POSITIVE RISK TAKING IN ADOLESCENCE

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ABSTRACT

Adolescents evince a more heightened propensity for risk taking than children and adults. This propensity can be directed toward negative (e.g., illegal or health-compromising) or positive (e.g., socially acceptable and beneficial) risk behaviors. Much existing research on adolescent risk behavior focuses on negative risk taking due to the public health implications of engaging in these behaviors. However, it is also important for society to promote youth engagement in positive risk behaviors that may benefit the well-being of adolescents and those around them. The present study explored positive risk taking in a sample of 164 American adolescents (45% female) ages 16-20 (M = 17.9; SD = .72). There were three central aims: (1) develop a reliable self-report measure of positive risk taking and examine its association with self-reports of negative risk taking and several behavioral measures of risk taking; (2) explore the extent to which previously established psychological correlates of negative risk taking are also associated with positive risk taking; (3) determine whether positive risk taking is associated with indicators of positive functioning, such as academic orientation, grit, and mental health. Results indicated that positive risk taking was associated with greater self-reported negative risk taking, and greater risk taking, feedback learning, and punishment sensitivity on experimental risk taking tasks. Although positive risk taking was not associated with grit or internalizing symptoms, positive risk taking was positively associated with stronger school engagement and better school performance. Future directions and applications to positive youth development programming are discussed.

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CHAPTER 1

INTRODUCTION

Adolescents evince a more heightened propensity for risk taking than children or adults (cf., Defoe et al., 2015; Shulman et al., 2016). This propensity can be directed toward negative (e.g., illegal or health-compromising) or positive (e.g., socially acceptable and beneficial) risk behaviors. Recently, there has been a lot of news about positive risk-taking adolescents, with headlines about teens winning Olympic medals for landing remarkable snowboard tricks and high schoolers protesting gun violence on national platforms. Despite this, little is known about the nature of positive risk taking, partly because researchers have not agreed upon what it means to take a positive risk, which real-world behaviors qualify as positive risks, and how to measure positive risk taking in controlled experiments. Instead, much of the research on adolescent risk taking has focused on negative risk behaviors. This is due in large part to the major public health implications of negative risk taking, which have commanded the attention of researchers and policymakers. For example, findings from epidemiological studies indicate that around the world, criminal (Eisner, 2002) and health-risk behaviors such as binge drinking (Duell et al., 2018; Willoughby et al., 2013) and cannabis use (Eisner, 2002) increase during adolescence. Furthermore, these activities are among the leading causes of youth morbidity and mortality (CDC, 2015) and have long-term implications for youths' health and well-being (Moffitt, Caspi, Harrington, & Milne, 2002).

In addition to preventing adolescents from engaging in negative risk behaviors, it is also important for society to promote engagement in positive risk behaviors, which

stand to benefit the well-being of adolescents and those around them. Beyond the potential to reduce engagement in negative forms of risk taking such as substance use or delinquency (Hansen & Breivik, 2001), positive risks may promote adolescents' school engagement and community connectedness (Wood et al., 2013), create opportunities for learning and goal-setting (Crone & Dahl, 2012), and foster healthy psychosocial functioning. While several researchers have examined positive youth development more generally (e.g., Phelps et al., 2009), it is important to focus specifically on positive *risk taking,* rather than on engagement in socially acceptable behaviors more generally, for two reasons. First, risk taking may help youth respond in healthy ways to numerous developmental demands of adolescence (e.g., Crone & Dahl, 2012; Ellis et al., 2012). Second, given evidence suggesting that adolescents evince a heightened propensity for, and tolerance of, risks (e.g., Duell et al., 2018; Steinberg, 2008; Tymula et al., 2012), society might provide youth with opportunities to take risks in safe, adaptive ways. In effect, the study of positive risk taking may yield a potential avenue for redirecting adolescents' propensities for risk taking toward behaviors that are in line with youths' inclinations and motivations and that also benefit their well-being.

In this introductory chapter, I provide a brief review of the adolescent risk taking literature with two intentions: (1) to shift the focus of research on adolescent risk taking to risks that can foster positive development; (2) to introduce positive risk taking as a measurable construct that can help researchers better understand adolescent risk taking and its benefits to youth. I begin by offering a theoretical model for, and definition of, positive risk taking, which is followed by a brief discussion regarding the importance of

positive risk taking to adolescent development. Next, I review findings from studies that have examined positive risk taking and related concepts, and discuss important directions for future studies. Finally, I describe the working model of risk taking that will inform the current study and discuss how this model is applicable to the study of positive risk taking.

Positive Risk Taking: Real-World Behaviors that Benefit Adolescent Well-Being

One starting point for conceptualizing positive risk taking is to consider risk in broader, more neutral terms, as a multidimensional construct not restricted to health-compromising or illegal behaviors. Drawing on the neuroeconomics literature (Mohr et al., 2010; Rangel, Camerer, & Montague, 2008), which has informed studies of adolescent decision-making (e.g., Van Duijvenvoorde & Crone, 2013), a risky act can be defined broadly by three components: (1) the potential for both rewards and costs, (2) variability in the likelihood of the outcomes being realized, and (3) uncertainty about the outcomes (Defoe et al., 2015; Figueredo & Jacobs, 2010; Hawley, 2011; Holton, 2004). From this perspective, risk taking can be thought of as engaging in a behavior for which the likelihood of an outcome, good or bad, is uncertain (Crone, van Duijvenvoorde, & Peper, 2016; Defoe et al., 2015), with high-risk behaviors being those yielding greater variability in potential outcomes, which thereby increases uncertainty about the outcome of the act (Figner & Weber, 2011; Figueredo & Jacobs, 2010).

Within this broad category, risk behaviors can be categorized as either positive or negative depending on the norms and standards of a given society. Generally, negative risks are behaviors that are inherently dangerous and oftentimes unlawful (Fischer & Smith, 2004), whereas positive risks are behaviors that are socially acceptable, legal

(Hansen & Breivik, 2001), and that promote the well-being of youth in several aspects of life, including academic, social, and psychological domains (e.g., fostering the development of perseverance or "grit"; Duckworth & Gross, 2014), or that may benefit others, as in prosocial risks (e.g., defending a friend from bullies; Do et al., 2017). Although it is relatively easy to think of behaviors falling into the category of negative risks (perhaps because we are accustomed to thinking about adolescent risk taking in negative terms), it is less clear which behaviors might be considered positive risks.

To put this conceptualization of risk into context, consider the American high school students who became public activists for changes in gun control legislation after the February 2018 shooting at a Florida high school. Standing up for one's beliefs is a risk given the high variability in potential outcomes and the fact that the individual does not know what will be the outcome of her efforts (e.g., her activism may lead to change or have no impact; her peers may support or criticize her; she may become popular on social media or a vicitm of bullying, etc.). While the end result may be undesirable (e.g., her platform makes no change, leading to dissapointment and ridicule), standing up for one's beliefs is both legal and yields the potential to benefit one's development (and in this case, it may also yield benefits to many others). For this reason, it is a positive risk.

Standing up for one's beliefs would not be considered a risk if a teen was advocating for his beliefs among a group of like-minded peers, however. Given the fundamental components of risk described above, a risk behavior must have both a potential reward and a potential cost. If an individual perceives no potential for loss (for example, because he believes his friends will agree with him), the behavior is no longer a

risk. Such caveats complicate the conceptualization of positive risk taking, but also emphasize the point that measuring positive risk taking requires special attention to the fundamental components of risk outlined above. (A more thorough discussion of measuring positive risk taking is provided in a subsequent section of this chapter.)

While it is difficult to formally define real-world positive risk taking, in order to frame the present work, as a starting point, I propose four elements that characterize positive risks and that may distinguish positive risks from negative risks: high possibility of gain, costs that are mild in severity, potential benefits that outweigh potential costs, and behaviors that are socially acceptable. Important to note is that the four elements proposed here are often overlapping, although each may not be independently realized in a given risk scenario. Furthermore, these elements are not absolute nor are they exhaustive. Rather, they serve as guidelines for thinking about positive risks and for identifying real-world behaviors that may be categorized as positive risks. Below, I describe each of the four elements of positive risk taking in greater detail.

First, a positive risk is one that stands to benefit the adolescent in some domain of his or her life and for which there is a reasonable likelihood of the youth receiving that benefit. Enrolling in an advanced course, for example, has the potential to yield a wide array of benefits. Even if the adolescent does not obtain the highest mark in that course, he may still benefit from the intellectual stimulation, the value it adds to his academic record, the opportunity to interact with a new group of peers, or the chance to learn more about his strengths, weaknesses, and academic interests.

The second element involves costs that are mild in severity. Should the adolescent incur a cost from a positive risk, the cost should be relatively minimal. For example, not being cast for a play or selected for a sports team may lead to significant distress or embarrassment, but such consequences are arguably mild in severity. Furthermore, the youth's distress may facilitate personal growth or, at a later point in time, help facilitate the development of a sense of meaning, leading the adolescent to ultimately perceive greater benefits than costs (Do et al., 2017). On the other hand, while drinking alcohol with friends may be likely to result in the reward of a fun, thrilling experience, the potential negative consequence (e.g., illness, a car accident, an arrest), however unlikely, could be detrimental to the adolescent's safety and the safety of his or her friends. A positive risk, in contrast, would not hold the potential to incur such a detrimental cost.

Accordingly, the third element of a positive risk is that the potential benefits outweigh the potential costs. Although engaging in any risk, positive or negative, warrants that the decision-maker perceive the benefits as outweighing the costs, in the case of positive risks, the extent to which the benefits outweigh the costs are determined in part by societal norms and standards (described further in the fourth element). An adolescent attempting to initiate a friendship with a peer may incur the cost of rejection, which could lead to consequences ranging from disappointment to severe distress. However, society would not want to discourage the youth from taking the risk of trying to make a friend simply because of this potential negative outcome. The benefit of learning to be interpersonally courageous and pursue new friendships, and the opportunity to learn from and overcome rejection, are all important life skills that make the risk worth taking.

This has been described as “the gift of failure” (Lahey, 2016). In contrast, the potential benefits of negative risks typically do not outweigh their potential costs. The potential benefit of being considered “tough” or popular after winning a physical fight, for instance, would not, from a societal standpoint, outweigh the potential cost of serious injury or harm (although in the moment, the adolescent may feel differently).

Although I am proposing that a positive risk is one in which the potential benefits outweigh the costs from a societal standpoint, the risk-taker himself must also be aware of the potential positive and negative outcomes. Though the risk-taker does not necessarily need to be aware of all potential outcomes, theoretically, they should be aware that they have the potential to gain or lose something from their decision. The risk-taker’s awareness is essential to researchers’ understanding of adolescents’ risky decision-making and the psychological mechanisms undergirding such decision-making.

The final element of positive risks proposed here is social acceptability. Although positive risks are behaviors that adolescents should enjoy and in which they should want to engage, in order to promote positive risk taking in the real world, researchers must focus on behaviors that parents and other adults would generally approve (e.g., researchers would be hard-pressed to convince parents that their teens should explore their sexuality, particularly through casual—even if protected—intercourse, merely because having intercourse has reproductive advantages or facilitates the development of intimacy among peers). This element admittedly narrows the conceptual scope of positive risk taking and blurs the line between activities in which youth want to engage and those in which adults want youth engaging. Nonetheless, the social acceptability of a behavior

is a critical part of identifying positive risks because it allows for the practical application of a positive risk taking model, such as implementation in positive youth development programming (e.g., Lerner et al., 2005).

Based on these four elements, I broadly define positive risks as risks that are socially acceptable and that yield the potential to facilitate adolescents' well-being in various aspects of life (e.g., academic or psychological). The elements of positive risk taking outlined above are admittedly imprecise, and are not without potential exceptions. However, my intention in offering theoretical components of positive risk taking that clarify the nature of positive risk taking and that may help distinguish it from negative risk taking is to advance the field's understanding of these behaviors in adolescence. As researchers further explore positive risk taking and the psychometric properties of positive risk taking measures, it is likely the theoretical framework proposed here will be sharpened by future empirical research.

Measuring Positive Risk Taking. In addition to operationalizing the construct of positive risk taking, one challenge for researchers interested in studying positive risk taking in adolescence is determining the best way to measure it. One point frequently overlooked in the adolescent risk taking literature is the distinction between real-world risk taking and risk taking propensity as assessed in the lab (Duell et al., 2018). Real-world risk taking, which typically is measured using self-report questionnaires, is influenced by the freedoms or constraints that provide chances for, or place limits on, adolescents' opportunities to engage in various activities. Furthermore, whether risks are categorized as being either positive or negative risks depends on the norms of the society

in which the adolescent lives. For example, in American society, dating during adolescence is generally viewed as a normative behavior that allows youth to develop healthy attachments to their romantic partners. However, in more conservative societies, like Iran, premarital dating is both legally and culturally banned; thus, any cross-gender associations may be deemed negative risks that threaten the reputation of the youth and their families (Rahbari, 2016). Similarly, whereas teen drinking is illegal in the United States, in China, adolescent alcohol use is both accepted and at times encouraged by parents because it is considered important for the development of social skills (Newman, Xue, & Fang, 2004; Xing, Ji, & Zhang, 2006).

In contrast to real-world risk taking, risk taking propensity reflects an individual's inherent inclination to take risks that is largely independent of context or value (i.e., "good" or "bad"). Risk propensity is thought to be best assessed through standardized experimental tasks (described in greater detail below), which largely control for contextual factors such as opportunity or societal norms. Measures of risk taking propensity can therefore be applied to the study of both positive and negative risk taking.

Positive risk taking measures often include behaviors that are legal and socially acceptable (Hansen & Breivik, 2001) but with the potential to result in physical or emotional harm (Wood et al., 2013). Previous self-report scales of positive risk taking (e.g., Fischer & Smith, 2004) have included behaviors falling under a wide range of domains such as interpersonal (e.g., asking someone on a date), academic (e.g., enrolling in a challenging course), and physical (e.g., sports). Using self-report scales to assess real-world positive risk taking is important for identifying the types of positive risks in

which youth commonly engage. These data would be particularly informative to the field of adolescent development given the dearth of research on positive risk taking. On the other hand, the benefit of measuring risk taking propensity using experimental tasks is that researchers are able to capture adolescents' underlying propensities for positive risk taking that are not dependent on opportunities to engage in specific types of positive risk behaviors (like those that are assessed in self-report scales). Ultimately, a multimethod approach to measuring positive risk taking, using data from both self-report and experimental measures, is ideal for capturing the nature of positive risk taking in youth.

Self-report questionnaires. Self-report measures of positive risk taking ideally include a diverse list of positive risk items that are representative of the general tendency to engage in positive risk taking in various domains (e.g., social, extracurricular). In attempting to measure socially acceptable behaviors that are also risky, one must be cognizant of the characteristics of the activity that make it a risk. An adolescent playing a sport he is not good at (Fischer & Smith, 2004) is not taking a risk if he is playing the sport in the privacy of his backyard, among friends and family, or if he has no concerns about what others will think of him. Playing a sport he is not good at when the teenager thinks he might embarrass himself, however, is a risk because it yields an uncertain outcome and the potential for both a reward (he plays well) and a cost (he embarrasses himself). In order to ensure the validity of self-report measures of positive risk taking, attention must be given to framing the items in a way that emphasizes the ambiguity of the outcome as well as its potential cost.

Finally, in measuring positive risk taking using self-report scales, the use of variety scores, which measure the variability in a category of behavior (i.e., the number of different types of risks one has taken), may yield more reliable information than simply measuring the number of times, or frequency with which, an adolescent has engaged in positive risk taking within a given time frame. (Thus, an adolescent who has both tried a new sport and joined a school club would score higher on a measure of positive risk taking that uses variety scores than one who had tried out three times for a sport but had not engaged in any other positive risks.) Relatedly, an adolescent only has so many opportunities to take positive risks, and it is not necessarily desirable for youth to frequently engage in these behaviors. For this reason, using variety scores may be more reliable for capturing one's propensity for positive risk taking. Variety scores are commonly used in the study of delinquent behavior (e.g., Osgood et al., 2002) but to my knowledge have not been used in studies of positive risk taking.

Risk-taking propensity. Behavioral measures that tap into individuals' propensities for taking positive risks are not well-established in the adolescence literature. However, one helpful starting point may be to examine whether current behavioral risk tasks (administered on computers), which have been linked to self-reported negative risk taking (Defoe et al., 2015; Kim-Spoon, Kahn, Deater-Deckard, Chiu, Steinberg, & King-Casas, 2015; Lejuez et al., 2003), can also capture the propensity for positive risk taking.

One category of behavioral risk tasks used to measure risk taking propensity are gambling tasks (Burnett et al., 2010; Figner, Mackinlay, Wilkening, & Weber, 2009), in which participants are asked to select among a series of options with varying probabilities

of gains and losses. On these tasks, risk taking is defined as selecting options with the greatest outcome ambiguity (i.e., the choice that does not indicate a clear gain or loss). On other tasks, such as the Balloon Analogue Risk Task (BART; Lejuez et al., 2002) and the Stoplight driving game (Steinberg et al., 2008), participants must take risks in order to obtain rewards. Based on the premise that risk taking propensity is a neutral propensity that can be manifested as either positive or negative behaviors, one would expect that risk taking on behavioral tasks should be comparably associated with both positive and negative risk taking.

That said, it may be possible to distinguish between positive and negative risk taking on behavioral tasks by analyzing youths' performance on these tasks. For example, on the BART (administered on a computer), participants pump "air" into a digital balloon in order to earn points, which are accrued in real-time as the participant inflates the balloon. At any point, participants have the option to "cash out," or stop inflating the balloon and collect their earnings. The balloon may explode at any point (that is unknown to the participant) and result in a loss of points earned for that trial, so the further participants inflate the balloon, the greater risk they incur. Although inflating the balloon is used as an indicator of risk taking, earning points on the BART depends on this behavior. Too much or too little inflation leads to suboptimal performance, but risk taking on the task is not inherently maladaptive. Thus, in most cases, a certain degree of strategic risk taking on behavioral risk tasks is essential for optimal performance (e.g., earning more points or completing a task quickly). It may be the case that adolescents who take positive risks in the real world are more likely to take strategic risks that yield

higher scores on experimental risk taking tasks than adolescents who take relatively more real-world negative risks. The literature on strategic risk taking in adolescence is discussed in a subsequent section; however, the extent to which behavioral risk tasks can be used to predict real-world positive risk taking has not been studied directly.

A Note on Terminology. At this juncture, it may be useful to briefly discuss other terms used in the literature to describe socially acceptable risk behaviors. Although in the present paper I use the term positive risk taking, other researchers have used terms such as prosocial (i.e., socially acceptable or the opposite of *anti*social), adaptive, and non-negative risk taking (e.g., Fischer & Smith, 2004; Hansen & Breivik, 2001; Wood, Dawe, & Gullo, 2013). I choose the term positive because the term prosocial may be confounded with behaviors that are solely intended to benefit another individual (e.g., Do et al., 2017). Prosocial risks, such as defending a peer who is getting bullied or inviting an unpopular classmate to a party, are arguably one category of positive risks because they are socially acceptable behaviors with uncertain outcomes that are coupled with the potential to both benefit another individual and to incur a cost to the risk taker (cf., Do et al., 2017). However, not all positive risk taking is prosocial. The term "adaptive risk taking" is problematic because adaptive can refer to behaviors that serve (or may have served at some previous time) an evolutionary function. For example, carrying a weapon might be considered an adaptive response to living in a dangerous neighborhood where an adolescent must protect himself, but would hardly be considered "positive" risk taking in the sense that I mean the term. Similarly, picking a fight with someone may stem from an evolutionarily adaptive desire to demonstrate one's position in a social hierarchy, but

this also does not qualify as a "positive" risk. Thus, any risk considered antisocial, regardless of its potential adaptive purpose, would not be considered a positive risk.

Importance of Positive Risk Taking to Adolescent Development

While there are certainly individual differences in the extent to which, and the ways in which, adolescents' risk proclivities are manifested, research generally supports the assertion that heightened risk taking is normative during the second decade of life. Indeed, evolutionary models of adolescence posit that heightened risk taking is an inherent feature of this stage of development and critical to meeting the developmental demands of the second decade of life, such as identity formation, the establishment of independence, skill acquisition, and reproductive success (Ellis et al., 2012; Spear, 2013). Risk taking also facilitates youths' development into healthy, autonomous adults (cf., Lourenco & Casey, 2013). As youth transition from dependence on parents to relative independence, they must establish a sense of autonomy and learn to undertake new decision-making challenges in their everyday lives (Lourenco & Casey, 2013; Zimmer-Gembeck, Ducat, & Collins, 2011). Developing personal interests and long-term goals as well as taking advantage of life's opportunities, requires that individuals be willing to try things they think they may not like, or at which they might fail, and this requires a certain tolerance, or even inclination, for risk. Various changes in the psychological and neurological characteristics of adolescence (described in a subsequent section) are thought to afford youth with the motivational drive to take the types of risks that serve these functions (Crone & Dahl, 2012; Spear, 2000).

Due to the increased independence characteristic of the second decade of life, adolescence is a time of increased opportunity for positive risk taking, as parents and other adults are more likely to grant youth with the autonomy to make their own choices. Positive risks represent a category of behaviors that allow adolescents to pursue novel or exciting experiences (often with unknown outcomes) that are also safe and potentially beneficial to their well-being. These positive risks may, in turn, provide adolescents with opportunities to develop important life skills such as responsibility, self-directed learning, goal-setting, and self-regulation. It could be argued that many of the behaviors theoretically encompassing positive risk taking require these skills, such as enrolling in a challenging course or applying for a leadership position in a school organization. Greater engagement in these behaviors may facilitate the process of setting long-term goals and developing a sense of purpose (Malin, Liauw, & Damon, 2017), which, in the long run, may teach adolescents to set priorities and direct their attention toward achieving their goals (Crone & Dahl, 2012). Ultimately, positive risk taking in adolescence offers the potential to benefit youth in various domains of life, both with respect to emotional well-being and personal achievements. However, additional research on positive risk taking is needed to determine what motivates engagement in positive risks and the extent to which these behaviors actually confer their presumed benefits to adolescents' lives.

Previous Research on Positive Risk Taking and Related Concepts

Only a few studies have explored positive risk taking in adolescents, and all have used self-report scales exclusively. Each of these studies employed its own definitions and measures of positive and negative risk taking, some of which were developed based

on items used in previous studies of risk taking (e.g., Wood et al., 2013), and others that were developed through Q-sorting procedures that asked trained raters to categorize items as being either "negative" or "non-negative" (or "not sure"). Table 1 summarizes the terms, definitions, and examples of positive and negative risks from the three positive risk taking studies described here. Although the definitions of positive risk taking used in these studies differed slightly, each identified the potential for loss or harm and the social acceptability of the behavior. Furthermore, the positive risk taking measures demonstrated reasonable reliability within the samples in the studies for which they were created (Cronbach's αs = .77-.84).

Two compelling themes have emerged from the findings of these studies: first, positive and negative risk taking are positively associated, and second, positive and negative risk taking appear to share some common psychological underpinnings. In one study of adolescents ages 12-16, Hansen and Breivik (2001) found that adolescents engaged in positive risk taking to a greater extent than they engaged in negative risk taking, but that both forms of risk taking were positively associated. In other words, although adolescents took more positive risks than negative risks overall, greater engagement in positive risk taking was associated with greater negative risk taking. These findings are consistent with those of Fischer and Smith (2004), who also found a positive association between positive and negative risk taking in a sample of college students, and those of Wood and colleagues (2013), who found a positive association between engagement in positive "physical" risk taking (e.g., involvement in certain types of sports) and substance use (e.g., alcohol, tobacco, and cannabis use) in adolescents ages

12-14 (Wood et al., 2013). The observed link between positive and negative risk taking supports the notion that adolescents evince a domain-general propensity for risk taking that can be manifested in both positive and negative forms.

Table 1

Terms, Definitions, and Examples of Positive and Negative Risk Taking Used in the Positive Risk Taking Literature

Citation	Terminology	Positive Risk Definition	Positive Risk Examples	Negative Risk Definition	Negative Risk Examples
Hansen & Breivik, 2001	Positive and Negative Risk Taking	Activities that are socially accepted and legal	Riding a rollercoaster, performing in front of a large audience	Activities that are criminal or not socially accepted	Getting drunk, shoplifting, ringing the doorbell and running
Fischer & Smith, 2004	Adaptive/Non-Negative and Maladaptive/Negative Risk Taking	Activities not having a reasonable chance of having a negative life outcome	Playing a sport with the opposite sex, auditioning for a play, initiating a friendship	Activities with a reasonable chance of having a negative life outcome	Misusing prescription drugs, plagiarizing, driving a car after drinking alcohol
Wood, Dawe, & Gullo, 2013	Prosocial Risk Taking and substance use	Objective situation appraised in terms of the potential for physical harm or injury, or mental or emotional harm or punishment	Physical-Risk: Rugby, dirt-bike riding; Performance-Risk: Public speaking, debating, dance, singing	Only examined substance use; did not offer formal definition for negative risk taking	Cannabis, tobacco, and alcohol use

Sensation seeking, or the tendency to seek novel and thrilling experiences, appears to be one trait that is common to both positive and negative risk taking (Fischer & Smith, 2004; Hansen & Breivik, 2001). For example, Wood and colleagues (2013) found that higher reward drive (characterized by reward sensitivity and approach behaviors) among adolescents was associated with greater substance use as well as greater prosocial behavior (e.g., considering other people's feelings), and positive risk taking, such as public speaking or playing competitive sports (Wood et al., 2013). The positive association between sensation seeking and positive risk taking was present even when adjusting for engagement in negative risk taking (Fischer & Smith, 2004), indicating a unique relation between sensation seeking and positive risk taking that was not solely explained by a general risk taking propensity.

One group of researchers hypothesized that, given the relation between sensation seeking (or reward drive) and positive risk taking, engaging in positive risk taking would mitigate engagement in negative risks such as substance use (Wood et al., 2013). To test this, Wood and colleagues examined the indirect effect of reward drive on substance use, mediated by positive risk taking. Results indicated that even when accounting for the relation between reward drive and positive risk taking, greater reward drive was still associated with greater substance use. This finding speaks to the larger point that youth who engage in positive, socially acceptable behaviors, such as sports, are still liable to engage in negative behaviors, such as substance use (Veliz, Boyd, & McCabe, 2015) or other antisocial behaviors (Rutten et al., 2007). One potential explanation for the observation that higher sensation seeking is associated with greater positive and negative

risk taking is that both forms of risk taking induce the excitement and physiological arousal to which sensation-seeking adolescents seem to be attracted (cf., Do et al., 2017). Importantly, these results highlight the importance of structuring youth's opportunities for risk taking in a way that mitigates opportunities for negative risk taking, as positive risk taking does not appear to function as a buffer against negative risk taking.

Self-regulation, or impulse control, has been implicated in adolescent risk taking for decades, in that adolescents are thought to engage in negative risk taking due to immature self-regulation (e.g., Gottfredson & Hirschi, 1990). Because positive risk taking is generally viewed as a sign of maturity, researchers have asked whether self-regulation evinces opposite associations with negative and positive risk taking, wherein high self-regulation is associated with less negative risk taking but more positive risk taking. Findings thus far on the link between self-regulation (or related constructs) and positive risk taking are inconclusive. Fischer and Smith (2004) found that greater deliberation (i.e., the tendency to think before acting) was associated with less negative risk taking, but was not associated with positive risk taking. Based on these findings, the authors suggested that whereas sensation seeking may encourage individuals to explore their environments and seek out new opportunities in ways that can result in either positive or negative forms of risk taking, deliberation may be one factor distinguishing between engagement in positive versus negative risk taking.

Consistent with this, Wood and colleagues (2013) found that greater impulse control was associated with greater engagement in positive performance risks like public speaking or stage performance, activities often requiring a certain level of planning and

self-regulation, but not with positive physical risk taking, such as skateboarding, or playing high-contact sports like rugby. That impulsivity was not associated with physical risk taking speaks to the potential importance of distinguishing among different types of positive risks that are distinctly associated with select psychological characteristics. Along those lines, one reason for the divergent findings regarding positive risk taking and impulsivity could be that Fischer and Smith (2004), who found that the two were unrelated, used more a more general scale of positive risk taking with items ranging across social risks like initating a friendship, extracurricular risks like trying out for a team or running for school office, and academic risks such as speaking with a professor. On the other hand, Wood and colleagues (2013) examined positive risk taking using two separate and specific scales of physical and performance risks. One point to be taken from these studies is that whether positive risk taking is associated with greater self-regulation or is not associated with self-regulation at all, results do not indicate that poor self-regulation, which has been consistently shown to be correlated with negative risk taking, is associated with positive risk taking.

Altogether, results from previous studies of positive risk taking have suggested that adolescents who take positive risks are also generally more likely to take negative risks and that sensation seeking is one psychological factor motivating engagment in these two forms of risk taking. Previous research has shown that adolescents high in sensation seeking, although more likely to report greater engagement in antisocial risk taking, are also more likely to be interested in “intense” or “novel” occupations, such as those involving saving people from danger or those requiring creativity and imagination

(Mallet & Vignoli, 2007). This association between sensation seeking and positive behaviors has implications for redirecting adolescents' tendencies to seek out novel and rewarding experiences towards socially acceptable behaviors that can benefit their well-being or the well-being of others. Granted, it could be argued that adolescents' positive experiences with sensation seeking may motivate them to puruse other (even negative) ways of fulfilling their desire for novel sensations. Thus, context and opportunity are likely to play a critical role in directing youths' behaviors. If given more opportunities to channel their sensation seeking tendencies toward prosocial or creative activities, and limited opportunities to channel these tendencies toward negative behaviors (e.g., through strucutred, adult-supervised activities), perhaps society can help reduce negative risk taking among high sensation-seeking youth (D'Silva et al., 2001).

Unlike sensation seeking, the role of self-regulation in positive risk taking is still unclear. Although poor self-regulation has consistently been linked to greater negative risk taking such as substance use (e.g., Castellanos-Ryan, Parent, Vitaro, Tremblay, & Séguin, 2013) and delinquency (e.g., Harden & Tucker-Drob, 2011), it is unclear whether adolescents showing *greater* self-regulation are more likely to engage in positive risk taking, or whether self regulation is unrelated to positive risk taking.

Although no studies using behavioral tasks have purported to measure positive risk taking specifically, findings from several studies of prosocial behavior using brain imaging techniques are largely consistent with the findings observed in previous self-report studies of positive risk taking. Specifically, research on prosocial decision-making among adolescents offers behavioral evidence that sensation seeking is linked to positive

behaviors. Although prosocial behavior is not the same as positive risk taking, research on prosocial decision-making is still informative given that prosocial risks theoretically represent one facet of positive risk taking. Researchers interested in prosocial decision-making often use donation games in which participants must choose to win money for themselves or for another individual (e.g., a parent, friend, or stranger). Some of these studies employ risk paradigms (e.g., Braams & Crone, 2016), in which participants must choose to gamble (e.g., choosing heads or tails in a coin toss with variations in the number of coins that can be won or lost) for themselves or others, with prosocial risks being the gambles that are intended to benefit another individual rather than oneself. Other studies simply employ prosocial decision-making paradigms in which participants must choose how many tokens (or how much money) to allocate, if at all, to others (e.g., Telzer et al., 2013; van Hoorn et al., 2016). Most of these studies have measured both behavior and brain activity during administration of the experimental tasks.

Results from prosocial decision-making studies suggest that adolescents perceive prosociality (e.g., gambling for friends or mothers) to be pleasurable more so than do adults (Braams & Crone, 2016) and that prosociality activates the same reward-related brain regions implicated in sensation seeking behaviors (see Smith, Chein, & Steinberg, 2013) and that are activated when taking risks on other behavioral tasks (Telzer, Ichien, & Qu, 2015; Telzer et al., 2013). Furthermore, activation in reward-sensitive brain regions in response to prosocial decision-making has been linked to longitudinal declines in self-reported risk behaviors, such as stealing, drinking alcohol, or skipping school (Telzer et al., 2013), suggesting that youth who view prosocial behaviors as intrinsically

rewarding are less inclined to engage in negative behaviors over time. These findings may be applicable to models of positive risk taking to the extent that youth may also view positive risks as intrinsicially rewarding, although future research will have to confirm these claims using more explict measures of positive risk taking (rather than prosocial behavior alone). Nonetheless, findings from behavioral studies of prosocial decision-making offer additional support for the trends observed in positive risk taking studies.

One potential way to measure positive risk taking through laboratory-based tasks is by measuring strategic risk taking, or risk taking that yields optimal outcomes on an experimental task (e.g., points earned). Risk taking on behavioral tasks requires a willingness to pursue actions with uncertain outcomes, as well as to accept a potential cost (e.g., balloon explosion on the BART) in the interest of obtaining a reward. Individuals less averse to negative feedback would be more likely to accept a potential loss in favor of a reward (e.g., watching points accrue as the balloon pumps). Indeed, previous neuroimaging studies of strategic risk taking among adolescents (e.g., McCormick & Telzer, 2017a) found that reduced neural sensitivity to negative feedback on the BART was related to greater risk taking on the task. In addition to risk taking, however, performing well on experimental risk tasks requires that individuals learn from the feedback provided by the task and integrate this information into their future decision-making. In other words, performing well on experimental risk tasks requires a more general sensitivity to feedback in which individuals are responsive to both the rewards and the consequences of their choices (McCormick & Telzer, 2017b).

Strategic risk taking might be associated with real-world positive risk taking because it reflects a pattern of behavior that is more goal-oriented and perhaps reflects a tendency to pay attention to feedback patterns and attune decision-making in response to this feedback. Adolescents who take negative risks might enjoy the thrill of rapidly pumping the balloon, watching it inflate, and pushing the limits of the balloon's maximum inflation point. As a result, these youths' decisions might be more influenced by the immediate reward than by the potential for loss, such that the prospect of an exploded balloon may not necessarily deter them from pumping the balloon. Consistent with this, McCormick and Telzer (2017a) found that adolescents who evinced less neural sensitivity to negative feedback on the BART reported greater real-world negative risk taking (e.g., substance use or sneaking out of the house). On the other hand, adolescents who take positive risks might generally be better at learning from, and changing behavior in response to, both positive and negative feedback, which would yield a decision-making pattern in which risks are taken in a more planned and strategic way. This is because youth who take positive risks theoretically gain experiences that facilitate learning and goal-oriented decision-making (e.g., Crone & Dahl, 2012) (or they may engage in positive risks because they already possess these traits). Granted, these assertions are all speculative and require confirmation from future studies of positive risk taking that integrate experimental measures.

Related to strategic risk taking, learning on experimental tasks of risk taking may also be a behavioral correlate of positive risk taking. Although previous studies have not examined links between learning and positive risk taking, several studies have explored

age patterns in learning and strategic risk taking. McCormick and Telzer (2017b) used the BART to examine the relation between age and learning from feedback and the relation between learning and risk behavior in a sample of youth 8-17 years. Results indicated that older adolescents were more likely than children to inflate balloons after cash-outs (winning money) but less likely to inflate balloons after explosions (losing money), an indication of sensitivity to, and learning from, positive and negative feedback. Learning was associated with both greater risk taking but also more points earned on the task, indicating a link between learning and strategic risk taking. In other words, adolescents who adjusted their behavior in response to feedback were more likely to take strategic risks that yielded more points.

Similarly, Humphreys and colleagues (2016) used a modified version of the BART called the Balloon Emotional Learning Task (BELT) to examine age differences in learning as a function of sensitivity to positive and negative feedback in a sample of subjects ages 3-26. On this task, balloons were categorized into three groups based on explosion points: slow-to-explode (more pumps before exploding), variable (random), and quick-to-explode (fewer pumps before exploding). Each balloon type was color-coded to encourage learning, which was measured as the change in points earned from the first third to the second third of the task, within each balloon condition. Results indicated that on slow-to-explode trials, adolescents took more risks (i.e., pumped the balloon to a greater extent) and earned more points than children, but to a lesser extent than adults. Adolescents performed similarly to adults in variable trials. On quick-to-explode trials, adolescents took more risks and ultimately earned more points compared

to children and adults. The authors determined that both learning and sensitivity to negative feedback (i.e., reducing pumps after an explosion) mediated the association between age and points earned on the task. Specifically, adolescents' behavior on these trials was a function of both linear age-related increases in learning and decreases in sensitivity to negative feedback, the combination of which ultimately led to greater strategic risk taking on the quick-to-explode trials among adolescents.

On slow-to-explode trials, adolescents may have cashed out (stopped pumping and collected points) earlier than adults, perhaps in the interest of obtaining an immediate reward. This is consistent with literature suggesting that adolescents demonstrate a greater willingness to accept smaller, but more immediate rewards (Steinberg et al., 2009). Adolescents' decision-making on these trials may also be attributable to a lower tolerance for negative feedback (the balloon explosion and subsequent loss of points) compared to adults (Humphreys et al., 2016). Contrary to this, previous research has suggested that adolescents are less likely than adults to adjust their behavior in response to negative feedback, and this pattern of behavior has often been associated with sub-optimal decision making among adolescents (e.g., Aite et al., 2012; Cauffman et al., 2010). However, the findings of Humphreys and colleagues suggest that in certain contexts, such as those in which a sensitivty to negative feedback can yield a more immediate reward (e.g., quick-to-explode trials), adolescents evince a higher sensitivity to negative feedback than adults. One compelling application of this research to positive risk taking is an examination of the extent to which youth who take positive risks in the real world and who take strategic risks in the lab evince a greater responsiveness to both

positive and negative feedback, which may be a function of a greater capacity to learn from feedback more generally.

Because a behavioral measure of positive risk taking has yet to be developed, it would be beneficial for researchers to understand the extent to which current experimental risk taking tasks are associated with positive risk taking. Based on the premise that behavioral risk tasks capture individuals' underlying propensities for risk taking, it is possible they are associated with all forms of real-world risk taking, positive or negative. Such a finding would be informative to the field's understanding of the utility of these measures, although not particularly useful for identifying individuals who possess a specific propensity for positive risk taking. However, differences in task performance and feedback learning may be two factors that can help distinguish between greater positive versus negative real-world risk taking. Individual differences in risk strategy, in other words, might be indicative of some of the underlying processes (e.g., learning or modifying behavior in response to feedback) that facilitate real-world engagement in positive risk behaviors. One implication of research comparing feedback learning between positive and negative risk takers is an understanding of the extent to which risk taking in the real world has the potential to benefit youths' learning capacities. Positive risk taking, for example, may afford youth with life experiences that facilitate attentiveness and learning, which would strengthen the argument that risk taking, in certain capacities, can yield certain psychological advantages to youth.

Limitations of Current Studies of Positive Risk Taking. Previous studies of positive risk taking have offered useful preliminary information regarding youth

engagement in these behaviors and some of the psychological factors underlying such behavior. However, these studies were limited in a few important ways. First, none of the studies incorporated outcome ambiguity into its conceptualization of positive risk taking. Although conceptualizing negative risks is relatively straightforward, if not phrased carefully, various behaviors that are listed as positive risks may simply be socially acceptable behaviors (e.g., asking someone out on a date when, based on previous interactions, the likely outcome is known to be positive). The element of ambiguity is important for measuring positive behaviors that are specifically risky because the exclusion of this element would yield only a measure of socially acceptable behaviors, which are distinct from risks. This issue of ambiguity may have confounded some of the relations observed in previous studies of positive risk taking. Additionally, with the exception of the Wood et al. (2013) study, previous studies of positive risk taking did not examine whether positive risk taking was a unidimensional construct or whether it could be separated into different categories, such as social, academic, and extracurricular risks. Findings from Wood et al. suggest there may be different types of positive risks with their own unique links to negative risk taking and other psychological factors like reward seeking and self-regulation.

An additional concern regarding findings from previous positive risk studies is that some of the items included in the positive risk scales employed in these studies seemed to relate more strongly to thrill-seeking rather than risk taking, such as riding a roller coaster (Fischer & Smith, 2004) or playing sports (Wood et al., 2013). Similarly, some of the positive risks included in the scale by Hansen and Breivik (2001) (e.g.,

mountain climbing) overlapped with the items on their sensation seeking scale ("I often dream about being a mountain climber"). This overlap among risk and sensation seeking items likely confounded the findings on the link between positive risk taking and sensation seeking. Furthermore, no study to date has included a measure of both self-reported positive risk taking and risk taking on experimental tasks; thus, it is still unclear whether positive risk taking can be measured using current experimental risk tasks. The idea that optimal performance or greater learning on risk tasks is associated with greater real-world positive risk taking is only speculative and yet to be tested empirically. Finally, none of the aforementioned studies examined any potential outcomes of positive risk taking. In future iterations of this work, it would be worthwhile to examine whether positive risks benefit adolescent well-being, such as by fostering school engagement and academic achievement (e.g., Wood et al., 2013), grit (Duckworth & Gross, 2014), or positive socioemotional functioning (e.g., Crone & Dahl, 2012).

Dual Systems Models of Risk Taking

Although not applied specifically to positive risk taking, research on the mechanisms thought to govern adolescents' propensity for risk taking more generally is a useful starting point for thinking about youth engagement in positive risk taking and offers a basis for developing testable hypotheses regarding the nature of positive risk taking and its correlates. Understanding how adolescents make decisions is critical to fostering youth engagement in activities that promote their positive development. One theoretical framework of adolescent risk taking that has received much empirical support (see Shulman et al., 2016 for a review) is grounded in "dual systems" (Steinberg, 2008)

or “maturational imbalance” (Casey, Getz, & Galvan, 2008) models, which integrate what is known about adolescent behavior with more recent findings on neurodevelopment. In short, adolescent risk taking propensity is thought to be a product of high sensation seeking and immature self-regulation, two psychological factors that are thought to be undergirded by the distinct developmental trajectories of brain regions implicated in reward processing and executive control, respectively. Adopting a dual systems framework is useful for beginning to think about the mechanisms undergirding positive risk taking among adolescents given that the primary mechanisms implicated in this model—sensation seeking and self-regulation—are consistent with the psychological traits that have been examined in previous studies of positive risk taking. Furthermore, findings from the aforementioned experimental studies that inform the understanding of positive risk taking discussed in this paper are grounded in dual systems theories.

Research on adolescent neurodevelopment generally suggests that development in subcortical brain regions implicated in reward processing is more or less complete by adolescence, whereas prefrontal brain regions implicated in cognitive control and other executive functions continue maturing into early adulthood (Spear, 2013; Steinberg, 2008). Furthermore, the extent to which these two brain regions are functionally connected is not fully established until early adulthood (Casey, 2015; Heller et al., 2016). This general concept of a maturational imbalance between regions in the brain’s socioemotional and cognitive control networks during adolescence is the basis for dual systems theories of adolescent risk taking. According to these theories, during middle and late adolescence, youth experience a heightened sensitivity to reward, which impels them

toward novel, exciting experiences before they have the mature self-regulatory capacities required to rein in impulsive behavior (Steinberg, 2008). Another way to think about this is that during adolescence, rewards play a prominent role in decision-making, particularly in contexts of heightened emotional or social arousal (e.g., peer presence) and in contexts requiring youth to engage in intuitive decision-making (Shulman & Cauffman, 2014).

Correlates of Risk Taking. Findings from research examining age patterns in the psychological constructs thought to undergird reward seeking and cognitive control (sensation seeking and self-regulation, respectively; Smith et al., 2013) demonstrate distinct age-dependent patterns (e.g., Shulman, Harden, Chein, & Steinberg, 2015). In these studies, sensation seeking is typically measured using self-report scales that assess characteristics such as thrill seeking or novelty seeking, or behavioral tasks that can be used to assess responsiveness to rewarding stimuli, such as the Iowa Gambling Task (IGT: Cauffman et al., 2010). Similarly, self-regulation is measured using both self-report scales that assess the tendency to act without thinking (e.g., “I act on the spur of the moment”) and behavioral tasks that require individuals to resist automatic, reactive responses to specific stimuli, such as the Stroop (e.g., Andrews-Hanna et al., 2011), and planning, such as the Tower of London (Albert & Steinberg, 2011).

Both self-report (Collado et al., 2014; MacPherson et al., 2010; Quinn & Harden, 2013) and behavioral (Hooper et al., 2004; Smith, Xiao, & Bechara, 2011) studies of sensation seeking indicate that this inclination peaks in mid-adolescence and subsequently declines in adulthood. For example, on the IGT, participants must learn to play from two advantageous (rewarding) decks and avoid two disadvantageous (losing)

decks (Behcara et al., 1994). Faster learning from rewarding decks is indicative of greater reward sensitivity (Cauffman et al., 2010) and has been linked to self-reported sensation seeking (Steinberg, 2010). Cross-sectional studies of IGT performance demonstrate that mid- to late adolescents increase their plays from rewarding decks earlier in the task than do their younger peers (Cauffman et al., 2010; Hooper et al., 2004; Smith et al., 2011) or adults (Cauffman et al., 2010; but see Christakou et al., 2013).

Studies of self-regulation, however, reveal different age patterns. Whereas studies of self-reported impulse control demonstrate that this characteristic improves into early adulthood (Quinn & Harden, 2013), findings from behavioral studies of self-regulation indicate that observed age differences depend on the cognitive demands of the task (cf., Shulman et al., 2016). On easy tasks requiring only that participants inhibit a prepotent response, such as in the antisaccade, individuals demonstrate adult levels of self-regulation by mid-adolescence (see Luna, 2009). On the other hand, on tasks causing attentional interference (e.g., the Stroop) or those requiring planning and complex reasoning (e.g., the Tower of London), mature performance is not observed until early adulthood (Albert & Steinberg, 2011; Davidson et al., 2006). Hence, consistent with models of adolescent brain development, research on psychosocial development suggests that adolescents evince a heightened sensitivity to reward and inclination for novel sensations in the context of immature self-regulatory functioning.

In addition to research demonstrating that adolescents tend to evince greater sensation seeking and more immature self-regulation than adults, studies also show that these psychological traits are linked with greater risk taking. For example, high sensation

seeking among adolescents has been associated with greater self-reported substance use (Kong et al., 2013; MacPherson et al., 2010; Martin et al., 2002; Quinn & Harden, 2013), delinquency (Harden & Tucker-Drob, 2011; Peach & Gaultney, 2013), and risky driving (Hatfield, Fernandes, & Job, 2014), as well as risk taking on several laboratory measures of risk taking (Figner et al., 2009; MacPherson et al., 2010). Likewise, greater impulsivity has been associated with higher rates of self-reported substance use (Castellanos-Ryan et al., 2013; Quinn & Harden, 2013) and delinquency (Harden & Tucker-Drob, 2011), as well as with increased risk taking on laboratory tasks (Collado et al., 2014). Although there are numerous other individual and environmental factors linked to adolescent risk behavior, findings on the links between sensation seeking and self-regulation and risk taking have strong empirical support and are largely consistent with findings from positive risk taking studies. Thus, building from this model is a useful starting point for learning about positive risk taking in adolescence.

Applications of Dual Systems Models to the Study of Positive Risk Taking. Based on previous research on positive risk taking in adolescence, it is likely that some of the psychological mechanisms thought to underlie youth engagement in negative risk taking are also linked to positive risk taking. Research on prosocial decision-making among adolescents suggests that reward sensitivity is linked to engagement in positive behaviors, consistent with studies linking sensation seeking to positive risk taking. Although it is not necessarily surprising that adolescent reward sensitivity is not exclusively linked to engagement in maladaptive behaviors, establishing associations between reward sensitivity and positive behaviors in the adolescent literature is important

for thinking about how best to structure opportunities for adolescents to participate in activities that benefit their development. If adolescents learn to direct their emotions and motivations toward positive, goal-oriented behaviors (e.g., after-school sports, internships, religious programs) reward sensitivity may be an asset rather than a detriment (Telzer, 2016). In this case, communities should provide adolescents with opportunities to engage in stimulating, rewarding activities that foster well-being and that might reduce engagement in maladaptive behaviors.

Given that many positive risks likely require a certain level of self-regulation and planning (e.g., enrolling an advanced course), it may be the case that youth engaging in at least some forms of positive risks demonstrate greater self-regulation. One reason for this could be that the potential rewards of positive risks, such as taking an advanced course or trying out for a sports team, are often dependent on performance. Thus, youth must be focused and goal-oriented to attain the rewards of the positive risks they take (e.g., getting a good grade or making the team). From this perspective, it may be the case that adolescents who take positive risks evince greater self-regulation compared to their peers engaging in negative forms of risk taking. Related to this, findings from studies using monetary incentive tasks suggest that when attaining rewards depends on task performance, adolescents' heightened sensitivity to reward can be capitalized on to motivate greater self-regulation (e.g., Geier et al., 2010; Jazbec et al., 2006; Padmanabhan et al., 2011). On the other hand, it is also possible that self-regulation is a psychological trait that distinguishes positive from negative risk taking. Taken together,

mounting evidence suggests that dual systems theories of adolescent risk taking propensity may inform the field's understanding of positive risk taking.

Remaining Questions

Results from current studies of positive risk taking and its associations with reward sensitivity and self-regulation are informative, but several important questions remain. First, positive risk taking is not yet clearly defined in the literature. Second, it is unknown whether behavioral measures of risk taking propensity are associated with both positive and negative risk taking in the real world, or whether they can be used to uniquely predict engagement in positive and negative risk taking, respectively. Additionally, little is known about the shared and unique mechanisms underlying both forms of risk taking. While findings from existing studies allude to the role of sensation seeking in both positive and negative risk taking, there is a need for further research on self-regulation and positive risk taking, as results in the current literature are mixed. Finally, it is also unknown whether engagement in positive risk taking has any applications to adolescents' psychological well-being. Developing a clearer understanding of what motivates positive and negative risk taking in adolescents may be useful for designing programs that provide adolescents with opportunities to engage in behaviors that promote their well-being in ways that are developmentally appropriate and that suit their interests and motivations.

The Current Study

In the present study, I define positive risks as risks that are socially acceptable and yield the potential to facilitate adolescents' well-being in various aspects of life, such as

academic and psychological domains. My intention in exploring positive risk taking is to expand existing work on adolescent risk taking, which is largely focused on negative forms of risk taking (e.g., illegal or dangerous behaviors, such as driving while intoxicated). The framework for my proposed research is grounded in dual systems models of adolescent risk taking and decision-making (Steinberg, 2008) and evolutionary theories of development (Ellis et al., 2012; Spear, 2013). Given that positive risk taking is an understudied concept in the adolescence literature, my hypotheses build on existing work on adolescent risk taking. Below, I summarize the central aims of the present study and briefly discuss my hypotheses. In Chapter 2, I describe the sample and measures used to test these hypotheses. Chapter 3 includes a summary of the methods of analysis and results. Chapter 4 concludes this paper with a discussion of the results and their applications to the adolescent risk taking literature.

Study Aims and Hypotheses

Aim 1: Develop a reliable self-report measure of positive risk taking and examine its association with self-reported negative risk taking and with behavioral risk taking in the lab. Although previous researchers have developed positive risk taking scales (e.g., Fischer & Smith, 2004; Hansen & Breivik, 2001; Wood et al., 2013), based on the conceptualization of positive risk taking outlined here, I believe certain modifications to these scales would improve their reliability and validity. Two aspects of current self-report measures of positive risk taking warranting modification are that (1) many of the positive risk items more strongly reflect sensation seeking than risk taking (e.g., riding a roller coaster), and (2) items are not worded to emphasize the ambiguity of

the outcome or the potential for loss to the risk taker (factors important for distinguishing between a positive behavior and a positive *risk*).

Drawing from previous positive risk scales (e.g., Fischer & Smith, 2004; Monahan, VanDerhei, & Amemiya, *unpublished*), I have created a new positive risk taking scale that addresses the two issues described above (see Appendix A). Using this scale, I explore the association between self-reported positive and negative risk taking, as well as between positive risk taking and risk taking on experimental risk tasks. Based on previous research (e.g., Fischer & Smith, 2004; Hansen & Breivik, 2001), I hypothesize that greater positive risk taking is associated with greater negative risk taking. Furthermore, as behavioral measures of risk taking are thought to capture a domain-general propensity for risk taking, I expect that greater risk taking on behavioral tasks is associated with higher levels of both self-reported positive and negative risk taking.

An overall shared association between risk taking on behavioral tasks and both positive and negative risk taking assessed via self-report would be informative to the field's understanding of the utility of behavioral risk measures, but not particularly useful for identifying a unique propensity for positive risk taking. Two aspects of performance on behavioral risk tasks that may distinguish between self-reported positive and negative risk taking, however, are performance and learning. The extent to which risk taking on a behavioral task yields optimal task performance (e.g., greater points) is called *strategic* risk taking. I hypothesize that greater positive risk taking, but not negative risk taking, is associated with greater strategic risk taking. One mechanism by which decision-making on behavioral risk tasks may lead to optimal task performance is through the ability to

learn and modify behavior in response to feedback (Humphreys et al., 2013; McCormick & Telzer, 2017b. Thus, I expect that greater positive risk taking will also be associated with greater learning on behavioral risk tasks. Results from these analyses will elucidate the extent to which current behavioral measures of risk taking capture the propensity for positive risk taking in the real world and may highlight some of the psychological mechanisms undergirding these patterns of behavior.

Aim 2: Explore the extent to which psychological correlates of negative risk taking are also associated with positive risk taking. Next, using a dual systems framework (Steinberg, 2008) and building from previous studies of positive risk taking (Fischer & Smith, 2004; Wood et al., 2013), I compare the extent to which sensation seeking, self-regulation, and sensitivity to positive and negative feedback are related to positive and negative risk taking. Previous research suggests that the motivation to seek novel, rewarding stimuli can be manifested as both positive and negative behaviors (Telzer, 2016). Thus, I hypothesize that high sensation seeking is associated with greater positive and negative risk taking.

With regard to self-regulation, it may be that poor self-regulation is associated with negative risk taking, but not associated with positive risk taking (e.g., Fischer & Smith, 2004). This finding would suggest that, unlike negative risk taking, adolescent engagement in positive risks is not dependent on the ability (or inability) to regulate behavior or engage in goal-directed actions. On the other hand, it may be that self-regulation yields opposite associations with positive and negative risk taking, such that higher self-regulation is associated with *less* negative risk taking and *more* positive risk

taking (e.g., Wood et al., 2013). This finding would suggest that positive risk taking represents a pattern of regulated and goal-oriented behaviors. In light of inconsistencies in previous work, in the present study, I do not advance specific hypotheses about the relation between self-regulation and positive risk taking.

Finally, previous research suggests that adolescents are generally more sensitive to rewards than punishment (Cauffman et al., 2010), and that this heightened sensitivity to reward and dampened sensitivity to punishment is linked with greater real-world negative risk taking (e.g., Ernst, 2014; Galvan, 2010). As described earlier, behavioral studies of adolescents' sensitivity to punishment and rewards yield mixed results with respect to the extent to which adolescents are sensitive to negative feedback and how this affects their decision-making (e.g., Aite et al., 2012; Cauffman et al., 2010; Humphreys et al., 2013). In an exploratory fashion, I will examine the relation between positive risk taking and sensitivity to rewards and punishments and compare these findings to the relation between negative risk taking and sensitivity to rewards and punishments. Findings from these analyses should be informative given the lack of information about psychological factors undergirding positive risk taking in youth.

Aim 3: Determine whether engagement in positive risk taking is associated with indicators of positive functioning. Finally, I aim to determine whether positive risk taking is associated with adolescents' positive functioning in order to test the claim that positive risks promote the well-being of adolescents, at least in certain domains of their lives. To test this assumption, I examine whether greater positive risk taking is associated with higher levels of grit, stronger school engagement and better school performance, and

decreased internalizing symptoms. I will also examine the association between negative risk taking and these indicators of positive functioning with the expectation that negative risk taking will not be associated with more optimal psychological functioning. Although not a comprehensive assessment of positive functioning, this component of the study will yield preliminary insight into the extent to which positive risk taking actually confers benefits to youth.

CHAPTER 2

METHODS

Participants

The sample for the present study included 164 American adolescents who have been participating in a larger cross-national study of parenting across cultures, *Parent Behavior and Child Adjustment Across Cultures* (PAC; Lansford & Bornstein, 2011). (Data from participants in other countries had not been collected in time for this dissertation, but will be analyzed in future analyses.) Youth and their parents have been interviewed annually since the youth were 8 years of age. During the third wave of data collection, participants in the PAC study were also included in a parallel study, *Decision-Making in Everyday Life* (DEL)*,* which assesses judgment, decision-making, and psychosocial development among adolescents. The ninth wave of the PAC study (and third year of the DEL study) in the American sample began in July 2017. Participants from the American sample included an ethnically diverse group (32% African American, 37% European American, and 31% Hispanic) of males and females (45% Female) ages 16-20 (M = 17.9; SD = .72). Participants came from households that were primarily working and middle class, based on the average of caregivers' education (median education level for the sample is, "some college"). This research was approved by Duke University's IRB (approval 2032).

Procedures

Participants were recruited via flyers posted in neighborhoods and schools, ads placed in newspapers, and word of mouth. Because of the varied recruitment methods, it

was not possible to determine whether those who responded to recruitment ads differed from those who did not. Parental consent and adolescent assent were acquired for all individuals younger than 18. Data were collected using various methods: (1) youth participants completed various (PAC) self-report measures administered in-person using paper and pencil, or remotely using Qualtrics, a private, online survey platform; (2) youth participants also completed a 2-hour (DEL) test battery administered by a trained research assistant on a laptop computer that included behavioral tasks, several self-report measures, a demographic questionnaire, and an intelligence assessment; (3) parents (mothers and fathers or primary caregivers) were given the option to fill out questionnaires themselves using Qualtrics or in-person using paper and pencil, or to have an oral interview with a trained research assistant (with rating scales provided as visual aids). Subjects were given the option to complete the self-report surveys remotely using Qualtrics in order to increase sample retention (especially among youth who had moved away from home for college) and to minimize the length of the in-person assessments. Most participants completed the self-report (PAC) surveys using Qualtrics.

The in-person assessments were completed individually in participants' homes, schools, or other locations designated by the participants and approved by the research assistant (in order to ensure that the location was suitable for administration of the behavioral tasks). To keep youth engaged, participants were told they would receive a base payment for participating, and that they could obtain a bonus based on their performance on the computer tasks. In actuality, all participants received the bonus. This strategy was used to increase motivation to perform well on tasks but ensure that no

participants were penalized for their performance. In the American sample, the base payment was $35 and the bonus was $15. Parents were also given modest financial compensation for their participation. Following each assessment, the interviewer answered five questions about the participant's engagement in the assessment and the quality of the data. Data marked as being unusable (*n* =2) were excluded. Sometimes, data for specific tasks were unusable due to computer glitches. The number of subjects whose data were excluded for a particular task is stated in the measures section.

Measures

Youth report measures. The following self-report measures were administered only to adolescent subjects. The positive and negative risk taking items, the grit scale, and the school engagement scale (PAC measures) were administered to participants remotely using Qualtrics or in-person using paper and pencil. The Benthin, sensation seeking, and impulse control scales (DEL measures) were administered in-person via laptop by a trained research assistant. The items included in each of these scales are listed in Appendix A-F, in order of their presentation here.

Positive risk taking. Positive risk taking was measured using 14 items modified from previous studies (Fischer & Smith, 2004; Monahan et al., *unpublished*). This scale was included in the PAC/DEL battery for the first time in the ninth wave of data collection. Items referred to risks thought to (a) be socially acceptable and (b) hold the potential to benefit the well-being of the individual or others around them. Based on the definition of risk outlined in Chapter 1 (i.e., engaging in a behavior for which the outcomes are uncertain), the wording of several of the risk items was modified from the

original scales to emphasize the novelty and ambiguity of each scenario. For example, the statement, "Initiated a friendship," was revised to read, "Started a friendship with someone new when you were not sure how your other friends would react." Participants were asked to indicate whether they had ever engaged in the activity (*Yes, No*) and how many times they had engaged in the activity over the past six months (*None, Once or Twice, 3-5 Times, More than 5 Times*). Response options were coded to match the Benthin scale of negative risk taking (see below) to facilitate comparison across scales. The 14 positive risk items were examined in an exploratory factor analysis (see Chapter 3 for details of analysis). Ultimately, a single-factor, 10-item scale evinced the best model fit (see Table 2 for factor loadings and model fit statistics) and reliability ($\alpha = .746$).

Frequency responses for engagement within the past six months were recoded into dichotomous variables indicating whether participants had engaged in the activity at least once over the past six months (coded 1) or had not engaged in the activity over the past six months (coded 0). Participants who had never engaged in the activity were also given a 0 score. Positive risk taking was computed as a proportion of positive risks endorsed by participants out of all possible risks. So-called "variety scores" have been widely used in criminological research because they are highly correlated with frequency measures but less susceptible to participant recall bias and unreliable estimates, a problem in the case of activities that some individuals engage in frequently. Furthermore, frequency scores for positive risks may be particularly unreliable given restrictions on opportunities to engage in certain risks (e.g., enrolling in an advanced course). In the

present sample, the frequency and variety scores for the 10-item positive risk taking scale were highly correlated ($r = .932$, $p < .001$).

Negative risk taking. Negative risk taking was measured using a composite of items from two self-report scales: nine items from the Benthin Risk Perception scale (Benthin, Slovic, & Severson, 1993) and eight additional negative risk items that were intermixed with the positive risk taking scale. Both scales were formatted and coded in a way that is identical to that of the positive risk taking scale. The risk items measured in the original version of the Benthin scale pertained to flagrant types of risks for which the negative outcomes are relatively high in magnitude (e.g., contraction of a sexually transmitted infection, serious injury), whereas the eight negative risk items intermixed with the positive risk scale were thought to reflect milder risks with the potential for less severe negative outcomes (e.g., getting in trouble or embarrassed), or other negative risks thought to be common to youth that were not included in the Benthin (e.g., looking at one's phone while driving). Two items (vandalizing and sneaking into a movie without paying) were endorsed by less than 5% of the sample and were therefore excluded from further analyses. The remaining 15 negative risk items were examined in an exploratory factor analysis to ensure the items loaded reasonably onto a single factor. The 15-item, single-factor negative risk scale yielded acceptable model fit statistics (see Table 2) and reliability ($\alpha = .779$). A negative risk taking variety score was computed as a proportion of negative risks endorsed out of all possible risks.

Table 2

Model Fit Statistics and Factor Loadings from Factor Analyses for Positive and Negative Risk Taking Scales

Positive Risk Taking Model Fit Statistics		**Negative Risk Taking Model Fit Statistics**	
Fit Index	**Coefficient and Significance**	**Fit Index**	**Coefficient and Significance**
$\chi^2(35)$	33.809, *ns*	$\chi^2(90)$	141.835, $p < .001$
RMSEA	< .001, 90% CI = 0 - .056, *ns*	RMSEA	.061, 90% CI = .041-.080, *ns*
CFI	1	CFI	.907
SRMR	0.086	SRMR	.160

Factor Loadings from EFA		**Factor Loadings from CFA**	
Item	**Loading**	**Item**	**Loading**
Joined new club/ activity	.485*	Stole from store	.682*
Tried new food	.447*	Got into fight	.377*
Enrolled in challenging class	.586*	Went to dangerous part o/town	.509*
Tried new outfit or hairstyle	.588*	Threatened/injured someone	.620*
Gone to event w/new people	.651*	Smoked cigarettes	.639*
Shared something personal	.782*	Drank alcohol	.734*
Stood up for beliefs	.685*	Got in car w/drunk driver	.408*
Started new friendship	.685*	Had unprotected sex	.476*
Tried new sport	.472*	Looked at phone while driving	.790*
Hung out w/new peer group	.852*	Cheated on an assignment/test	.598*
		Ditched class	.713*
		Disclosed personal info online	.410*
		Snuck out of house	.641*
		Sexted	.683*
		Drove over speed limit	.865*

Note. Results for positive and negative risk taking are from the final, single-factor solution from the exploratory factor analyses. See Appendix A for the full list of items.

(Table 2 cont'd). Four items were omitted from the final positive risk scale: *tried out for team/auditioned for play, told someone the truth, ran for a leadership role,* and *asked someone on a date.* Two items were omitted from the final negative risk scale: *vandalized,* and *snuck into a movie without paying.* See Kline (2011; pp.193-209) for a discussion of model fit.

* $p < .05$

Sensation seeking. Sensation seeking was assessed using a subset of six items from the Sensation Seeking Scale (Zuckerman, Eysenck, & Eysenck, 1978). Many items on the full 19-item scale appeared to measure impulsivity (e.g., "I often do things on impulse") and were excluded. Thus, the items used to measure sensation seeking included only items that clearly indexed thrill- or novelty-seeking (e.g., "I like doing things just for the thrill of it"). The six-item version of the sensation seeking scale has been used in other studies (e.g., Duell et al., 2016; Steinberg et al., 2008). Participants responded either true (coded 1) or false (coded 0) to each of the prompts, and an average score across the six items was computed. Higher scores reflected greater sensation seeking. The reliability (Cronbach's α) for the six-item sensation seeking scale was .737.

Impulse control. Impulse control was measured using six items from the Zuckerman Sensation Seeking scale thought to measure impulse control or the tendency to engage in thoughtful, planned behavior (e.g., "I usually think about what I'm going to do before doing it"). Participants rated the extent to which each item was true (coded 1) or false (coded 0) for them and an average of these scores was computed. Higher scores reflected greater impulse control. Reliability for the six-item scale was .663.

Grit. Grit was measured using a 12-item scale that measured individuals' tendencies to work strenuously toward challenges and maintain effort and interest despite failure, adversity, or plateaus in progress (Duckworth, Peterson, Matthews, & Kelly, 2007). Participants indicated the extent to which each statement (e.g., "setbacks don't discourage me") was representative of their behavior using a 5-point Likert-style scale. Response options ranged from (1) *Very much like me* to (5) *Not like me at all,* and were averaged to compute a single measure of grit. Higher scores reflected higher grit. Reliability for the 12-item grit scale was .731.

School engagement. School engagement was measured using the Academic Identity scale developed for use in the PAC study. This scale included 13 items that asked participants about the extent to which they were engaged and invested in their academics (e.g., "I often do my best work in school"). Participants recorded their responses using a six-point Likert-style scale, with response options ranging from (1) *Strongly disagree* or (7) *Strongly agree*. Responses were averaged to create a single score, with higher scores indicating greater school engagement. Reliability for the 13-item scale was .733.

Parent-Report Measures. The following measures were administered to adolescents' mothers and fathers or primary caregivers. Only one parent was interviewed in single-parent homes or if one parent refused or was not involved in the youth's life. The items included in the internalizing scale are listed in Appendix G.

School performance. Parents rated their child's performance in reading, writing, math, social studies, and science. The questions were adapted from the *Performance In Academic Subjects* section of the Child Behavior Checklist (Achenbach, 1991), which

has demonstrated acceptable criterion validity in previous studies. Parents rated whether their children were *Failing, Below Average, Average,* or *Above Average* in each area. Consistent with previous studies that have used this scale (Putnick et al., 2015), a single composite score was computed as the average of scores for at least 4 of the courses (up to 5, if students were enrolled in all 5 courses), with higher scores indicating better school performance. Data for two subjects (n = 2) were excluded because the youth was not enrolled in school. For data analysis, an average of the mother (α=.907) and father (α=.898) reports was computed and used as a single indicator of school performance.

Internalizing symptoms. Internalizing symptoms were assessed using parent reports from the *anxious/depressed*, *withdrawn*, and *somatic complaint* subscales on the Child Behavior Checklist (CBCL; Achenbach, 1991). Parents were asked to report on the frequency (*Never, Sometimes, Often*) with which their child had demonstrated a particular behavioral pattern over the past six months. A sum of the 31 internalizing symptom scores was computed to create one measure of internalizing behaviors, with higher scores indicating greater internalizing symptoms. For data analysis, an average of the mother (α = .898) and father (α=.967) scores was computed to create a single indicator variable.

Behavioral Measures. The following behavioral tasks were administered to adolescent subjects only. Trained research assistants administered these tasks in-person using a laptop computer.

Balloon analogue risk task (BART). A modified version of the BART (adapted from Lejuez et al., 2002) was used as a measure of risk taking propensity. This computerized task included 20 trials in which participants decided how much air to

“pump” into a balloon. The larger the balloon inflated, the more points were earned. Participants initiated inflation by pressing the space bar. The balloon inflated continuously until the participant paused inflation by pressing the space bar again. From this point, participants could incrementally inflate the balloon by pressing the space bar until the desired inflation size was reached, at which point participants would hit a separate key to obtain their accumulated points.

Each balloon had a unique maximum inflation point that was predetermined on each trial and unknown by the participant. Thus, the more the participant inflated the balloon, the greater risk he or she incurred. If the balloon hit its maximum inflation point, it would burst, and all points earned up until that point were lost. Risk taking was operationalized as the average inflation percentage across the 20 trials [(inflated size of a balloon / maximum inflation point) x 100], with higher inflation percentages indicating greater risk taking. Performance (i.e., total points earned for the entire task) was used as a measure of strategic risk taking.

Data for one subject were excluded from the analyses due to a technical error in which the computer was unresponsive to the subject’s attempts to inflate the balloon.

Stoplight. The Stoplight game (Steinberg et al., 2008) is a computerized behavioral measure of risk taking propensity. Participants were asked to “drive” a car to a party at a distant location in as little time as possible (with a 5-minute time cap), and had to pass through 20 intersections, each marked by a traffic signal. The participant’s vantage point was that of someone behind the wheel. Before playing, participants were informed that when approaching an intersection in which the traffic signal turned yellow,

they had to decide whether to stop the car (using the space bar) and wait for the light to cycle back to green, or attempt to cross the intersection. Participants could not control the car's speed, and the "brake" only worked after the light had turned yellow. Participants were told that one of three things could happen depending on their decision: (a) if brakes were not applied and the car passed through the intersection without crashing, no time would be lost, (b) if brakes were applied before the light turned red, the car would stop safely, but three seconds would be lost waiting for the green light, or (c) if brakes were not applied or applied too late and the car crashed (accompanied by squealing tires, a loud crash, and the image of a shattered windshield), six seconds would be lost. Participants had to decide whether to drive through the intersection to save time (but risk losing time if a crash occurred), or to stop and wait (and willingly lose a smaller amount of time). Among the 20 intersections, there was one in which the light remained green and all cars passed through (data from this intersection were not used).

Risk taking propensity was computed as the proportion of intersections the participant entered without applying the brakes. The time it took participants to complete the task (in *seconds*) was used as an index of strategic risk taking, with faster times being indicative of greater strategic risk taking.

There were several technical glitches with the Stoplight task. Initially, these glitches were due to software incompatibility between the task program and the laptop computer. These issues resulted in the loss of data for a large number of subjects ($n = 42$). Once the compatibility issue was resolved, the task functioned reasonably well, although at times there were issues with the graphics (e.g., the car was displayed as driving on the

side of the road rather than on the road) and with the task failing to respond to participants' attempts to stop the car (hitting the space bar). Data for these cases (n = 8) were excluded from the analyses. Although efforts were made to fix the technical glitches and interviewers were thorough in reporting all issues during task administration, results from the Stoplight analyses should nonetheless be interpreted with caution.

Iowa gambling task. The Iowa Gambling Task (IGT) was used to measure reward and punishment sensitivity as well as feedback learning. In this task, individuals attempted to earn pretend money by playing cards from four different decks, presented on the computer screen. Two decks were advantageous and resulted in monetary gain over repeated play, and two decks were disadvantageous, producing a net loss over repeated play. The task was administered in six blocks of 20 trials each. The standard task (Bechara et al., 1994) was modified in two ways. First, participants decided to play or pass a card from a pre-selected deck rather than deciding to draw from any of the four decks (see Cauffman et al., 2010 for details). This modification has been shown to be more sensitive to individual differences in performance because it separates the independent effects of gains and losses on subsequent card selection (Peters & Slovic, 2000). Second, participants received information on net gain or loss associated with each card rather than information on gain and loss separately. This modification was made to equate working memory loads across subjects and to ensure that participants did not unequally weight rewards and losses within a given trial.

During the task, one of four decks was highlighted and participants were given four seconds to play or pass the card. A running total of the participant's "earnings"

appeared on each screen. If the participant passed, the image of the card displayed the message “Pass” and the total amount of money earned would not change. If the participant played, a monetary outcome was displayed on the card and the total amount of money earned was updated. Reward sensitivity was computed as the difference in the number of plays from advantageous decks (relative to the total number of advantageous cards presented during each block) in the last and first blocks: (# Plays Block 6) – (# Plays Block 1). Larger values were indicative of a steeper increase in participant’s plays from advantageous decks between the final and first blocks, and therefore reflected greater reward sensitivity. Punishment sensitivity was computed as the difference in the number of plays from disadvantageous decks in the last and first blocks. Smaller values were indicative of a steeper decrease in participant’s plays from disadvantageous decks between the final and first blocks, and therefore reflected greater punishment sensitivity.

Learning was indexed using two variables: (1) subjective learning, in which participants identified which decks they believed to be advantageous or disadvantageous (with greater learning being indicated by a higher percentage of blocks *correctly* identified as being either advantageous or disadvantageous), and (2) objective learning, which was computed as a net score of total points earned during the task (with more points indicating greater learning on the task).

Covariates. Along with gender (Male = 1) and ethnicity (White = 1; African American and Hispanic = 0), parental education and intellectual functioning were used as covariates in all analyses. Research assistants administered these self-report scales in-person using a laptop computer. For some subjects ($n_{\text{parent ed.}} = 130$; $n_{\text{intellectual fxng}} = 119$),

these measures were administered during the first wave of DEL data collection (when participants were approximately 11 years old) and were not re-administered at subsequent waves. Subjects who did not complete the measures during Wave 1 completed them in a subsequent wave ($n_{\text{parent ed.}} = 29$; $n_{\text{intellectual fxng}} = 22$ for Wave 2; $n_{\text{parent ed.}} = 5$ for Wave 3).

Parental education. Participants' parents or caregivers provided information on their educational attainment, which was used to index socioeconomic status (SES). Responses were given numeric values representing completed years of education. A value of 0 indicated no education, values 1—12 corresponded to grade level (e.g., 10 indicated completion of 10th grade), 13 indicated some college, 14 indicated a college degree, and 15 represented education beyond college. The parent or caregiver's highest level of education was used in single-parent homes, and the average of the participant's parents' education levels was used in homes with two parents.

Intellectual functioning. The Matrix Reasoning subtest of the Wechsler Abbreviated Scale of Intelligence (WASI) (Psychological Corporation 1999), administered on a laptop, was used to produce an estimate of nonverbal intellectual ability. Other subtests, which rely on verbal ability, were not used due to the variability in language across sites in the original cross-national sample. The WASI has been normed for individuals ages 6– 89 years. An age-normed T-score was computed for each participant and used as a proxy for intellectual functioning.

CHAPTER 3

RESULTS

Below, I discuss missingness in the sample as well as descriptive information about the main study variables. Following, I report the final results from the factor analysis conducted to develop the positive risk taking scale. Finally, I report results from the primary analyses, organized by the three study aims outlined in Chapter 1. All analyses were conducted using Mplus v.7. Because Mplus does not allow for hierarchical regressions and because each analysis included only one independent variable of interest, all variables were entered into a single step. Each regression analysis included the covariates SES, intellectual functioning, gender (1 = Male), and ethnicity (1 = White, 0 = Hispanic or Black), followed by the independent variable of interest.

Missingness

A total of 13 youth subjects were missing data for the PAC survey battery that included the positive risk taking, grit, and school orientation measures, and 16 youth subjects were missing data for the DEL computerized battery that included all the behavioral tasks (including intellectual functioning), the self-reported sensation seeking and impulsivity scales, as well as the questionnaire for parental education (SES). This discrepancy in missingness among interview items is because several participants were away for college during the period of data collection preceding this study. Therefore, these youth were able to complete the PAC survey online using Qualtrics, but could not be present for the in-person interview required for the DEL battery.

For the parent-report measures, data from 19 mother and 63 father reports were missing for the internalizing symptoms scales, and 26 mother and 69 father reports were missing for the school performance scale. A substantial number of father reports were missing because the interviewer either could not locate the subject's father or the father was not involved in the subject's life. There are a variety of other reasons that may explain why parent data are missing (e.g., parents refused; parents will not be interviewed until the subject returns from college; parents do not know about their youth's school performance, etc.), although I do not have data to confirm this. Missing data were handled using full information maximum likelihood estimation, which results in parameter estimates that are generally more reliable than those obtained with listwise deletion or other *ad hoc* methods (Schafer & Graham, 2002).

With *t*-tests, I determined that there were no significant differences in the primary study variables (i.e., positive and negative risk taking, SES, IQ, gender, and ethnicity) between youth missing and not missing data for the self-report measures. Youth missing the Stoplight data evinced significantly higher sensation seeking scores. Between youth missing and not missing data for the parent-report measures, there were significant differences in SES, IQ, and ethnicity (for both mother- and father-reports), as well as positive risk taking (for father-reports only). Generally speaking, youth missing parent-report data were from lower-SES homes, evinced lower IQs, identified as being either Black or Hispanic and, for those missing father-reports specifically, evinced lower positive risk taking scores. Statistics from these analyses are available upon request.

Descriptive Information

In order to equalize variances across the study variables, all proportion scores (positive risk taking, negative risk taking, sensation seeking, impulse control, and Stoplight risk index) were transformed by multiplying scores by a constant of 100. Other than this, no other transformations were applied to the data. Inspection of histograms indicated that the distribution of scores for almost all of the main study variables followed a normal bell curve. The self-reported negative risk taking and impulse control composites evinced slight positive and negative skews, respectively. Demonstrating more extreme skewness were the mother and father reports of internalizing symptoms, which were positively skewed (and evinced a modal response of 0) and school performance, which evinced a negative skew. The statistical power of the analyses including the parent report data is limited by its skewness, but a transformation was not applied in the interest of maintaining interpretability of the coefficients.

Although there were a small number of extreme outliers for various measures (BART risk taking and performance, IGT reward sensitivity, and the parent-report data), sensitivity analyses including and excluding the outliers yielded no substantive differences in the results. For this reason, data for all subjects were included in the analyses. Table 3 lists the range of values, means, and standard deviations for each of the study items, as well as the number of subjects with data for those items. Tables 4-5 present the correlations among the main study variables.

For descriptive purposes, a linear regression was conducted to examine associations between the covariates and self-reported risk taking. Results indicated that

intellectual functioning (B = .625, SE (B) = .257, β = .212, p = .015) and ethnicity (B = 11.142, SE (B) = 5.129, β = .216, p = .03) were associated with positive risk taking, such that higher intellectual functioning was associated with greater positive risk taking, and white youth were more likely than Black and Hispanic youth to engage in positive risks. SES (B = .824, SE (B) = .992, β = .081, p = .406), and gender (B = -6.258, SE (B) = 3.988, β = -.125, p = .117) were not associated with positive risk taking. By comparison, only ethnicity was associated with negative risk taking, in that white youth were more likely than Black or Hispanic youth to take negative risks (B = 13.645, SE (B) = 4.372, β = .307 p = .002). SES (B = -.058, SE (B) = .819, β = -.007, p = .944), intellectual functioning (B = .065, SE (B) = .221, β = .025, p = .77), and gender (B = -3.05, SE (B) = 3.391, β = -.071, p = .368) were not associated with negative risk taking.

The primary goal of this study was to examine positive risk taking among adolescents. Thus, the sample for this study was expected to be a homogenous group of adolescents, as there were no predictions regarding age differences in positive risk taking. Although subjects ranged in age from 16-20 years, age was not associated with positive risk taking (see Table 4). Potential age differences in positive risk taking were also examined using an omnibus test based on ANOVA. Results indicated no significant age differences among 16-17 year-olds (n = 42), 18-year-olds (n = 89), and 19-20 year-olds (n = 20) [1] in positive risk taking ($F(2, 148) = .284$, p = .753).

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[1] 16- and 17-year-olds and 19- and 20-year-olds were combined because the number of 16 year-olds (n = 3) and 20 year-olds (n = 2) was too low to represent individual groups.

Table 3

Descriptive Statistics for Main Study Variables

Variable	**N**	**Min.**	**Max.**	**M**	**SD (M)**
Age	164	16	20	17.896	.715
SES	163	5	15	12.546	2.442
IQ	146	20	68	51.596	8.470
Male	164	0	1	.555	.499
White	164	0	1	.372	.485
PRT	151	0	100	60.795	25.522
NRT	155	0	86.67	29.242	21.553
BART Risk	143	28.73	93.44	69.380	10.344
Stoplight Risk	107	5.26	88.89	41.296	18.595
BART Win	143	2	8.39	6.001	1.108
Stoplight Time	107	251.45	3000	287.041	10.676
Subj. Learn.	144	0	100	54.514	20.693
Obj. Learn.	144	-21.48	66.67	12.365	17.140
Sens. Seek.	144	0	100	57.292	30.708
Impulse Cont.	144	0	100	72.222	26.591
Change Good	141	-7	9	.575	2.162
Change Bad	144	-10	4	-1.604	2.995
Grit	151	1.92	4.5	3.470	.501
Sch. Eng.	145	2.1	5.67	3.940	.738
Sch. Perf. (M)	138	1	4	3.404	.543
Sch. Perf. (F)	95	2.4	4	3.423	.474
Int. Sympt. (M)	145	0	28	6.510	6.679
Int. Sympt. (F)	105	0	50	8.333	11.506

(Table 3 cont'd). Note. SES = socioeconomic status; Intel. Fxn. = intellectual functioning (IQ proxy); Male (1 = Male; 0 = Female); White (1 = White; 0 = Black or Hispanic); PRT = Self-reported positive risk taking scale; NRT = Self-reported negative risk taking scale; Subj. Learn. = % blocks on Iowa Gambling Task (IGT) correctly identified as being either advantageous or disadvantageous; Obj. Learn = net score on IGT; Sens. Seek = Self-reported sensation seeking; Impulse Cont. = Self-reported impulse control; Change Good/Bad: Change in plays from advantageous/disadvantageous decks between the end and beginning of the IGT; Sch. Eng. = self-reported school engagement; Sch. Perf. = Mother (M) and father (F) report of youth's school performance; Int. Sympt. = Mother (M) and father (F) report of internalizing symptoms.

Table 4

Correlations Among Main Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. PRT	—	$.318^{**}$	.1	$.273^{**}$	.075	-.177	$.420^{**}$	$.248^{**}$	$.322^{**}$	.063	$-.181^{*}$	$-.255^{**}$	$.217^{**}$	$.274^{**}$	-.082	$.321^{**}$
2. NRT		—	$.187^{*}$	$.211^{*}$	.127	-.132	.155	.066	$.370^{**}$	-.113	-.054	.039	$.162^{*}$	.136	-.049	$.308^{**}$
3. BART Risk			—	.183	$.735^{**}$	-.034	.151	.012	.115	-.067	.042	.075	-.061	.102	$.267^{**}$	.159
4. Stoplight Risk				—	$.264^{**}$	$-.557^{**}$	$.218^{*}$	.149	.128	.108	-.054	-.173	.085	.182	.109	$.210^{*}$
5. BART Win					—	-.190	$.165^{*}$	.117	.095	-.035	.095	-.119	-.061	.099	$.172^{*}$	$.206^{*}$
6. Stoplight Time						—	-.165	-.021	-.198	.048	.028	.06	.068	-.039	-.005	-.132
7. Subj. Learn.							—	$.559^{**}$	$.197^{*}$	.148	.125	$-.409^{**}$	$.348^{**}$	$.298^{**}$	.057	$.524^{**}$
8. Obj. Learn.								—	.128	.111	.07	$-.621^{**}$	$.233^{**}$	$.256^{**}$	-.023	$.388^{**}$
9. Sens. Seek.									—	-.069	.068	-.162	-.016	$.282^{**}$	.02	$.200^{*}$
10. Impulse Cont.										—	.012	-.127	.014	.082	-.026	.095
11. Change Good											—	.131	-.021	.024	-.022	.061
12. Change Bad												—	-.141	-.139	.084	$-.219^{**}$
13.SES													—	.074	-.077	$.529^{**}$
14. Intel. Fxn.														—	$.199^{*}$	$.417^{**}$
15. Male															—	.055
16. White																—

Note. PRT = Self-reported positive risk taking scale; NRT = Self-reported negative risk taking scale; Subj. Learn. = % blocks on Iowa Gambling Task (IGT) correctly identified as being either advantageous or disadvantageous; Obj. Learn = net score on IGT Sens. Seek = Self-reported sensation seeking; Impulse Cont. = Self-reported impulse control; Change Good/Bad: Change in plays from advantageous/disadvantageous decks between the end and beginning of the IGT; SES = socioeconomic status; Intel. Fxn. = intellectual functioning (IQ proxy); Male (1 = Male; 0 = Female); White (1 = White; 0 = Black or Hispanic). *See* Table 3 for correlations among indicators of positive functioning.

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

Table 5

Correlations Among Indicators of Positive Functioning

Variable	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1. PRT	—	-.041	.251**	.388**	.333**	.093	.045	.217**	.274**	-.082	.321**
2. Grit		—	.194*	.072	.005	-.365**	-.172	-.208*	.068	.069	-.219**
3. Sch. Eng.			—	.188*	.250*	-.103	-.024	.01	.221*	-.042	.077
4. Sch. Perf. (M)				—	.809**	-.067	-.163	.286**	.398**	.056	.424**
5. Sch. Perf. (F)					—	-.153	-.179	.349**	.346**	.053	.403**
6. Int. Sympt. (M)						—	.370**	-.008	.053	-.259**	.088
7. Int. Sympt. (F)							—	-0.1	.05	-.093	-.212*
8. SES								—	.074	-.077	.529**
9. Intel. Fxn.									—	.199*	.417**
10. Male										—	.055
11. White											—

Note. PRT = self-reported positive risk taking; Sch. Eng. = self-reported school engagement; Sch. Perf. = Mother (M) and father (F) report of youth's school performance; Int. Sympt. = Mother (M) and father (F) report of internalizing symptoms; SES = socioeconomic status; Intel. Fxn. = intellectual functioning (IQ proxy); Male (1 = Male; 0 = Female); White (1 = White; 0 = Black or Hispanic).

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

Finalization of the Positive Risk Taking scale

An exploratory factor analysis was conducted on the 14 positive risk items (see Table 6 for correlations), modeling for up to 4 factors and using oblique rotation. Model fit statistics and factor loadings for individual items yielded 4 consistently problematic items: (1) tried out for a new team or auditioned for a play; (2) told someone the truth; (3) run for a leadership role; (4) asked someone new on a date for the first time. These items either consistently loaded poorly on all factors, or loaded equally on more than one factor. After removing these four items, a single factor, 10-item scale was developed with excellent model fit (Table 2) and reliability ($\alpha = .746$).

Measurement invariance. To ensure that the positive risk taking scale was consistent across gender, ethnicity, and age, three tests of measurement invariance using the alignment method (Asparouhov & Muthén, 2014) were conducted to confirm measurement invariance of the positive risk taking items across groups. The alignment method estimates factor mean and variance parameters in each group by incorporating a simplicity function similar to that of the rotation criteria used with exploratory factor analysis. An iterative procedure determines the largest "set" of groups containing no significant difference on a given parameter. Pairwise tests establish the largest set of groups that do not significantly differ ($\alpha = .01$ to adjust for multiple comparisons). Any two groups that do not differ are connected. Next, the average value of the parameter from this invariant group is compared to the value of the parameter of each individual group. If the comparison suggests not-significant differences, the group is added (or kept in) to the invariant set; if there is a significant difference, the group is removed (or kept

out of) the invariant set. This procedure is repeated until no groups are added or removed for each parameter. Groups excluded from the invariant set, therefore, differ from the average value of the invariant group for a given parameter. In the output file, Mplus flags the scale items for which there is group measurement non-invariance. Results indicated measurement invariance across males and females, individuals identifying as being White, Black, or Hispanic, and across age (using the groups defined above).

Discriminant validity. To ensure that the positive and negative risk taking scales represented two distinct constructs (rather than a single “risk taking” factor), two confirmatory factor analyses were conducted to determine the extent to which the (10-item) positive and (15-item) negative risk taking scales were distinguishable. In the first CFA, a single factor model was examined using all of the positive and negative risk items. In the second CFA, a 2-factor model was examined (one factor with the 10 positive risk items and a second factor with the 15 negative risk items). If the 2-factor CFA yielded the best model fit, this would be evidence in favor of the notion that the 10 positive risk items and 15 negative risk items represented two distinct constructs.

Weighted least squares (WLSVM) estimation was used for the factor analyses given the dichotomous nature of the risk variables. For WLSVM estimation, traditional chi-square testing is not possible because the chi-square difference is not distributed as a chi-square (Muthén & Muthén, 2012). Thus, according to convention, the DIFFTEST option in Mplus was used to compare chi-square model fit between the single-factor and two-factor risk models. Using this approach, the least-restrictive model (the two-factor model) was fit first. The derivatives from this model were saved and then used in the test

Table 6

Correlations Among All Positive Risk Taking Scale Items

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Club/Org.	—	.116	.320**	.064	.231**	.217**	.126	.155	.199*	.249**	.218**	-.027	.169*	.001
2. New Food		—	.165*	.063	.188*	.170*	.078	.199*	.184*	.195*	.052	.089	-.058	.041
3. Hard Class			—	.245**	.152	.338**	.152	.230**	.216**	.226**	.104	.202*	.09	.143
4. New Hair or Trend				—	.295**	.325**	.248**	.180*	.183*	.345**	-.004	.135	-.098	.044
5. Social Event					—	.310**	.248**	.269**	.196*	.331**	.125	.117	-.01	.145
6. Tell Secret						—	.358**	.317**	.165*	.418**	.035	.247**	.012	.023
7. Stand up for Beliefs							—	.246**	.022	.346**	.03	.181*	.079	.066
8. Initiate Friendship								—	.186*	.467**	.129	.021	.049	.39**
9. New Sport									—	.225**	.272**	.107	-.02	.175*
10. New Group										—	.059	.158	.097	.153
11. Audition/Try Out											—	-.021	.155	.113
12. Tell Truth												—	.027	-.033
13. Leadership Role													—	.053
14. Ask on Date														—

Note. See Appendix A for full questions. Items 11 through 14 were omitted from the final scale. * $p < .05$; ** $p < .01$

of the most restrictive model (the single-factor model). A significant *p*-value for the difference test suggests that the restriction worsens model fit. Results from the DIFFTEST analysis suggested that the single-factor model was a significantly worse fit to the data than the two-factor model ($\Delta\chi^2(1) = 39.93$, $p < .001$), supporting the notion that the positive and negative risk taking items represented two distinct constructs.

A Wald Test for discriminant validity was also conducted using the MODEL TEST command in Mplus. This analysis tested whether the correlation between the two continuous factors (positive and negative risk taking) was equal to 1. A significant Wald test (i.e., rejecting the null hypothesis that the correlation is equal to 1) would indicate discriminant validity between the factors. Results of this analysis yielded a significant Wald coefficient, indicating that the correlation between the factors was not equal to 1 and therefore providing evidence for discriminant validity between the positive and negative risk scales (Wald$\chi^2(1) = 279.43$, $p < .001$).

Results for Aim 1: Examine the Association Between Positive and Negative Risk Taking and Experimental Measures of Risk Taking

First, a linear regression was conducted to examine the association between self-reported positive and negative risk taking. Results indicated that greater self-reported negative risk taking was associated with greater positive risk taking (see Table 7). Next, four separate linear regressions were conducted to examine the association between self-reported positive risk taking (dependent variable) and behavioral risk taking on the BART and Stoplight tasks, as well as strategic risk taking on the BART via task points earned, and strategic risk taking on the Stoplight via task completion time. Results

indicated that risk taking on the Stoplight task, but not the BART, was associated with greater positive risk taking. Performance on the BART task was not associated with positive risk taking. However, performance on the Stoplight task indicated a marginal association with positive risk taking in that, as predicted, faster times on the Stoplight task (i.e., better performance) was associated with greater positive risk taking. These analyses were repeated using negative risk taking as the outcome variable and results indicated that risk taking on the BART was associated with greater negative risk taking and risk taking on the Stoplight was marginally associated with greater negative risk taking. BART and Stoplight performance were not significantly related to negative risk taking. Results from these analyses are presented in Table 7.

Additionally, the association between learning and positive risk taking was examined using the subjective and objective learning variables from the Iowa Gambling Task. Results (see Table 7) indicated that greater positive risk taking was associated with greater subjective learning, or the ability to correctly identify advantageous and disadvantageous decks on the task. However, objective learning, or subjects' final performance on the task, was not associated with positive risk taking. Neither subjective nor objective learning were associated with negative risk taking.

Table 7

Associations Between Self-Reported Positive and Negative Risk Taking and Various Experimental Measures of Risk Taking

Variable	B	SE (B)	Std. β	p (B)	R^2	p (R^2)
Outcome: Positive Risk Taking						
NRT	.268	.092	.233	.004	.154	.003
BART Risk	.227	.205	.094	.270	.125	.01
BART Perf.	.92	1.913	.041	.63	.115	.01
Stoplight Risk	.323	.122	.24	.008	.171	.003
Stoplight Perf.	-.355	.211	-.152	.092	.133	.007
Subj. Learning	.408	.107	.338	< .001	.209	.001
Obj. Learning	.176	.126	.121	.163	.121	.007
Outcome: Negative Risk Taking						
BART Risk	.359	.175	.173	.04	.115	.03
BART Perf.	1.533	1.648	.08	.346	.093	.067
Stoplight Risk	.193	.108	.167	.074	.116	.039
Stoplight Perf.	-.19	.189	-.095	.313	.098	.063
Subj. Learning	< .001	.1	< .001	> .999	.097	.095
Obj. Learning	-.085	.111	-.067	.446	.112	.077

Note. Each variable was analyzed in a separate regression analysis that included the covariates (excluded from this table) SES, IQ, gender, and ethnicity. R^2 values are for the full model including covariates. NRT = self-reported negative risk taking; BART Perf. = performance (points earned) on the BART task; Stoplight Perf. = performance (time to complete task) on the Stoplight; Subj. and Obj. Learning = Iowa Gambling *(Table 7 cont'd)* Task: % of blocks correctly identified as being advantageous or disadvantageous, and average net score, respectively.

Results for Aim 2: Explore the Extent to Which Psychological Correlates of Negative Risk Taking are Also Associated with Positive Risk Taking

Four separate linear regressions were conducted to explore associations between positive risk taking (dependent variable) and sensation seeking, impulse control, reward sensitivity, and punishment sensitivity (see Table 8). Results indicated that greater sensation seeking and punishment sensitivity were associated with greater positive risk taking. In contrast, greater reward sensitivity was associated with less positive risk taking. Impulse control was not significantly associated with positive risk taking.

The four regression analyses were repeated using negative risk taking as the dependent variable. Results (also see Table 8) indicated that greater sensation seeking was associated with more negative risk taking and that there was a marginal negative association between impulse control and negative risk taking (i.e., greater impulse control was marginally associated with less negative risk taking). Negative risk taking was not associated with either reward sensitivity or punishment sensitivity.

Results for Aim 3: Determine Whether Engagement in Positive Risk Taking is Associated with Indicators of Positive Functioning

Four separate regression analyses were conducted to examine the association between positive risk taking (independent variable) and grit, school engagement, school performance, and internalizing symptoms. Results indicated that positive risk taking was associated with stronger school engagement and better academic performance, but was not associated with grit or internalizing symptoms (see Table 9). These four regressions were repeated, replacing positive risk taking with negative risk taking as the predictor

variable. Results indicated that negative risk taking was associated with weaker school engagement and lower grit, but was not associated with school performance or internalizing symptoms (see Table 9).

Table 8

Psychological Correlates of Positive and Negative Risk Taking

Variable	**B**	**SE (B)**	**Std. β**	***p* (B)**	**R^2**	***p* (R^2)**
Outcome: Positive Risk Taking						
Sensation Seeking	.213	.066	.264	.001	.171	.001
Impulse Control	.024	.076	.026	.749	.114	.01
Reward Sensitivity	-2.497	.928	-.216	.007	.166	.002
Punishment Sensitivity	-1.52	.678	-.183	.025	.14	.004
Outcome: Negative Risk Taking						
Sensation Seeking	.236	.055	.342	< .001	.178	.002
Impulse Control	-.124	.065	-.152	.057	.128	.039
Reward Sensitivity	-.785	.812	-.079	.334	.108	.067
Punishment Sensitivity	.888	.597	.123	.137	.124	.051

Note. Each variable was analyzed in a separate regression analysis that included the covariates (excluded from this table) SES, IQ, gender, and ethnicity. R^2 values are for the full model including covariates. Sensation seeking and impulse control are self-report scales. Reward sensitivity and punishment sensitivity represent the change in plays from good and bad decks, respectively, between the first and last blocks on the Iowa Gambling Task. Greater reward sensitivity is indicated by higher values (i.e., greater plays from advantageous decks at the end of the task compared to the beginning); greater punishment sensitivity is indicated by *lower* values (i.e., less plays from disadvantageous decks at the end of the task).

Table 9

Associations Between Positive and Negative Risk Taking and Indicators of Positive Functioning

Variable	**B**	**SE (B)**	**Std. β**	***p* (B)**	**R^2**	***p* (R^2)**
Predictor: Positive Risk Taking						
School Eng.	.006	.003	.218	.011	.109	.067
Grit	< .001	.002	.01	.909	.095	.1
School Perf.	.004	.002	.226	.005	.215	< .001
Int. Sympt.	.027	.027	.088	.319	.08	.127
Predictor: Negative Risk Taking						
School Eng.	-.012	.003	-.343	< .001	.183	.006
Grit	-.005	.002	-.2	.015	.105	.03
School Perf.	.003	.002	.141	.083	.189	.001
Int. Sympt.	.007	.031	.019	.820	.076	.142

Note. Each variable was analyzed in a separate regression analysis that included the covariates (excluded from this table) SES, IQ, gender, and ethnicity. R^2 values are for the full model including covariates. School engagement (School Eng.) and grit are self-report scales. School performance (School Perf.) and Internalizing symptoms (Int. Sympt.) are averages of mother- and father-report scales.

CHAPTER 4

DISCUSSION

Epidemiological (World Health Organization, 2014) and experimental data (Shulman et al., 2016) indicate that adolescents are prone to risk taking. Evolutionary models of adolescent development suggest that risk taking propensity is heightened in adolescence in order to facilitate the accomplishment of numerous developmental milestones such as skill acquisition, identity development, and autonomy (Crone & Dahl, 2012; Ellis et al., 2012). Despite this notion that risk taking may confer advantages upon youth, most research on adolescent risk taking has focused on negative (e.g., dangerous or illegal) risks, such as substance use or delinquency. Only recently have researchers begun to explore the extent to which adolescents' risk taking propensity can lead to adaptive behaviors (Fischer & Smith, 2004; Humphreys et al., 2013; 2016; Telzer, 2016). Presently, there is not yet a clear conceptualization in the adolescence literature of what is positive risk taking and how best to measure it. Drawing from behavioral neuroeconomic models of risk (Mohr et al., 2010), positive risk taking in this study was defined as engaging in a behavior for which the outcomes, good or bad, are uncertain, but that also yields the potential to benefit the individual or those around her.

The framework for the present study was grounded in dual systems models of adolescent risk taking and decision-making (Steinberg, 2008) and evolutionary theories of development (Ellis et al., 2012; Spear, 2013). Based on these theories, and using a self-report measure of positive risk taking designed for this study, I examined positive risk taking in adolescents and its association with existing self-report measures of negative

risk taking, behavioral measures of risk taking propensity, psychological correlates of negative risk taking, and a variety of psychological outcomes. I found that greater self-reported positive risk taking is associated with greater self-reported negative risk taking as well as risk taking on experimental tasks of risk taking propensity. As hypothesized, high sensation seeking is linked to engagement in both positive and negative risk taking, but only negative risk taking is associated with poor impulse control. Positive risk taking seems to be particularly beneficial to youths' academic functioning, as higher positive risk taking is associated with greater school engagement and performance.

Although sensation seeking is linked to both positive and negative forms of risk taking, findings from the present study indicate that punishment sensitivity and subjective feedback learning are uniquely associated with positive risk taking (but not negative risk taking). These two psychological characteristics go hand in hand, as avoiding actions yielding a cost (or loss) requires the ability to learn from feedback patterns. On the Iowa Gambling Task, the disadvantageous decks yield rewards (and losses) that are larger in magnitude than in the advantageous decks. Given that adolescents evince a heightened sensitivity to rewarding stimuli (Spear, 2013), their decision-making is typically biased towards stimuli that produce frequent and larger rewards (Cauffman et al., 2010). This may be because adolescents are generally less sensitive to negative feedback, or are less likely to integrate negative feedback into their decision-making than are adults (but see Humphreys et al., 2016). However, differences among adolescents with respect to positive risk taking may be linked to individual differences not only in one's sensitivity to costly decisions, but to incorporate that information into one's decision-making.

This association between positive risk taking and punishment sensitivity may be a function of the fact that positive risk-takers are inherently more sensitive to, and avoidant of, punishments or costs (and theoretically, positive risk behaviors evince a lower potential for harm or loss). Alternatively, it could be that positive risk taking is associated with a more general tendency to focus on tasks and learn from feedback. Findings on the association between punishment sensitivity and learning complement the findings on positive risk taking and school performance, and create a broader image of positive risk taking as being associated with more goal-oriented decision-making and positive psychological functioning, which could be a function of the experiences gained and lessons learned in taking certain positive risks (e.g., enrolling in a challenging course, standing up for one's beliefs, or participating in a school club). This would be consistent with the notion that positive risk taking reflects a more mature pattern of behavior compared to negative risk taking.

One odd and unexpected finding related to feedback sensitivity is that greater positive risk taking is associated with less reward sensitivity. In other words, greater positive risk taking was associated with a decrease in draws from rewarding decks at the end of the task compared to the beginning of the task. Given that sensation seeking and reward sensitivity are correlated (Steinberg, 2008), that positive risk taking is linked to less reward sensitivity is inconsistent with the observed positive association between positive risk taking and sensation seeking. However, this finding may actually be a function of positive risk takers' sensitivity to punishment (i.e., losses on the task). Although the rewarding decks on the Iowa Gambling Task yield net gains, the

advantageous decks produce infrequent losses, some that are small in magnitude (-$25) and others that are quite large (-$200). Thus, perhaps positive risk taking is associated with less pulls from advantageous decks because high positive risk takers are sensitive to the punishments. Based on the task parameters (see Cauffman et al., 2010), participants do not experience their first loss on advantageous decks until the second half of the task, which would explain the shift from frequent to less frequent pulls from advantageous decks between the beginning and end of the task. This pattern of behavior may also explain why positive risk taking was not associated with objective learning (net score): although positive risk taking is associated with a general understanding of which decks are advantageous and disadvantageous, it is not necessarily indicative of individuals using this information to guide decision-making. At this point, future research will have to further investigate this matter, perhaps using multiple indices of reward sensitivity to help clarify the association between reward sensitivity and positive risk taking.

That positive risk taking is associated with greater negative risk taking is consistent with previous work on positive risk taking (Fischer & Smith, 2004; Hansen & Breivik, 2001; Wood et al., 2013). The observed link between positive and negative risk taking supports the contention that adolescents evince a propensity for risk that can be manifested in both positive and negative forms. Perhaps more importantly, this association indicates that youth who take negative risks are also prone to (or are interested in) taking risks that have the potential to promote their well-being. For example, adolescents involved in sports, a positive, socially acceptable behavior, are known to also engage in substance use (e.g., drinking alcohol) (Veliz et al., 2015) and

engage in delinquent behaviors such as theft or vandalism (Rutten et al., 2007). This concept is important for the way communities think about and treat youth who engage in negative forms of risk taking, for it raises the idea that it may be possible to interest individuals who are inclined toward antisocial risk taking to experiment with other, more benign behaviors, that satisfy similar psychological needs. Although positive risk taking will not diminish youth engagement in negative risks, adolescents may still benefit from increased opportunities to also engage in activities that promote their well-being.

One extension of previous research on positive risk taking seen in the present study is an examination of the association between positive risk taking and risk taking on experimental tasks. To date, studies of the correlates of positive risk taking have relied solely on self-report measures; no studies of positive risk taking have yet examined links between self-reported positive risk taking and performance on experimental measures of risk taking. Findings from this study indicate that greater risk taking on the Stoplight task, but not the BART task, is associated with greater positive risk taking. Consistent with previous research (Lejuez et al., 2002; Kim-Spoon et al., 2015), greater risk taking on the BART and Stoplight tasks was associated with greater self-reported negative risk taking (the coefficients representing the relations between negative risk taking and the BART and Stoplight were comparable in magnitude, although the association between Stoplight risk taking was only marginally significant). I do not have an obvious explanation as to why risk taking on the Stoplight, but not the BART, was associated with greater positive risk taking, but this finding is further evidence that widely used measures of adolescent

risk taking are not pure indicators of a single psychological characteristic or behavioral tendency (such as risk taking) (Duell et al., 2018).

Findings from this study ultimately suggest that risk taking on certain behavioral measures that have been shown to predict negative risk taking is also correlated with higher rates of positive risk taking in the real world. This finding is methodologically informative, because it indicates that certain behavioral measures of risk taking capture an underlying propensity for risk rather than a specific tendency for negative risks. Based on this, researchers making assertions about youth risk taking on widely used behavioral tasks should be careful not to imply that risk taking on these tasks is necessarily indicative of a negative pattern of real-world behavior.

Although I had hypothesized that strategic risk taking on behavioral tasks (i.e., risk taking that yields optimal outcomes) would be uniquely associated with positive, but not negative, risk taking, results did quite not pan out in this way. Optimal performance on the BART task was not associated with either form of risk taking, findings that are consistent with the finding that scores on the Iowa Gambling Task (used to index objective learning) were also not associated with positive risk taking. These results suggest that risk taking cannot be defined by its outcome. That is, whether an individual's risk behavior yields a positive or negative outcome does not have any bearing on whether the risk itself is good or bad. This point is also (if not more so) applicable to real-world risk taking. Arriving home safely after a night of drunk driving, for instance, does not make the risk good.

Granted, optimal performance on the Stoplight task did evince a marginal association with positive risk taking, in that subjects who completed the Stoplight task faster evinced higher positive risk taking scores. This finding suggests that, perhaps under certain contexts, positive risk taking is associated with more strategic risk taking, although the nature of this association relative to the non-significant association with BART performance warrants further investigation. It is also worth mentioning that at this point, it is unclear the extent to which a subject's decision-making on the Stoplight (i.e., choosing to brake or run through the light) affects their task performance. With only 20 intersections, there may not be enough time in the task for subjects to develop any strategy based on learning. In light of the mixed results regarding associations between task performance and positive risk taking, examinations of the association between positive risk taking and performance on existing experimental risk tasks warrants replication. Concurrently, future researchers of positive risk taking will need to spend time considering how positive risk taking is manifested in the lab and whether or not new experimental measures can be developed to uniquely capture the propensity to take positive risks in the real world.

Sensation seeking is one psychological characteristic that seems to motivate both positive and negative forms of risk taking (Hansen & Breivik, 2001; Fischer & Smith, 2004; Wood et al., 2013). In other words, an interest in novel, exciting experiences is one factor that motivates youth engagement in risk taking of varied sorts. Evolutionary theories of adolescent development highlight the importance of novelty-seeking for motivating adolescents to explore their environments and try new things (Ellis et al.,

2012), which may in the long-term serve functions such as the facilitation of identity development or autonomy from caregivers. Although it is currently unknown which factors motivate sensation-seeking youth to engage in positive rather than negative forms of risk taking, one could speculate that opportunity plays a large role. If youth are provided with opportunities to engage in novel, exciting activities that minimize the likelihood for harm or danger and maximize opportunities to learn and grow, it is likely high sensation-seeking youth will seek out more positive risks (Spear, 2013). Positive youth development programming is based on helping youth thrive by capitalizing on their personal and environmental assets. Complementary to this, developing programs that redirect youths' natural inclinations (i.e., sensation seeking and risk taking) toward positive activities may also have applications to adolescents' long-term well-being. The findings of this study are one small part of a much broader body of research that must be conducted to establish the potential role of a positive risk taking model in youth development programs.

I had hoped to clarify the role of self-regulation in predicting positive risk taking, but findings from this study yielded results that warrant caution. Similar to Fischer and Smith (2004), findings from the analyses in this study suggest that self-regulation is not predictive of positive risk taking, one way or the other. From this vantage point, self-regulation may be one psychological factor that distinguishes positive from negative risk taking. However, negative risk taking was also not associated (at least statistically) with self-regulation. That is, it is not clear whether the absence of a relation between self-reported self-regulation and positive risk taking in this study is mainly a function of

shortcomings in the self-regulation measure. Given that poorer self-regulation has been consistently associated with greater negative risk taking among adolescents (e.g., Shulman et al., 2016), I hesitate to interpret too deeply the results of the self-regulation analyses in this study.

Despite widely held beliefs that positive risk taking is a potentially important contributor to adolescents' psychological development, previous research on positive risk taking has not examined potential outcomes of youth engagement in positive risk taking. Thus, there is little research with which to compare the findings regarding the link between positive risk taking and the outcome variables studied here. In the present study, positive risk taking was found to be associated with stronger school engagement and better academic performance, but not with grit or with the absence of internalizing symptoms. That greater positive risk taking is associated with greater school engagement and performance suggests that positive risk taking is indeed predictive of healthy adolescent outcomes, at least in certain domains of functioning. This finding should stimulate further study of the extent to which, and the ways in which, positive risk taking may confer benefits upon youth.

The associations between positive risk taking and greater school engagement and higher school performance may be evidence to support the idea of implementing positive risk taking models into youth development programs, as school engagement and performance are thought to be protective factors against outcomes such as depression and delinquency (Li & Lerner, 2011) as well as school dropout (which, on its own, has long-term implications for individuals' well being, such as financial stability; Rumberger,

2012). Findings on the association between positive risk taking and school engagement and performance are consistent with previous assertions that certain forms of risk taking are advantageous rather than detrimental to youths' well-being (e.g., Crone & Dahl, 2012). Adolescents who take positive risks may be more socially integrated and committed to learning. These youth may also be more involved in school-related activities such as clubs and after-school sports, which has been linked to school engagement and performance in previous studies (Fredricks et al., 2004). Engagement in school and school-sponsored programs may also foster positive relations with teachers and prosocial peers who may reinforce positive risk taking among other prosocial behaviors (Whitlock, 2006). Thus, one way to potentially apply risk taking models to school- or community-based programs is to use these models to inform the development of extracurricular programs for youth.

Although I expected that greater positive risk taking would be related to higher levels of grit and lower levels of internalizing symptoms, I was surprised to find that this was not the case. This is especially surprising given the observed link between grit and school achievement (e.g., Duckworth et al., 2007). In light of the association between sensation seeking and positive risk taking, it seems that adolescents who take positive risks do so because they are to some extent novel and thrilling, but that engaging in these risks is not necessarily associated with the tendency to persevere in the face of obstacles or to sustain interest in long-term goals (Duckworth et al., 2007). Further, given the relation between grit and self-regulation (Ivcevic & Brackett, 2014), positive risk taking may not be associated with grit for the same reason it is not associated with self-

regulation. On the other hand, it could be that positive risk taking has a longer-term effect on characteristics like grit that could not be observed given the time frame of the present study. Perhaps youth who take positive risks regularly will, through their experiences, develop personality strengths such as grit (Crone & Dahl, 2012). Various positive risks, such as standing up for one's beliefs, enrolling in a challenging course, or joining a school club, likely foster the development of skills such as responsibility, teamwork, and goal setting. It would be interesting for future work to examine outcomes of adolescent positive risk takers as emerging or young adults.

It is important to remember that the presence of something good (e.g., positive risk taking) does not necessarily indicate the absence of something bad (e.g., internalizing symptoms). That positive risk taking was not associated with less internalizing symptoms fits in with the general theme that youth who engage in good behaviors may nevertheless also engage in less desirable behaviors or evince problematic outcomes. Although positive risk taking has the potential to yield various positive outcomes for youth (such as school engagement), it is not necessarily a protective factor against negative outcomes (and indeed, positive risk taking shares certain underlying characteristics, such as sensation seeking, with negative risk taking, which is associated with a variety of problematic outcomes). That is, positive risk taking may be something we should facilitate, but we should not expect it to be a panacea.

The present study is one of the first to embark on a comprehensive examination of positive risk taking in adolescents and has set a framework from which future studies can build. Perhaps the greatest strength of this study is that it explored adolescent positive

risk taking in the context of a general and wide range of functioning, including trait-level psychological characteristics, academic outcomes, and indicators of mental health, using a variety of measurement techniques, including self-report, behavioral, and parent reports. Additionally, the positive risk taking scale designed for this study appears to be a promising tool with good psychometric properties that can be used in future studies. In addition to its strong reliability and structural invariance across demographic groups, there is evidence for its construct validity, given that positive risk taking in this study was associated with negative risk taking and sensation seeking, consistent with previous work, as well as with risk taking on the Stoplight task. That the positive risk taking scale also evinced discriminant validity from negative risk taking indicates that it is distinct from negative risk taking and that the items used in the positive risk taking scale are capturing a behavioral pattern that is more than just a general propensity for risk taking.

In addition to these strengths, there are also several limitations of this study that warrant caution when interpreting the results. First, many of the effects sought in this study were small. Despite my best effort to obtain the largest sample size possible given the constraints of the larger study from which the present study's data were obtained, it is likely that the sample for this study was too small to detect certain effects. Results from the analyses involving the parent-report data were also limited in their interpretability given the large amount of missingness for the parent-report data and the fact that subjects whose parents did and did not provide data differed on several demographic characteristics. Furthermore, there were several technical issues with the Stoplight task, which may have limited the utility of this measure, although it is worth mentioning that

the observed associations between Stoplight risk taking and performance and self-reported risk taking were in the expected direction.

That the scale development analyses yielded a single-factor solution for the positive risk taking scale may be a function of the fact that only 14 items were developed for the scale. It is possible that positive risk taking is a multifaceted construct, related to various domains in individuals' lives, such as academic, social, and extracurricular, or related to certain personality types, such as extroversion or introversion. Future researchers may want to explore a broader range of positive risks to determine whether or not positive risk taking is truly represented by a single factor. An additional limitation of this study is that the validity of the positive risk taking scale developed for this study may be limited to adolescents. It is currently unknown how positive risk taking differs across development and whether the scale is adaptable to older populations. Some of the items in the positive risk taking scale, particularly those related to school activities (e.g., joining a school club) are undoubtedly affected by age differences in opportunities to take those risks as well as the norms for a particular age group (e.g., trying a new hairstyle or fashion trend may seem like a bigger risk for a teenager than adult). Relatedly, it would have been helpful, particularly for establishing the validity of the positive risk scale, to have recorded subjects' ratings of the perceived degree of riskiness for each of the positive risk taking items. Although one aim in designing the positive risk scale was to include items that varied in terms of riskiness (with some items being higher in riskiness than others), any item perceived as being completely un-risky would have compromised the validity of the scale. Granted, it is worth noting here that the positive risk items used

in this scale were generated in previous studies via focus groups of adolescents and young adults that had identified the items as being subjectively risky (Fischer & Smith, 2004; Monahan, VanDerhei, & Amemiya, *unpublished*).

The analyses of the present study were also largely constrained to models of negative risk taking in the sense that the correlates of positive risk taking measured in this study were chosen based on findings from previous studies of negative risk taking. Although it is conceptually useful to understand positive risk taking in the context of negative risk taking, there are several contextual factors that future research will want to consider, such as peer influence, parent support, and community- and school-based opportunities. Indeed, it is likely that one important difference between youth who do and do not engage in positive and negative risks is the contexts in which they grow up, especially as it relates to the role models in their lives and the family values with which they were raised. Future research may also want to consider positive risk taking from a developmental perspective, examining this pattern of behavior in both younger and older teenagers, as factors such as opportunity, values, and perceptions of risk are likely to change across age. As we learn more about the nature of positive risk taking, and as we grow more confident in how to best measure it, the field will be able to turn to questions about contextual factors that either facilitate or hinder its development.

In this study, I have attempted to develop a conceptual framework of positive risk taking in adolescence and examine its psychological correlates. An important point to take away from this study is that adolescents who take negative risks also take positive risks and that capitalizing on youths' interests in novel, rewarding sensations may be one

way to encourage engagement in positive risks. Furthermore, positive risk taking appears to have implications for adolescent learning and academic orientation, which may make models of positive risk taking applicable to positive youth development programs. Specifically, schools may want to structure opportunities for youth to engage in positive risks in safe, adaptive ways by facilitating youth engagement in structured activities in which they can interact with pro-social peers and adult mentors and in which they can learn important skills such as teamwork, time management, or goal-setting. There is still much work to be done to understand the nature of positive risk taking in adolescence, but I hope that the findings of the present study offer a useful starting point. Furthermore, I hope the findings of this study demonstrate that not all risk taking in adolescence is negative, and that some forms of risk taking may indeed confer benefits upon youth.

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APPENDIX A

POSITIVE AND NEGATIVE RISK TAKING SCALE

Below are items included in the positive risk taking scale as well as items (asterisked) included in the negative risk taking scale. Items 1, 4, 7, and 9 were omitted from the final positive risk taking scale. Item 18 was omitted from the final negative risk taking scale.

1. Tried out for a team or auditioned for a play when you were not sure you would be picked?
2. Joined a new club or activity when you were not sure you would like it?
3. Looked at your phone while driving a car instead of paying attention to the road? *
4. Told someone the truth, even if they did not want to hear it?
5. Tried a new food you thought you might not like?
6. Cheated on a homework assignment or exam even though you knew you would get in trouble if you were caught? *
7. Ran for a leadership role in school or in some other organization when you were not sure you would be picked?
8. Decided to skip class even though you could get in trouble and fall behind on your schoolwork? *
9. Asked someone new on a date when you thought the person may say no?
10. Taken a class in a subject you knew nothing about or that seemed challenging?
11. Posted something very personal about yourself on the Internet that you hoped only your friends would see but that other people could find out about? *

12. Tried a new hairstyle or outfit that you were not sure others would like?
13. Snuck out of your house without telling your parents where you were going? *
14. Gone to a party or social event where you did not know very many people and thought you might not have anyone to talk with?
15. Told a secret or shared something personal about yourself to someone?
16. Sent sexy messages or pictures to someone? *
17. Stood up for what you believe is right, even though you thought someone might disagree with you?
18. Snuck into a movie without paying even though the owner could have caught you and called the police? *
19. Started a friendship with someone new when you were not sure how your other friends would react?
20. Tried a new sport or played a sport you are not good at where you might have embarrassed yourself?
21. Driven faster than the legal speed limit?*
22. Spent time with a new group of people when you were not sure you would fit in?

APPENDIX B

BENTHIN RISK TAKING ITEMS

Below are the risk items included in the negative risk taking scale. Item 5 was omitted from the final negative risk taking scale.

1) Drinking alcohol
2) Riding in a car with a drunk driver
3) Having unprotected sex
4) Smoking cigarettes
5) Vandalism
6) Shoplifting
7) Going into a dangerous neighborhood
8) Getting into a fight
9) Threatening or injuring someone with a weapon

APPENDIX C

SENSATION SEEKING SCALE

1. I like to have new and exciting experiences and feelings even if they are a little frightening.
2. I like doing things just for the thrill of it.
3. I sometimes like to do things that are a little frightening.
4. I'll try anything once.
5. I sometimes do "crazy" things just for fun.
6. I like wild and "crazy" parties.

APPENDIX D

IMPULSE CONTROL SCALE

Below are items from the self-reported impulse control scale. Items with an (R) were reverse-scored.

1. I tend to begin a new job without much advance planning on how I will do it (R)
2. I usually think about what I'm going to do before doing it
3. I often act without thinking (R)
4. I hardly ever spend much time on the details of planning ahead (R)
5. Before I begin a complicated job, I make careful plans about how I would complete it
6. I usually act before I think about what I want to do (R)

APPENDIX E

GRIT SCALE

Below are items from the self-reported grit scale. Items with an (R) were reverse-scored.

1. I have overcome setbacks to conquer an important challenge
2. New ideas and projects sometimes distract me from previous ones (R)
3. My interests change from year to year (R)
4. Setbacks don't discourage me
5. I have been obsessed with a certain idea or project for a short time but later lost interest (R)
6. I am a hard worker
7. I often set a goal but later choose to pursue a different one (R)
8. I have difficulty maintaining my focus on projects that take more than a few months to complete (R)
9. I finish whatever I begin
10. I have achieved a goal that took years of work
11. I become very interested in new pursuits every few months (R)
12. I am diligent

APPENDIX F

ACADEMIC IDENTITY SCALE

Below are items from the self-reported academic identity scale that was used as an index of school engagement. Items with an (R) were reverse-scored.

1. Being a good student is an important part of who I am
2. I feel that the grades I get show my abilities
3. My grades do not tell me anything about what I can do (R)
4. I don’t really care what tests say about my intelligence (R)
5. School is satisfying to me because it gives me a feeling of accomplishment
6. If the tests we take were fair, I would be doing much better in school (R)
7. I am often relieved if I just pass a course (R)
8. I often do my best work in school
9. School is very boring for me, and I’m not learning what I feel is important (R)
10. I put a great deal of myself into some things at school because they have special meaning or interest for me
11. I enjoy school because it gives me a chance to learn many interesting things
12. I feel like the things I do at school waste my time more than the things I do outside of school (R)
13. No test will ever change my opinion of how smart I am (R)

APPENDIX G

PARENT-REPORTED INTERNALIZING SYMPTOM SCALES

Below are all items from the Child Behavior Checklist. Items marked with (AD), (S), and (W) reflect items from the *anxious/depressed*, *somatic*, and *withdrawn* subscales that were summed to create a composite score of internalizing symptoms. Item 53 was associated with two subscales but only entered once into the computation.

1. Argues a lot
2. Bragging, boasting (AD)
3. Complains of loneliness
4. Cries a lot (AD)
5. Cruelty, bullying or meanness to others
6. Demands a lot of attention
7. Destroys his/her own things
8. Destroys things belonging to his/her family or others
9. Disobedient at home
10. Disobedient at school
11. Doesn't seem to feel guilty after misbehaving
12. Easily jealous
13. Fears he/she might think or do something bad (AD)
14. Feels he/she has to be perfect (AD)
15. Feels or complains that no one loves him/her (AD)
16. Feels others are out to get him/her (AD)

17. Feels worthless or inferior (AD)

18. Gets in many fights

19. Hangs around with others who get in trouble

20. Would rather be alone than with others (W)

21. Lying or cheating

22. Nervous, high-strung or tense (AD)

23. Too fearful or anxious (AD)

24. Feels dizzy (S)

25. Feels too guilty (AD)

26. Overtired (S)

27. Aches or pains (S)

    27i. Headaches (S)

    27j. Nausea, feels sick (S)

    27k. Problems with eyes (S)

    27l. Rashes or skin problems (S)

    27m. Stomach aches or cramps (S)

    27n. Vomiting (S)

28. Physically attacks people

29. Prefers being with older kids

30. Refuses to talk (W)

31. Runs away from home

32. Screams a lot

33. Secretive, keeps things to self (W)

34. Self-conscious or easily embarrassed (AD)

35. Sets fires

36. Showing off or clowning

37. Shy or timid (W)

38. Stares blankly (W)

39. Steals at home

40. Steals outside the home

41. Stubborn, sullen or irritable

42. Sudden changes in mood or feelings

43. Sulks a lot (W)

44. Suspicious (AD)

45. Swearing or obscene language

46. Talks too much

47. Teases a lot

48. Temper tantrums or hot temper

49. Thinks about sex too much

50. Threatens people

51. Truancy, skips school

52. Underactive, slow moving, or lacks energy (W)

53. Unhappy, sad, or depressed (W) (AD)

54. Unusually loud

55. Uses alcohol or drugs

56. Vandalism

57. Withdrawn, doesn't get involved with others (W)

58. Worries (AD)