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The Impact of Peer Group Size on Adolescent Socially Risky Decision-Making Behavior

TERESA LEONARD
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Reviewed and approved* by the following:

Nina Lauharatanahirun
Assistant Professor of Biomedical Engineering and Biobehavioral Health
Thesis Supervisor

Kari Kugler
Associate Teaching Professor of Biobehavioral Health
Honors Adviser

* Electronic approvals are on file.

ABSTRACT

Adolescence demonstrates a dynamic time where young people are making autonomous decisions to interact with new social groups as they move away from parental control. The decision to interact with new people to make new friends is healthy and normative for adolescents. However, initiating new friendships with peers is socially risky as it introduces potential rejection. There is limited literature that confirms whether the number of peers adolescents choose to approach results in an increased experience of rejection. Therefore, the purpose of this thesis was to investigate how adolescents respond to peer groups within socially risky environments. Furthermore, differing adolescent responses between risky social and non-social environments were measured by a novel social analogue risk task (SART) modified from the well-established Balloon Analogue Risk Task (BART; Lejuez et al., 2002). We also examined the correlations between behavioral risk taking during the SART and BART to self-reported risk taking. To measure social risk taking, adolescents (*N*=192) played the SART where they were faced with decisions to interact (or not) with groups of peers that varied by sizes of one, two, four, or six. Adolescents (*N*=178) also completed the BART to measure individual non-social risk taking. Results indicated that adolescents differ in their risk taking between social and non-social environments, such that adolescents were more socially risk averse, which may explain why adolescents may shy away from generating friendships with peers. The SART was not correlated with self-reported social risk-taking behavior, but the BART was correlated with one measure of self-reported risk-taking behavior. We found no significant difference in adolescents' decisions to interact among varying group sizes. This finding may be advantageous for adolescent health as it indicates adolescents are not as sensitive to group size when making

socially risky choices to initiate interactions with others. This insensitivity is potentially adaptive during the period of adolescence when youth are exploring and forming new friendships with others and should be further explored in future research.

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Chapter 1
Introduction

Adolescence denotes a period of increased growth and development resulting in a psychosocial environment noticeably different than that of adults and children (Choudhury et al., 2006). As adolescents begin to exit the realm of parental control, they learn to become autonomous and take charge of their decision-making processes (Cumsille et al., 2009). Theoretical models of adolescent risky behavior posit that during middle adolescence, the socioemotional limbic areas of the brain increase reward seeking behaviors before the cognitive control systems of the prefrontal cortices have fully matured to regulate impulse control (Steinberg, 2008, 2010). At the same time, adolescents are particularly sensitive to their social environments and the presence of peer influence (Blakemore & Mills, 2014; van Hoorn et al., 2016). Previous research has shown that adolescents take more risks in the presence of peers than when alone due to a greater activation in reward circuits housed in the mesolimbic dopamine system of the brain (Chein et al., 2011; Banich et al., 2013; de Boer, Peters, and Koning, 2016). Yet increased sensitivity to social stimuli has also found adolescents to become more risk averse in social settings (Blakemore, 2018). Understanding the interaction between adolescents and their social environments has important implications for the development of prevention and intervention programs that encourage adolescents to take more positive social risks. Adolescents who engage in more positive social risks may benefit socially, emotionally, physically, and academically, having a lasting impact on overall health.

Risk involves weighing the potential likelihoods of receiving a reward. A decision is considered risky if the consequences of the choice are uncertain (Lauharatanahirun et al., 2023). Social risks involve situations in which an individual is faced with uncertain outcomes that are determined by another person or people, yet there lacks consensus regarding the definition of social risk and how it may be influenced differently than non-social risk (Andrews et al., 2020; Allen et al., 2003; Blakemore, 2018; Harrison et al., 2013). In the present study, adolescents made risky decisions in a non-social context (did not involve others) and a social context where the outcomes were determined by a varying number of people. Adolescents may take social risks that either promote or harm their health, such as initiating friendships with new peers, trying out for a sports team, or joining a club. The outcome of health-harming or health-promoting decisions depends on the individual adolescent and the ideas, presence, and composition of the social group present (Andrews et al., 2020). The decision-making process for adolescents involves considering not only potential health consequences but also the potential social repercussions of their choices. For example, engaging in risky behaviors like smoking not only poses long-term health risks but also puts adolescents at risk of social exclusion if smoking is normative in their peer group (Blakemore, 2018). Adolescents' sensitivity to social acceptance and rejection influences their decision-making regarding social risks, and individual differences in rejection sensitivity play a role in mediating the likelihood of engaging in social risks (Andrews et al., 2020).

Initiating a social interaction and acquiring a new friend is a type of positive social risk an adolescent may choose to take, thus benefiting their social development (Duell & Steinberg, 2020). The development and maintenance of friendships during adolescence is important for learning healthy prosocial behaviors (Hartup, 1993). Research shows that the formulation of just

one close supportive friendship generates psychological resiliency into adulthood (Graber et al., 2015). Increased resiliency from initiating new friendships has been shown to mitigate adolescent decisions to engage in negative health risk behaviors such as substance misuse (Rutter, 1999). Adolescents are prone to taking increased negative health risks around peers (Fryt et al., 2021; Chein et al., 2011), yet avoid taking risks that may benefit them socially for fear of rejection (Duell & Steinberg, 2020; Blakemore, 2018). Adolescents are at a heightened sensitivity to social comparison and the outcomes of social risks (van der Aar, Peters, & Crone, 2018). Social comparison research shows that people become more risk averse when they are in a socially disadvantaged position, such as approaching a stranger (Linde & Sonnemans, 2012).

The experience of rejection during adolescence can contribute to negative mental health outcomes, such as depression (Allen et al., 2003). It is possible that the experience of rejection may substantially increase when adolescents approach more than one person. Group size has been identified as an important variable in theories of group behavior, but additional research is needed to determine its effect on adolescent decisions to interact with others (Thomas & Fink, 1963). The current study aims to determine how individual adolescents differ in their risk-taking behavior due to changing peer group size and whether their sensitivity to social feedback causes risk aversion or risk-seeking in the face of rejection.

Factors that Influence Adolescent Social Decision-Making

Neurobiological Factors

Adolescence represents a unique developmental period to study risky social decision-making processes due to the maturational imbalance between cognitive control and reward seeking systems in the brain (Cascio et al., 2015; Chein et al., 2011; Lee et al., 2021; McCormick et al., 2018; Steinberg, 2008). The cognitive control system responsible for inhibitory behaviors and other self-regulatory processes is housed in the anterior cingulate and prefrontal cortices (Casey at el., 2008). The mesolimbic dopamine system, including the ventral tegmental area and nucleus accumbens, are brain areas involved in the processing of rewards (Banich et al., 2013; Chein et al., 2011; Peake et al., 2013). The dual systems model of adolescent decision-making asserts that neurobiological changes during the onset of puberty cause rapid developments in brain regions that function to process rewards, while cognitive control systems gradually mature well into late adolescence (Steinberg, 2008; Van leijenhorst et al., 2010). This biological imbalance leads researchers to believe adolescents are more salient towards rewards than the outcomes of potentially harmful behavior (Steinberg, 2010). Peer approval and a sense of belonging are rewards that adolescents are seeking as they attempt to navigate new social environments (Blakemore, 2018; Blakemore & Mills, 2014; Cascio et al., 2015; Tomova et al., 2021; Weigard et al., 2014). It is proposed that increased activation of reward circuitry without a fully matured cognitive control system causes adolescents to weigh peer influence more heavily when faced with determining risk versus reward (Banich et al., 2013). Neural activation identified during fMRI in the insula and dorsal anterior cingulate cortex (dACC) shows where risk processing occurs during adolescence (Asscheman et al., 2020). The social brain is referred

to as the network or brain regions involved in understanding others, including the medial prefrontal cortex (mPFC), anterior cingulate cortex (ACC), inferior frontal gyrus, superior temporal sulcus (STS), the amygdala, and the anterior insula (Blakemore, 2008). Among other physical, psychological, and social changes occurring between childhood and adulthood, these areas are developing significantly during adolescence (Blakemore, 2008; Huttenlocker 1979, 1983). Continuing advancements in our understanding of the social brain lend strong support to the notion that adolescents exhibit heightened sensitivity to acceptance and rejection from peers, primarily due to synaptic reorganization during this critical period (Steinberg & Morris, 2001; Huttenlocker, 1979).

Chein and colleagues utilized functional magnetic resonance imaging (fMRI) to measure brain activity across different age groups during the Stoplight Task. During the Stoplight Task, participants play a simulated driving task in which they are confronted with making the decision to risk a crash by running a yellow light or stop at the yellow light before it turns red. Findings revealed that adolescents demonstrated heightened risk-taking behavior when their friends were present, in contrast to adults. Adolescent decisions to increase speed, rather than slow down when presented with a yellow light, were associated with increased activation in the ventral striatum and orbitofrontal cortex, brain regions known to be involved in reward processing and decision-making. Adults engaged multiple brain regions more robustly than adolescents, showing better neural suppression of brain regions seeking immediate rewards (Chein et al., 2011). The study's results imply that adolescents may exhibit a discrepancy in decision-making, where their ability to choose options that are safest or most beneficial in the long term might be less developed compared to their inclination towards seeking immediate rewards (Chein et al., 2011; Crone & Dahl, 2012).

In another study, McCormick and colleagues developed a different social variation of the Balloon Analogue Risk Task (BART; Lejuez et al., 2002) in which adolescents were presented with adult faces that became angrier as adolescents made the decision to knock on a door. Neural responses were measured using fMRI as adolescents weighed the risk of increasing anger or cashing out with their reward. Adolescents displayed decreased tracking of negative social feedback in the insula, indicating that they may not be as hypersensitive to social information when there is a goal (McCormick et al., 2018). The results from this study demonstrated that adolescents could update social information flexibly based upon their goals and may not exhibit the same risk-taking behaviors across all contexts (McCormick et al., 2018). In the current study, adolescents are presented with a goal which may affect their sensitivity to the socially risky situation. McCormick and colleagues' study shows that adolescents do not always show higher sensitivity in response to social situations, as previously found by Chein and colleagues. Therefore, there continues to be uncertainty about how adolescents respond behaviorally to social environments, and their responses may depend on the type of task given.

Individual differences in neural sensitivity during social contexts also contribute to a wide range of responses. For example, some adolescents have been shown to have more resistance to peer influence than others (Peake et al., 2013). Adolescents with higher resistance to peer influence are shown to have higher activation in the right and left lateral prefrontal cortices while making safe decisions under peer observation during the Stoplight Task (Peake et al., 2013). The implication of these brain areas shows that mentalizing processes are being utilized during social evaluation, even after exclusion. Therefore, those who have a predisposed higher resistance to peer influence are likely to regulate their cognitive control systems to make safe decisions, despite increased reward sensitivity that occurs during adolescence (Peake et al., 2013).

Social Sensitivity of Adolescents

Adolescents may be more prone to engage in risky behaviors when in the presence of their peers due to the influence of social context and the developing brain's sensitivity to social rewards (Chein et al., 2011). The presence of peers has been found to increase a variety of health-harming behaviors in adolescents (Brechwald & Prinstein, 2011), including underage binge drinking (Bot et al., 2005), aggression (Brendgen et al., 2008), and drug use (Duncan et al., 2005). Experimental evidence indicates that adolescents' decisions are directly influenced by the mere presence of peers (Gardner & Steinberg, 2005). In Gardner & Steinberg's study, adolescents and adults each played a driving task called Chicken. Similar to the Stoplight Task, participants made in the moment decisions about whether to stop a car that is approaching a yellow light. Participants were tasked with the goal of moving the car as fast as possible without crashing. During the sole condition, adolescents played the task by themselves, while in the group condition there were two other participants who could offer advice while one participant was playing the game. Participants were also separated into an adult group and an adolescent group so that age differences in risk taking could be inferred. Gardner & Steinberg (2005) found that risk taking decreases with age. Following self-report data from a shortened version of the Benthin Risk Perception Measure (BRPM; Benthin, Slovic, & Severson, 1993), researchers concluded that both adolescents and adults focused more on the potential benefits than the costs of risky behavior. The BRPM measures both risk perception and risk preference and was administered to see if a difference in risk perception between adolescents and adults could explain higher risk seeking in adolescents. However, the conclusion that adolescents and adults did not differ strongly in self-reported risk perception and risk preference indicates that age

differences in risky decision-making could be related to psychosocial functioning, or the presence and number of peers present. Indeed, both groups made riskier decisions in peer groups than when alone. All peer effects were stronger for adolescents than for youths or adults, indicating an increased sensitivity to the presence of peers during adolescence (Gardner & Steinberg, 2005). The findings of this study motivate research of peer group size and its impact on decision making during adolescence, given that adolescents differed in decision-making in comparison to other age groups when 2-3 of their friends were observing and offering advice.

In a study examining how individual preferences during social risks are changed by the expected attitude of other group members, subjects were significantly more risk averse when they knew the preferences of other group members (Harrison et al., 2013). Using a within subjects' design in which all participants completed two lottery tasks (one where decisions are chosen by a group majority and the other by an individual) and a Dictator task, people were found to be more risk averse in the social condition (Harrison et al., 2013). Therefore, people seek peer approval and make decisions based upon their perceived preferences of the group they are in. Peer influence plays a significant role in adolescents' lives as they constantly assess their position within social networks and make decisions based on their relative importance within these networks. Even when adolescents are not included in a social network, their brains still encode information about their perceived rank and use it in decision-making (Schwyck et al., 2022). This suggests that adolescents' decision-making can be influenced by their perception of where they stand in the social hierarchy of a group, even in ambiguous situations.

Peers have also been shown to increase health promoting decisions in adolescents, such as concern for others (van Hoorn et al., 2016), involvement in team sports (Barber, Eccles, & Stone, 2001), and helping others (Foulkes et al., 2018). In a study examining prosocial behavior of

adolescents aged 12-16, the Public Goods Game (PGG) was played in groups of four. The PGG measures prosocial behaviors such as self-interest and group concern when adolescents are confronted with the task of dividing tokens among a group. Adolescents worked to divide tokens between their group while under the supposed watch of ten same-age peers from another school who would provide either antisocial feedback, prosocial feedback, or no feedback. Results found that prosocial behavior changed depending on what was liked by the peer group, with equal sharing of coins only increasing when prosocial feedback was given by others (van Hoorn et al., 2016). While adolescent sensitivity to peer groups was shown to increase health harming behaviors such as risky driving (Gardner & Steinberg, 2005), increased sensitivity to peer feedback during the PGG shows that the presence of peers can also increase positive prosocial behavior. Therefore, increased social sensitivity during adolescence may not always be harmful to adolescent health. Much of the focus on adolescent risk-taking behaviors pertains to how peers are a negative influence for increased health-harming behaviors (Gardner & Steinberg, 2005; Brechwald & Prinstein, 2011), but it is important to recognize how sensitivity to social feedback can be adaptive for health-promoting behaviors as well.

Rejection Sensitivity

Seeking social acceptance and maintaining close relationships are two of the most fundamental needs of human beings (Baumeister & Leary, 1995). These needs become especially pertinent during adolescence (Knoll et al., 2015; Tomova, 2021; Van Harmelen et al., 2017). The increased sensitivity to social cues during adolescence can be advantageous, allowing adolescents to be more flexible in prioritizing their social goals and updating their motivations. But it can also

be harmful when individual feelings about self-worth and value are tied to social cues and rejection reinforces a negative self-image, leading to mental health struggles (Crone & Dahl, 2012). In a study measuring mental well-being and future psychological resilience of adolescents ages 14-24, friendship and family support both positively predicted immediate resiliency. Friendship was an even stronger predictor than family and was the only variable predictive of future resilient functioning (van Harmelen et al., 2017). Friendships are important to adolescent well-being, and yet initiating friendships can be a frightening task when rejection is a possibility.

According to a 2018 review of adolescent brain development, peer influence, and behavior, adolescents are prone to taking more risks under peer influence but may take less risks when faced with the fear of rejection (Blakemore, 2018). Stereotypes often portray adolescents as unconcerned about their risk-taking behaviors, but conflicting results show they are concerned about the outcomes of social risks (Andrews et al., 2020). In fact, a higher concern for social risk is related to an increase in rejection sensitivity that leads to an avoidance of socially risky behavior (Andrews et al., 2020). Avoidance of rejection may be an attempt to prevent negative mood (O'Brien % Bierman, 1988; Sebastian et al., 2010; Masten et al., 2010). O'Brien and Bierman (1988) suggest that in adolescents ages 13-17, peer rejection incites feelings of unworthiness. The effect of social exclusion from a group on risk taking has been studied using financial decisions. After completing the Cyberball task in which half the participants were in a condition to mimic social exclusion, those same participants were more likely to choose a riskier lottery option between two options of the same utility (Duclos et al., 2013). The Cyberball task (Williams et al., 2000) is an online game in which participants toss a ball to other online players in the hopes that the ball will be returned. In the condition mimicking social exclusion, participants received the ball substantially less than those participants in the inclusion group.

Duclos and colleagues hypothesize that people crave money and popularity, so that when exclusion occurs and popularity decreases, people will fall back on choices that will garner them more money despite the risk of monetary loss. Studies such as this show that interpersonal rejection increases risk taking in the financial domain but raise questions as to whether the same results will occur when financial decisions are not the model, and whether adolescents will follow a similar pattern as adults (Duclos et al., 2013). In an early study examining the consequences of deviation from a group standard, feelings of rejection were defined as greater when there was greater pressure to conform and high dependence on group standards (Schachter, 1951; Festinger et al., 1950). Adolescence has been previously categorized as a sensitive period for sociocultural processing in which the pressure to conform is heavily influenced by the social environment (Blakemore & Mills, 2014). Schachter wrote that one method of deviation is to cut the deviate off from communication with the group, because communication is the mechanism by which power is exerted (Schacter, 1951). In the current study, participants may be cut off from communication and must adapt their risk-taking behaviors to this knowledge.

Baumeister and colleagues found that exclusion can directly impact self-regulation. In a sample of undergraduate students, participants were told to rank who they wanted to work with after getting acquainted with one another. Half were randomly assigned to receive negative feedback that nobody wanted to work with them. Afterwards, consumption of cookies was used as the dependent variable to measure self-regulation. People who were rejected by the group ate more cookies overall, showing that feelings of rejection impair self-regulation (Baumeister et al., 2005). Impaired self-regulation may further impair decision-making such that adolescents respond differently to social situations after being rejected. As the present study seeks to measure behavioral changes in response to social and non-social tasks, it contributes to the ongoing

exploration of how rejection shapes adolescent decision making and emotional health. The question remains how adolescents may respond to rejection from a group, and if the number of people in the group increases those feelings of rejection.

Group Size

Research has been devoted to uncovering how adults interact and make decisions within groups across varying group sizes (Baker et al., 2008; Harrison et al., 2013; Masclet et al., 2009; Zhang and Casari, 2012). However, emphasis is rarely placed on how an individual responds to a changing group dynamic when they are not working within the group, and how adolescents uniquely respond to peer groups. Early research by Thomas & Fink (1963) examined the variable of group size in relation to group performance, conformity and consensus, and the nature of the interaction. By reviewing empirical studies of small groups, Thomas & Fink (1963) found that discrepancies in the definition of group size across literature and the inability to control for the intended variables made conclusions invalid. Thomas and Fink posit that further research should be more systematically conducted to test whether group size exerts behavioral effects without the presence of social and psychological variables (Thomas and Fink, 1963).

Decisions to interact with groups are important for building diverse social connections, especially during the formative period of adolescence. Group size could support adaptive social decision-making leading to positive social and mental health outcomes. Many studies on group decision making behavior have used adult samples focused on economic decisions and have found inconsistent results (Duclos et al., 2013; Lu et al., 2018; Roush et al., 2019). For instance, adults who were socially excluded displayed higher levels of risky financial decisions (Duclos et

al., 2013). In another study measuring the influence of group social preferences on financial decisions, a lottery task was used to assess whether people would take more financial risks if they knew the other people in the room were presented with the same choices (Roush et al., 2019). Individuals were separated into group and single environments and presented with the option to receive a fixed amount of money or opt for a lottery. The lottery consisted of two equally likely payoffs, with one payoff being greater than the baseline and the other being less than. The results were compared to provide insight on how group size impacts decisions. Results indicated that financial risk-taking behavior neither increased nor decreased when participants knew that other people in the room were given the same choices, regardless of the size of the peer group in the room (Roush et al., 2019). However, in a study of interpersonal insecurity and risk-taking propensity within known and unfamiliar groups, participants differed in their decisions made during financial situations when compared to other social risks (Lu et al., 2018). Interpersonal insecurity, defined as the extent to which people worry about interpersonal rejection and hurt, was positively correlated with risk taking propensity in the natural/physical, moral, reproduction, safety, and gambling domains of the DOSPERT Scale (Lu et al., 2018). Meanwhile, interpersonal insecurity was not correlated with risk taking propensity in the financial domain (Lu et al., 2018). While group size has often been measured using lottery tasks, this result reveals that participant behavior may be less influenced by rejection during financial tasks. For this reason, further research into group size using social situations not involving finances is needed. Overall, those who felt rejected by known members of a group exhibited increased risk-taking propensity, while feeling rejected by unfamiliar group members decreased risk taking propensity (Lu et al., 2018). This result introduces another dimension to social risk taking. The connections that an individual has with their peer group further influences their behavior. Therefore, the current study presents a

unique contribution to the literature by examining group size as a factor that may influence adolescent socially risky decision making. Inconsistencies persist in the literature due to the complexity of social contexts and the multitude of factors influencing decision-making within them. While previous research has largely focused on financial decision-making within groups, neglecting other social risks, this study aims to fill this gap by examining how adolescents weigh social rewards beyond financial considerations.

In the field of education, group size has been studied in the form of class size and its effects on participation and learning (McKeachie, 1980; Kim, 2013; Bohlke, 2003). In a review of studies relating to increasing class size and student engagement, retention, and memory, it is stated that the larger the group, the less likely it is that a person will be open to speaking up. However, teaching methods, subject areas, and individual interest could mediate these results (McKeachie, 1980). In a study of small groups compared to larger groups measuring online classroom interaction, students were found to be more likely to interact within smaller groups. In this case, small groups were defined as clusters of 25-30 students of the same class compared to the whole class of 138 students (Kim, 2013). In the current study, adolescents will not be presented with groups of classroom size. However, research in the field of education suggests that adolescents are more likely to interact with smaller group sizes (McKeachie, 1980; Kim, 2013). It remains unclear how small or large the group size must be to display a significant difference in adolescent decisions to interact.

The Current Study

Research Questions

The present study aims to determine how adolescent social risk-taking behaviors differ as a function of the number of peers present within a social group, using a novel experimental task that measures social risk-taking behaviors (SART). The study aims to address the following research questions: (1) How do adolescents differ in their risk-taking behavior between social and non-social environments? (2) How do adolescent social risk-taking behaviors differ as a function of increasing peer group sizes? (3) How does risk taking in a laboratory task relate to adolescent real-world risk taking? Answering these questions will aid in better understanding how adolescents make decisions in socially risky environments, which is important given their heightened sensitivity to social cues during the developmental period. Behavioral differences between performance on the BART and SART will also inform the reliability of this novel task in measuring social risk.

Hypotheses

Based on prior research that shows evidence of heightened sensitivity to social situations during adolescence (Blakemore, 2008; Crone & Dahl, 2012; McCormick et al., 2018; Peake et al., 2013) and existing literature proving that people approach social and non-social risk taking differently (Harrison et al., 2013; Morone & Morone, 2014), we hypothesize that adolescents will exhibit higher levels of risk aversion in social (i.e., SART) relative to non-social (i.e., BART) risk environments. It is expected that adolescents will be more risk averse as group size increases

from 2 to 4 to 6, based on literature showing adolescents less inclined to participate as class size increases (McKeachie, 1980; Littlepage & Silbiger, 1992; Kim, 2013), and literature showing groups to be more risk averse than individuals when making financial decisions (Baker et al., 2008; Fukutomi et al., 2022; Masclet et al., 2009, 2012; Morone et al., 2017; Zhang & Casari). Lastly, we expect that adolescents who self-report as more risk averse will display higher risk aversion on both the SART and BART than adolescents who self-report less risk aversion, in light of evidence proving the online BART to be an adequate measure of behavioral risk taking (Ju & Wallraven, 2023; de Boer et al., 2017; Lejuez et al., 2002), and the modification of the SART based upon the BART.

Chapter 2

Methods

Participants

Adolescents were recruited to participate via the Character Lab Research Network (CLRN). The Character Lab Research Network is a nonprofit organization that seeks to unite researchers and educators who want to better understand and improve the wellbeing of adolescents. CLRN randomly assigned students to one of the studies running at their school. Adolescents (*N*=318; 62.3% female) aged 13-19 years (M= 15.4, SD =1.5) participated in the current study. Adolescents were in middle or high school, in grades ranging from 8-12. Parental consent and adolescent assent were obtained for participants aged under 19 and signed consent was obtained for those participants 18 and older (*N*=25). Due to technical difficulties regarding wireless internet stability, only a subset of adolescents completed all trials of the SART (*N*=192; 56.25% female; M_{age}=15.6, SD_{age}=1.4). In addition, there were only a subset of participants who completed all trials of both the SART and BART (*N*=178; 56.6% female; M_{age}=15.6, $SD_{age=}$1.4). Finally, there were a total of *N*=84 adolescents who completed the entirety of the self-report surveys assessing real-world risk behaviors.

Table 1. Demographic Characteristics of Participants with Complete SART Data

Sample Characteristics	*N*	*%*	*M*	*SD*
Gender				
Female	108	56		
Male	78	41		
Other	5	3		
Not Reported	1	0.5		
Age			15.6	1.4
13	8	4		
14	38	20		
15	47	24.5		
16	41	21		
17	39	20		
18	18	9		
Not Reported	1	0.5		
Grade				
8	10	5		
9	51	26.5		
10	42	22		
11	44	23		
12	44	23		
Not Reported	1	0.5		

Note. N=192 for gender, age, and grade

Table 2. Demographic Characteristics of Participants with Complete BART and SART Data

Sample Characteristics	*N*	*%*	*M*	*SD*
Gender				
Female	99	56		
Male	71	40		
Other	5	3		
Not Reported	1	0.5		
Age			15.6	1.4
13	6	3.4		
14	34	19		
15	44	25		
16	37	21		
17	37	21		
18	17	9.6		
Not Reported	1	0.5		
Grade				
8	8	4.5		
9	46	26		
10	38	21.5		
11	42	23.8		
12	41	23.2		
Not Reported	1	0.5		

Note. N=178 for gender, age, and grade

Table 3. Demographic Characteristics of Participants with Complete Self-Report Data

Sample Characteristics	*N*	*%*	*M*	*SD*
Gender				
Female	43	51		
Male	39	46		
Other	2	3		
Not Reported	0	00		
Age			15.9	1.3
13	1	1		
14	16	19		
15	18	21		
16	18	21		
17	21	25		
18	10	12		
Not Reported	10	12		

Note. *N*=84 for gender and age

Procedure

Adolescents participated in this study via school computers during class time. Testing days were predetermined, and on these days, teacher proctors were chosen to administer the CLRN research study to the students in their class. Before participating in the study, teachers read a script to students indicating that all research activities were part of an educational research initiative at their school, participation was voluntary, they were not being graded, and teachers would not see their answers. Teachers were also instructed to tell their students to focus on their own computers and not look at other classmates' screens. When students logged into the CLRN platform, they were initially shown a screen reiterating the aforementioned information. Furthermore, they were informed that their parents would not have access to their responses and that their names or any other identifiable information would not be shared with researchers. Students who agreed to these terms were then taken to the survey and tasks.

Students were administered a Qualtrics survey which included a battery of questionnaires assessing students' personality traits and how they may make decisions in life. Questionnaires were presented in a randomized block order to each student and consisted of the 12 item Carleton Intolerance of Uncertainty Scale (Carleton, 2007), 6 item social media usage questions, Health and Social Risk questionnaire (HSRQ2), an 8 item Brief Sensation Seeking Scale (Hoyle et al., 2002), a general risk assessment (Dohmen et al., 2011), and a 14 item Positive Risk Scale (Duell & Steinberg, 2018). However, only a subset of these self-report questionnaires that specifically pertained to individual and social risk situations were used for further analysis. Students then completed two tasks: a chat game (SART) and a balloon game (BART). Before each task, students were briefed on how to play and asked questions assessing their understanding of the

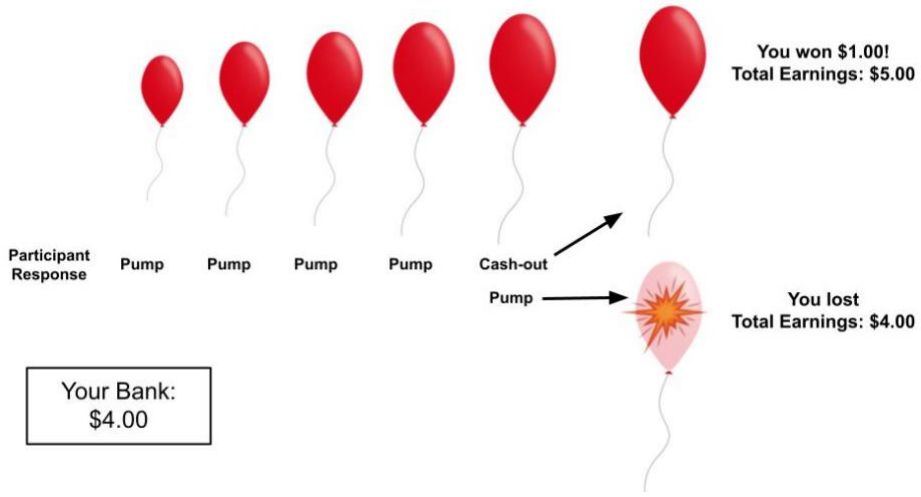
rules. After each task students were asked questions about their goals, strategies, and feelings during the game.

Measures

Non-Social Risk Taking

Adolescents completed the Balloon Analogue Risk Task (BART; Lejuez et al., 2002) as a behavioral measure of non-social risk taking under neutral circumstances. Numerous studies have established a significant association between BART performance and aggregated self-reported real-world risk behaviors (Lejuez et al., 2002; Sohn et al., 2014; Ju & Wallraven, 2023). The validity of this measure has been thoroughly confirmed in older adolescent samples, as affirmed by Reynolds et al., 2013. The task was completed as follows: Participants were told their goal was to earn as many points as possible before the balloon exploded. On each round, they were presented with a balloon for which they could choose to inflate to increase its size. Each time the balloon was inflated, more points accumulated. At any time, participants could stop inflating the balloon to collect their accumulated points for the round and transfer them to their game bank by clicking “Collect”. At any point, the balloon could explode, and they would lose the accumulated points for that trial. Participants completed 15 trials each and would not know when the balloon would explode as it varied by each round. Non-social risk taking was treated as a continuous variable and operationalized as the average number of pumps administered on trials in which the balloon did not explode across the 15 trials.

Figure 1. Example of one trial within the BART



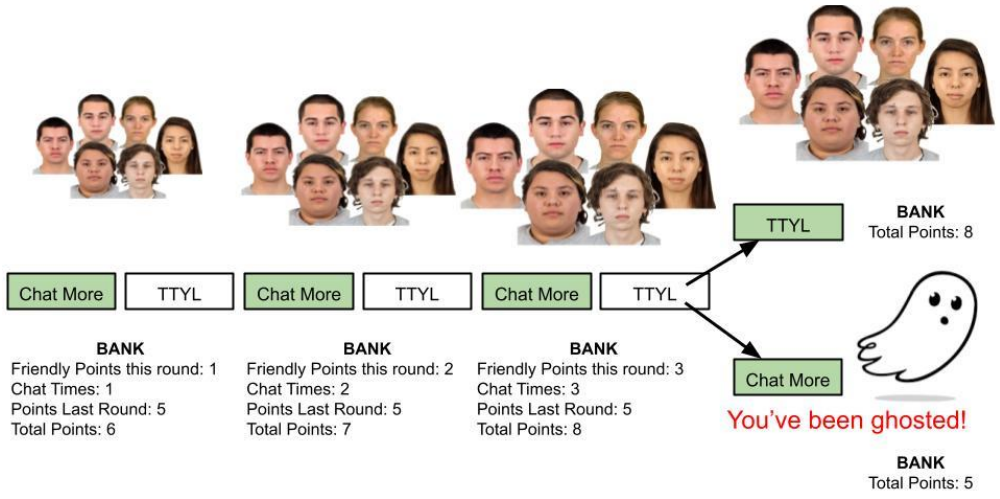
Note. The figure above shows the two possible results of a singular trial in the BART.

Social Risk Taking

Adolescents completed a novel social risk-taking task based on the well-established BART (Lejuez et al., 2002), which involves making risky decisions in pursuit of rewards in the form of money or points. Participants were told they were about to play a chat game with the goal of earning as many friendly points as possible before peers chose to end the conversation, referred to here as ghosting. Friendly points were earned by choosing to "Chat more" with the potential friends (faces). On each round, participants were presented with a picture of potential friends. The picture would be either one face (control) or a group of 2,4 or 6 faces. Each group size condition was shown to each participant an equal number of times (7) in a randomized order across 28 trials. Every time participants chose to chat more, the picture would get larger, indicating they were becoming closer through chatting. However, the more times they chose to

click chat more, the chance of being ghosted increased. Participants could be ghosted if the potential friends chose to end the conversation. In this case, all friendly points would be lost for the trial, and they would advance to the next trial with a different group size. At any point, participants could end the trial by banking their friendly points and clicking "TTYL", which would save their points for the next trial. Participants would not know when potential friends would end the conversation because it was random. Social risk taking was treated as a continuous variable and operationalized as the average number of chats on each trial in which participants were not ghosted across all 28 trials.

Figure 2. Example of one trial within the SART



Note. The figure above shows the two possible results of a singular trial in the SART.

Self-Report Questionnaires

After completing both tasks, self-report measures were administered to the entire sample. Measures utilized for further analyses included the Intolerance of Uncertainty scale (IUS; Carleton, 2007), the General Risk Question (Dohmen et al., 2011), the Brief Sensation-Seeking Scale (BSSS; Hoyle et al., 2002), and the Positive Risk-Taking scale (PRTS; Duell & Steinberg, 2020). Only a sub-sample of students completed all questions of each respective survey and were included in analyses (N= 78). Students were prompted to answer questions about themselves and respond as truthfully as possible, with the promise that answers would be kept completely confidential.

Intolerance of Uncertainty Scale (IUS)

The 12-item IUS was adopted from the previous 27-item scale to reduce factor instability and increase inter-item correlations (Carleton, 2007). The full IUS has previously demonstrated good internal consistency and test-retest reliability ($\alpha = .91$, $r = .74$) (Freeston et al., 1994). Carleton and colleagues found the shortened 12-item version to correlate highly ($r = .96$) with the total score of the 27-item scale (Carleton, 2007). A high intolerance for uncertainty may relate to poor problem-solving skills and thus an avoidance of decisions made in ambiguity (Dugas, Freeston, & Ladoucer, 1997). For this reason, students were given this survey to inform on their reactions to uncertainty, ambiguous situations, and the future. They were told to answer all 12 questions by how much they agree with each statement. Results were scored using a five-point Likert scale from 1 (strongly disagree) to 5 (strongly agree). Examples of statements included were “Unforeseen events upset me greatly”, “The smallest doubt can stop me from acting”, and

"Uncertainty keeps me from living a full life." Scores were summed for each participant such that total IUS scores could range from 12-60, where a higher score indicated higher intolerance of uncertainty.

The Dohmen General Risk Question

Dohmen and colleagues (2011) found that asking subjects how generally willing they are to take risks elicits the best predictor of risky behavior across different contexts. The general risk question was found significant in multiple contexts, including individual risk taking in the financial, sports and leisure, career, and health domains. Using a representative subject pool, the answers to the general risk question were found to predict actual behavior in a lottery task quite well. Multiple regressions showed that the coefficient of general risk was positive and significant across all four domains listed above (Dohmen et al., 2011). For this reason, participants in this study were asked "How willing are you take risks in general?" and shown a box where they could fill in a circle indicating a range from 1 (never willing) to 10 (always willing).

Brief Sensation Seeking Scale (BSSS)

The 8 item Brief Sensation Seeking Scale (BSSS) was adopted from the combined Form V of the Sensation Seeking Scale by Zuckerman and Eysenck (1978) and a different modified version of Form V by Huba and colleagues (1981) which is tailored towards adolescents. Internal consistency of the 8-item scale was found to be 0.76. Validity was maintained across sex, age, and ethnic characteristics of adolescents (Hoyle et al., 2002). Due to the high reliability and

validity for adolescent age groups, participants in this study were administered the 8-item BSSS. They were asked to select how frequently they engage in specific behaviors with the options of very frequently, frequently, sometimes, rarely, or never. Statements such as "I would like to explore strange places", "I like to do frightening things", and "I prefer friends who are excitingly unpredictable" were displayed and students were asked to rank their agreeability with the statements. Answers were coded such that 1=strongly disagree and 5=strongly agree, with the option of 7=prefer not to answer. Scores were summed so that a higher score meant a higher inclination towards sensation seeking.

Positive Risk-Taking Scale (PRTS)

The Positive Risk-Taking Scale (PRTS) was developed by Duell and Steinberg from the Non-Negative Risk-Taking scale by Fischer and Smith (2004). Researchers found compelling reliability of the self-report measure for predicting risk taking behaviors when compared to the BART. The single factor 10-item scale was found to have the best reliability ($\alpha = 0.746$). Positive risks were determined to be socially acceptable and hold the potential to benefit the wellbeing of the individual or those around them (Duell & Steinberg, 2020). Students were provided a list of different things they may have done at some time in the past and were instructed for each one to indicate how many times they have engaged in the activity during the last six months. Options included none, once or twice, 3-5 times, and more than 5 times. All questions of the 14-item positive risk scale were asked, with the inclusion of an attention check question alerting them to select "none" for question number thirteen. The question "In the past six months, how many times have you…" was displayed and participants received options such

as “joined a new club or activity when you were not sure you would like it?” and “told a secret or shared something personal about yourself to someone?”. Measures were coded such that 1= none, 2=once or twice, 3=3-5 times, and 4=more than five times and summed such that higher scores indicated higher likelihood of engaging in positive risks.

Statistical Analysis

R was used to conduct all statistical analyses. “Base”, “dplyr”, and “tidyr” were the main packages used for data cleaning. Descriptive statistics were calculated for each variable and assembled into summary tables using the “stargazer” package. R package “ggplot2” was used to create data visualizations in the form of bar graphs, boxplots, and scatter plots. The independent variable was peer group size, presented as groups of faces in four different conditions. The four conditions included one face, two faces, four faces, and six faces. The dependent variable was social risk taking (operationalized as the average number of clicks on trials in which participants were not ghosted across all four group size conditions). To assess the main effects and interaction effects of group size on social risk taking, the “aov” function was used to perform a within-subjects two-way ANOVA. Another two-way ANOVA was also performed using the “aov” function which included age and gender as covariates and categorized as factor. Only participants who completed all trials of the SART were used in analysis (N=192). A two-way Welch two sample T-test was utilized to identify significant differences in risk taking between the SART and BART. This test only included participants who had completed all trials of both the SART and BART (N=178). For analyses of self-report measures and social risk taking, Pearson correlation

tests were conducted using the “cor” and “cor.test” functions. For each statistical test, the level of significance was set at α=0.05.

Chapter 3

Results

Descriptive Statistics

Descriptive Statistics for Social Decision Making (SART)

Across all participants with complete SART data (*N*=192), the average social risk-taking score was 3.350 (SD=0.965), meaning that across all 28 trials, participants clicked “chat more” an average of 3.350 times before deciding to bank their friendly points. In terms of age, the youngest group (13-year-olds) decided to chat with peers an average of 3.689 (SD=1.057) times, while the oldest group (18-year-olds) chatted with peers an average of 3.061 (SD=0.857) times. For all age-related social risk-taking scores, see Figure 4. In terms of gender, males had a social risk score of 3.30 and females had a social risk score of 3.39. Participants were ghosted on average 9.073 (SD=5.097) times across all trials. They were ghosted an average of 2.484 times (SD=1.525) when interacting with peer group size 6 and ghosted an average of 2.146 (SD=1.558) times when interacting with peer group size 2. Across varying group sizes, average social risk scores were as follows: Group Size 1=3.261 (SD=1.072), Group Size 2=3.290 (SD=1.009), Group Size 4=3.427 (SD=1.143), Group Size 6=3.484 (SD= 1.164).

Figure 3. Adolescent Social Decision Making as a Function of Group Size

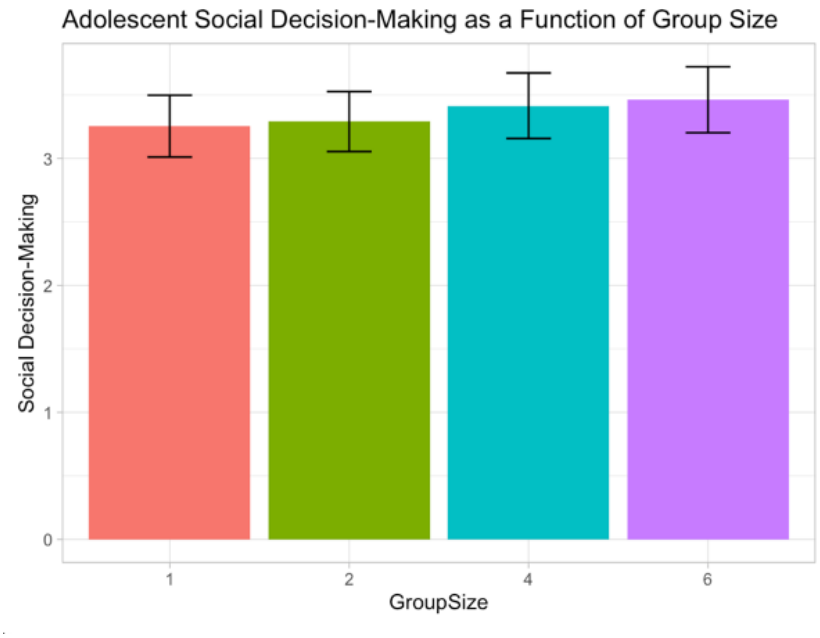
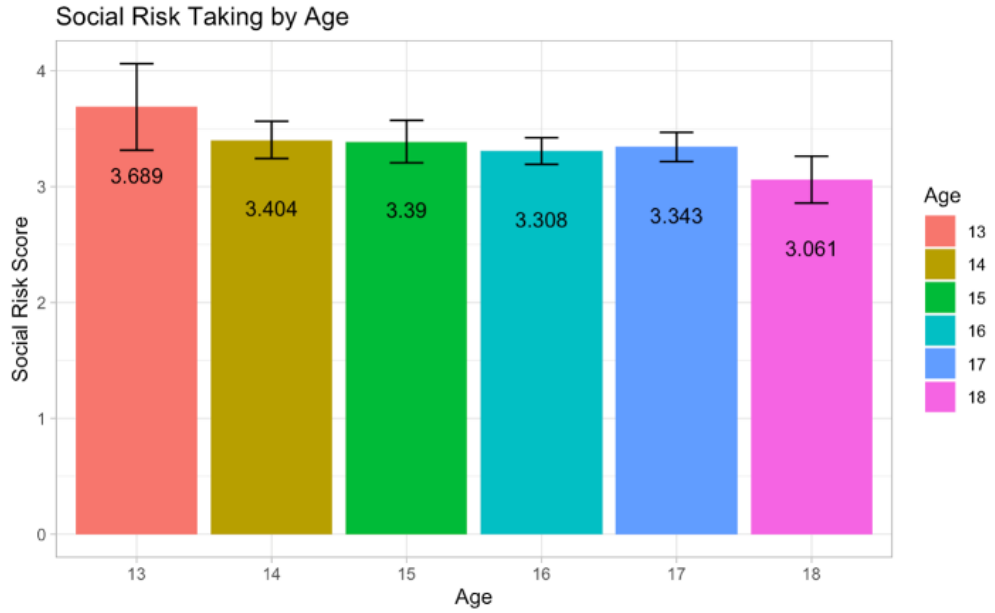


Figure 4. Social Risk Taking by Age



Descriptive Statistics for Non-Social Decision Making (BART)

The average pumps and number of explosions assessed from the BART were used to analyze non-social risk-taking behavior. Across all participants with complete BART data (*N*=178), the average non-social risk-taking score was 3.556 (SD= 1.049), meaning that across all 15 trials, participants chose to pump up the balloon an average of 3.556 times before it exploded. The average times the balloon exploded across all trials for all participants was 5.428 (SD=2.848). In terms of gender, females chose to inflate the balloon 3.640 (SD=1.187) times before banking their points. Males chose to inflate the balloon 3.516 (SD=0.517) times before banking their points. In terms of age, adolescent non-social risk-taking scores were as follows: 13-year-olds = 3.615 (SD= 1.05), 14-year-olds = 3.620 (SD=1.004), fifteen-year-olds = 3.690 (SD = 1.238), sixteen-year-olds = 3.585 (SD=0.676), seventeen-year-olds = 3.563 (SD=1.150), and eighteen-year-olds = 3.158 (SD=0.938). For a comparison of descriptive statistics between social and non-social tasks with all participants who had complete data for both tasks, see Table 4.

Table 4. Descriptive Statistics of Social and Non-Social Risk Taking

Measure	Social Risk Taking	Non-Social Risk Taking

	M	SD	M	SD
Total Average Chats/Pumps	3.565	0.939	3.816	1.004
Average Chats/Pumps on Wins *(Social/Non-Social Risk Score)*	3.350	0.965	3.556	1.049
Group Size				
1	3.261	1.072		
2	3.290	1.009		
4	3.427	1.143		
6	3.484	1.164		

Differences in Social Risk Taking Across Group Size

A two-way ANOVA was used to test if adolescents' social risk-taking behavior would differ with increasing group sizes. With respect to average social risk-taking behavior across group size as assessed by SART, the ANOVA revealed no significant interaction $F(3)=0.958$, $p = 0.412$. When accounting for covariates of age, $F(5)=1.655$, $p = 0.143$, and gender, $F(2)=1.177$, $p = 0.309$, group size still did not show a statistically significant difference in social risk-taking $F(3)=1.436$, $p = 0.231$ (See Table 5). For this reason, no Tukey post-hoc comparisons were made.

Table 5. ANOVA Results for Effects of Group Size on Social Risk Taking

Predictor	Sum of Squares	*df*	Mean Square	*F*	*p*
Group Size	5.4	3	1.786	1.436	0.231
Age	10.3	5	2.057	1.655	0.143
Gender	2.9	2	1.463	1.177	0.309

Figure 5. Social Risk by Gender and Group Size

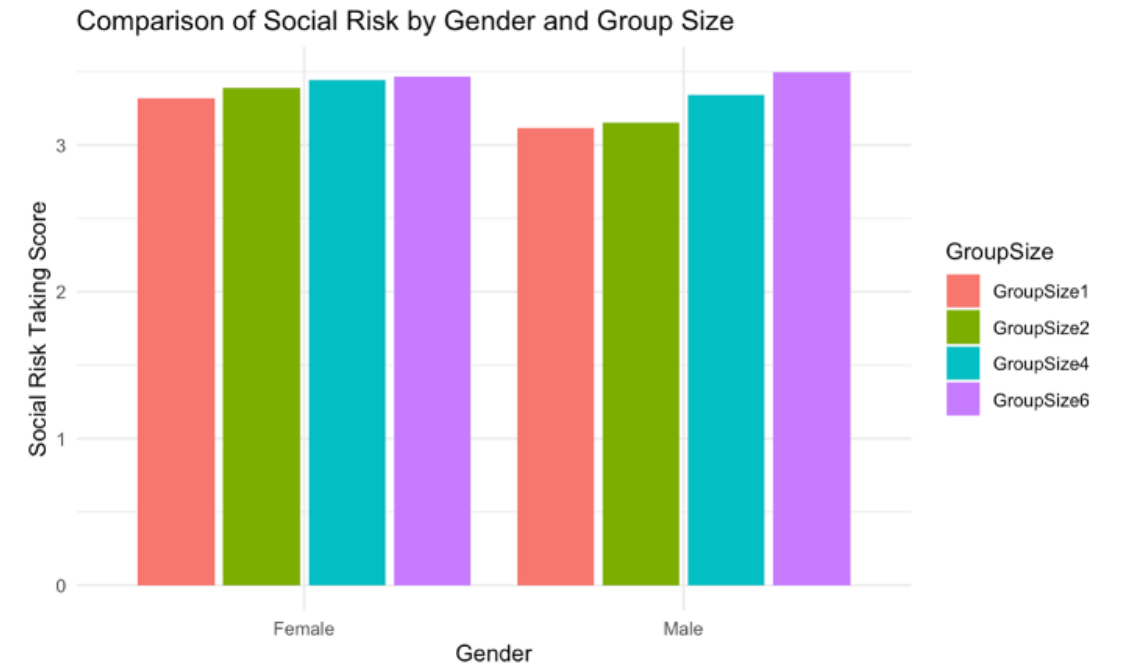
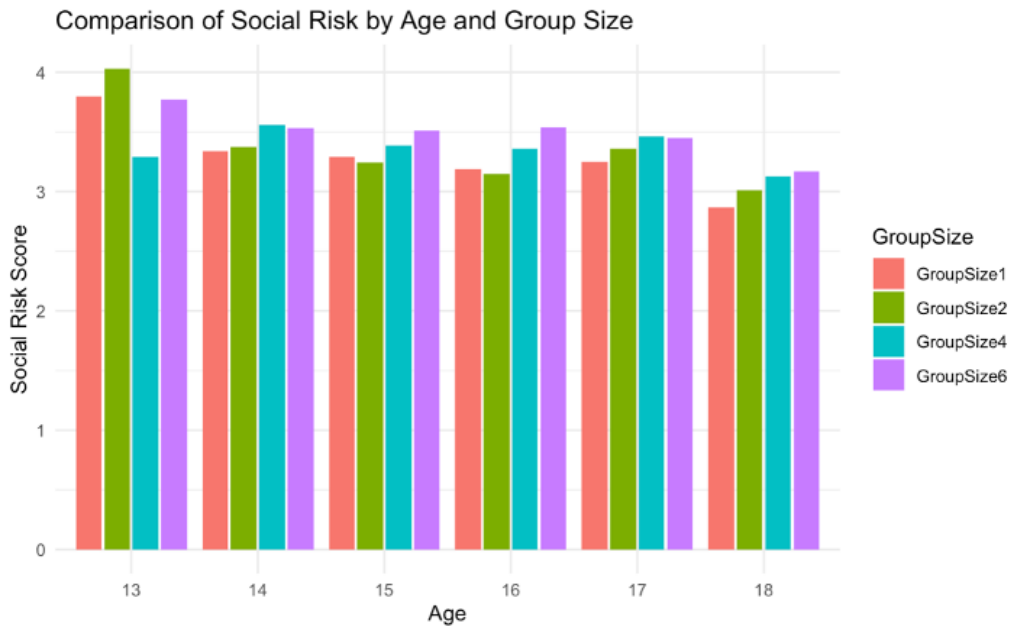


Figure 6. Social Risk by Age and Group Size



Differences in Social and Non-Social Risk Taking

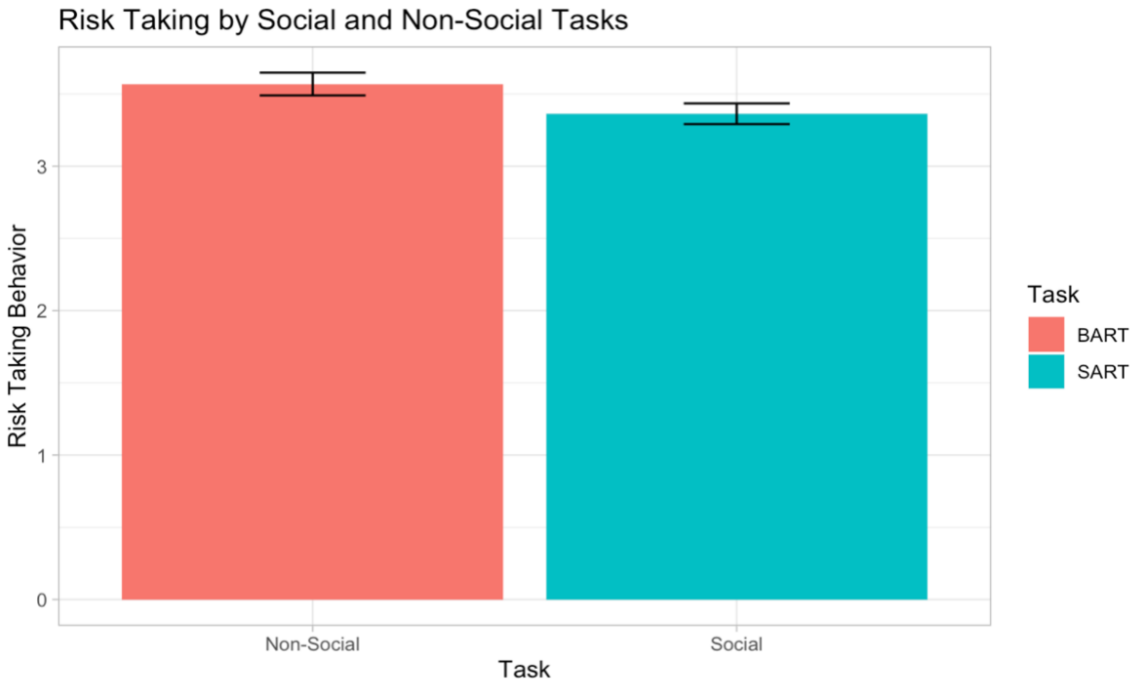
A two-tailed T-test revealed a marginally significant difference between risk taking on the social and non-social tasks $T(174)= -1.932$, $p = 0.05421$. This result indicates that risk taking was slightly higher during the BART than the SART. However, the result did not reach conventional levels of significance ($p < 0.05$). While the evidence falls short of rejecting the null hypothesis at the 0.05 significance level, it may warrant further investigation or consideration in the context of the research question.

Table 6. T-test Results for Comparison of Risk Taking between Social and Non-Social Tasks

Task	*t*	*P*	*df*
BART-SART	-1.9318	0.05421	174

*p<.05, **p<.01, ***p<.001

Figure 7. Risk Taking by Social and Non-Social Tasks



Correlations Between Self-Report and Behavioral Risk Taking

Across all four self-report measures, there were no results significantly correlated with behavioral risk taking on the SART. For the Carleton Intolerance of Uncertainty Scale, results showed no correlation between a participant's ability to tolerate uncertainty and their social risk-taking task performance, $r(82) = -0.01$, $p = 0.93$. For the Dohmen general risk question, no correlations were found with social risk taking, $r(82) = -0.01$, $p = 0.898$. For self-reported propensity for sensation seeking on the BSSS, no correlations were found with the social risk-taking task, $r(82) = 0.004$, $p = 0.966$. Lastly, no significant correlations were found between risk taking as measured by the PRTS and the SART, $r(82) = -0.056$, $p = 0.623$. When compared with risk taking during the BART, a higher self-reported willingness to take risks as measured by the Dohmen general risk question was positively and significantly correlated with higher propensity for risk taking during the BART, $r(82) = 0.27$, $p = 0.013$. The three other self-report measures found no significant correlations between non-social risk taking and reported uncertainty, positive risk taking, or sensation seeking (see Table 7).

Figure 8. Dohmen General Risk Question Correlation with SART

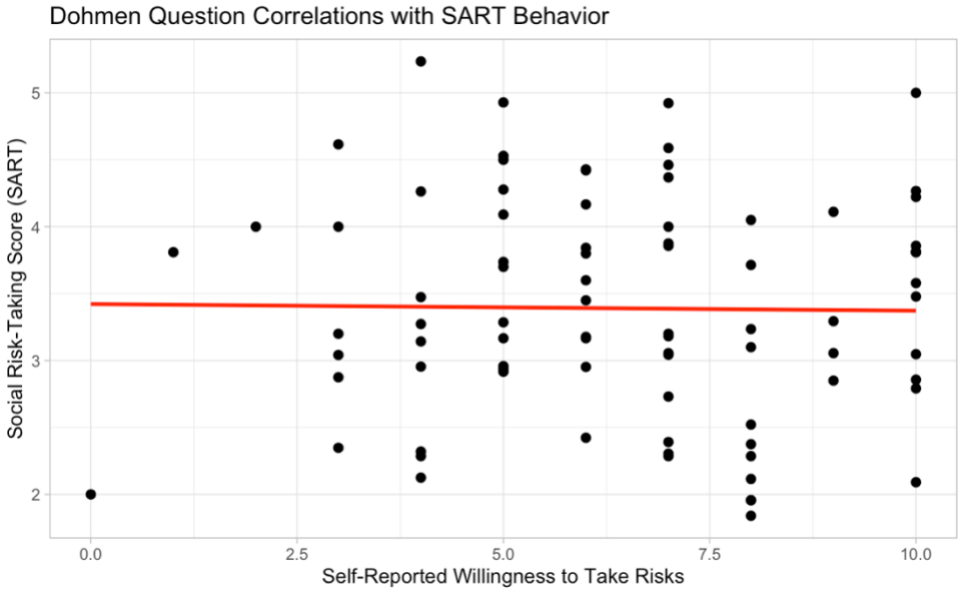


Figure 9. Dohmen General Risk Question Correlation with BART

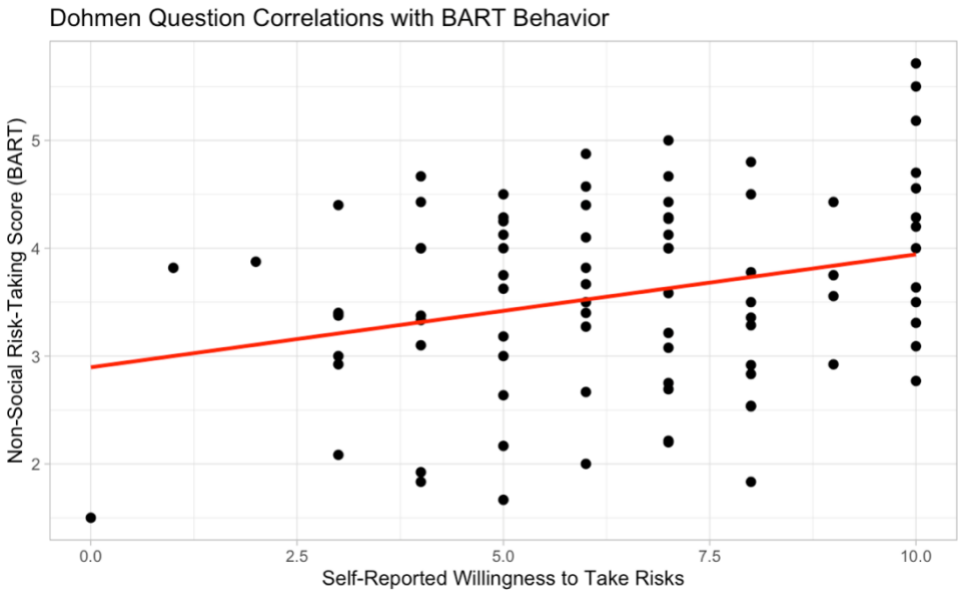


Table 7. Pearson's Correlation of Self-Report Surveys and Behavioral Risk Measurements

	Self-Report Descriptives			Social Risk Taking		Non-Social Risk Taking	
	M	Max	Min	*r*	*p*	*R*	*p*
IUS	31.55	56	12	-0.01	0.928	-0.12	0.249
DOHMEN	6.542	10	0	-0.01	0.898	0.27	0.01**
BSSS	33.99	52	8	0.004	0.966	0.01	0.918
PRTS	30.01	56	14	-0.056	0.623	0.15	0.191

*p<.05, **p<.01, ***p<.001

Note. IUS = Intolerance of Uncertainty, Dohmen = Dohmen General Risk Question, BSSS = Brief Sensation Seeking Scale, PRTS = Positive Risk-Taking Scale

Table 8. Descriptive Statistics and Correlations between Self-Report and Behavioral Risk

	M	*SD*	1	2	3	4	5
IUS	31.70	8.24					
PRTS	30.10	9.72	-0.23				
BSSS	33.74	9.43	0.31	-0.01			
DOHMEN	6.47	2.44	0.15	0.43	0.27		
SART	3.45	0.81	-0.04	-0.06	0.02	-0.01	
BART	3.57	0.92	-0.15	0.15	0.001	0.29	0.45

Note. IUS = Intolerance of Uncertainty, Dohmen = Dohmen General Risk Question, BSSS = Brief Sensation Seeking Scale, PRTS = Positive Risk-Taking Scale, SART = Social Analogue Risk Task, BART = Balloon Analogue Risk Task

Chapter 4

Discussion

This study aimed to determine how adolescents would differ in their risk-taking behavior between social and non-social environments, and how they make different decisions to interact based on varying peer group sizes. We hypothesized that differences would be found between risk taking during the BART and the SART, such that adolescents would be more risk averse during the SART. Results were in line with this hypothesis such that adolescents were marginally more risk averse during the SART relative to the BART. In terms of adolescent risk-taking behavior differing based upon the changing peer group sizes, results were not in line with our hypothesis. No significant interactions were found between group size and adolescent social risk-taking behavior. There was a slight increase in risk taking as group size increased, but results were not at a significant enough level to reject the null hypothesis. Lastly, experimental laboratory risk taking during both the SART and BART was not found to be correlated with self-reported risk-taking measures, except for the significant correlation between the Dohmen general risk question and performance on the BART. The correlation between performance on the BART and self-reported risk-taking propensity as assessed by The Dohmen General Risk question is in line with hypotheses and previous research that has shown the BART to be an accurate measure of experimental risk taking (Lejuez et al., 2002).

The hypothesis that adolescents would exhibit higher risk aversion during the SART when compared with performance on the BART showed marginally significant results and was not supported. However, adolescents were slightly more risk averse during the SART than the BART, which is in line with the direction of the hypothesis. Previous research has shown that

adolescents perceive social situations differently than non-social situations when making decisions (Crone & Dahl, 2012; Harrison et al., 2013; Morone & Morone, 2014; Steinberg, 2010). Prior work by McCormick and colleagues (2017) has also shown adolescents to selectively discount social feedback in pursuit of their goals. Using a different social version of the BART (adapted from Humphreys et al., 2015), and fMRI data acquisition, they found that there are age-related changes in how the brain processes and responds to increasing social risk, with older adolescents showing a shift towards neural insensitivity to dynamic social feedback, possibly reflecting a capacity to ignore social information when it conflicts with their goals (McCormick et al., 2017). Slight age effects were also found in this study, as adolescents were more socially risk averse as age increased, but not in a significant way. In the current task, adolescents were given a goal to accumulate as many friendly points as possible, which could have caused them to discount the effect of ghosting as they sought to accomplish the goal.

Secondly, information in social contexts frequently undergoes dynamic changes in real-world scenarios; however, this study and most studies have predominantly relied on static social inputs, such as still faces (Burnett et al., 2009; Guyer et al., 2009). The purpose of using still faces was to ensure differing group size would be the primary variable to elicit differences in social risk taking. However, the use of dynamic social faces could more accurately represent real-world social risk taking (McCormick et al., 2017; Smith & Smith, 2019). In this task, the faces grew in size to signify a closer relationship through chatting. The facial expressions of the peers did not change. While the distinction between social and non-social risk-taking did not manifest behaviorally, emerging evidence suggests potential neural distinctions (Chein et al., 2011). Studies have revealed notable variations in brain activity associated with social and non-social tasks (Baltruschat et al., 2021; Somerville et al., 2013). For instance, regions implicated in

mentalizing processes, such as the middle frontopolar area and the temporoparietal junction (TPJ), exhibit heightened activity during the execution of risky decisions within a social context (Zhang et al., 2017). The presence of peers is also thought to influence neural activity in regions associated with reward processing, such as the ventral striatum or the orbitofrontal cortex (Chein et al., 2011; Sherman et al., 2018; Telzer et al., 2015). Concurrently, disparate brain regions are engaged during non-social tasks, offering neural evidence that social and non-social situations are processed using distinct neural pathways, even when these differences may not be readily apparent in the observed behavioral outcomes (Nasiriavanaki et al., 2015; Rao et al., 2008). This neural perspective highlights the possibility that risk-related decision-making processes may be more intricately encoded at the neural level, revealing distinctions that might elude behavioral assessments alone.

The hypothesis that adolescents would exhibit more risk aversion as group size increased was not supported. In fact, the opposite was shown. Adolescents exhibited slight increases in risk taking as group size increased from 1 to 2 to 4 to 6. However, this hypothesis was drawn from research in the field of education showing students less inclined to answer questions and deliberate in group discussions when class size increased (Kim, 2013; Littlepage & Silbiger, 1992; McKeachie, 1980). Adolescents are possibly not as sensitive to the increasing group size when completing a laboratory task as opposed to a real-world classroom setting. There are mixed results regarding how peer manipulation can best be employed (Baltruschat et al., 2021). The mere presence of a peer has been shown to not influence risky decision making during the Columbia Card Task (Somerville et al., 2018), but the presence of a peer during a modified High/Low Card Guessing task has been shown to increase reward sensitivity and risk taking (Smith et al., 2015). In this study's task, the peer manipulation employed was virtual and the

people were not related to the participant in any way. It is possible that adolescents may feel more aversion to increasing group size when their peers are known to them and present within the room (Somerville et al., 2018). More research is required to discover how to best measure changing group size and the effects it has upon decision making behavior.

Lastly, the hypothesis that adolescents who self-reported to be more risk averse would show higher risk aversion on the SART and BART was not supported by most self-report surveys used. The Dohmen general risk assessment was the only survey correlated with higher risk taking, but effects were only shown for the BART and not the SART. The four self-report surveys that were chosen (IUS, BSSS, Dohmen, and PRTS) have been shown to relate to real world individual risk taking (Hoyle et al., 2002; Carleton et al., 2007; Dohmen et al., 2011; Duell & Steinberg, 2020). However, they may not be the best measurements of social risk taking. The seminal paper detailing the IUS describes its availability to measure a person's ability to cope with ambiguity or uncertainty (Carleton et al., 2007). As previously stated, risk involves engaging in behaviors with uncertain or ambiguous outcomes (Figner & Weber, 2011). In a study assessing the relationship between impulsivity, intolerance of uncertainty, and risk-taking behavior, the IUS was not found to predict risk taking propensity. In fact, only the sensation-seeking factor of the UPPS-P showed a relationship between sensation seeking and performance on the BART, specifically in females (Sohn et al., 2014). So, while intolerance of uncertainty may be a trait implicated in ambiguous decision-making, it has not been proven to relate to decreased risk taking in a social context. Meanwhile, the validity of the BSSS was measured in comparison to adolescent drug related attitudes, intentions, and behaviors (Hoyle et al., 2002). In this way, sensation seeking was associated with a higher propensity for risk taking in health risk behaviors. Higher self-reported risk taking on the BSSS has been linked to higher risk taking on

the BART in a study assessing risk propensity during sleep deprivation (Killgore et al., 2008) However, associations between sensation seeking and the likelihood to engage in social risks remain unclear. The Dohmen general risk question has been utilized to predict real world risk behaviors in a variety of domains such as career, sports and leisure, car driving, health, and financial matters (Dohmen et al., 2011). It has also been found to positively relate to the BART, DOSPERT-general, and DOSPERT-health/safety in predicting risk taking propensity (Brailovskaia et al., 2018). Therefore, it is in line with previous literature that this singular question would correlate with adolescent task behavior on the BART. However, the BART did not predict risky behavior as self-reported by the DOSPERT and SSS-V (The Sensation Seeking Scales, Form V; Beauducel et al., 2003) in the same study (Brailovskaia et al., 2018). Therefore, it could be that the Dohmen question's strength resides in its simplicity.

Limitations

It is important to discuss the study's limitations in terms of participant data and recording. First, participant race and ethnic data was not included or reported in this data set. For this reason, there was no analysis into these factors as impacting behavior, and this limits the generalizability of this data to the entire population. Furthermore, 40% of data was incomplete as participants did not complete all trials, and this limited the original number of participants included in the study, as well as the ability to detect effects. Lastly, it should be acknowledged that this study was a pilot study meant to examine the feasibility of recruitment, assessment procedures, and the novel task.

Future Directions

Future research should focus on defining distinctions between social and non-social risk so that tasks can directly target social risk-taking behavior in adolescents. The variable of group size should be targeted to uncover how adolescents work both within groups and when facing groups of other peers. The acquisition of an fMRI study using this research design would more clearly define what brain regions are implicated during the novel social decision-making task and whether they align with regions previously connected to the social brain. An ecological real world study design could also reveal more about adolescent social risk taking when facing groups of peers. Understanding how adolescents make decisions to interact socially is crucial for adolescent health and well-being. By delving into the factors mediating adolescent social interactions, such as the size of the peer group, we gain valuable insights into how adolescents may foster connections in an increasingly disconnected world. This research not only sheds light on the factors influencing social decision-making but also provides a motivation for further research that seeks to understand and promote adolescent healthy social behaviors. This understanding will be beneficial for promoting positive social risk-taking in adolescence that generates healthy friendships and further resiliency into adulthood.

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