Real-World Versus Laboratory Risk-Taking Behavior among Children and Adolescents

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Abstract

Although youth risk behavior is widely studied, the reason why adolescents usually take more risks in real-life than children is not yet fully understood. This study explored the importance of sensation seeking and "risk opportunity" as explaining factors in risk-taking among children aged between 10 and 12 (N = 82) and adolescents between 16 to 23 (N = 68). It was examined whether risk opportunity moderated the relationship between sensation seeking and the intake of energy drinks and whether risk opportunity on the Columbia Card Task (CCT) moderated the relationship between age group (e.g. children and adolescents) and risk-taking on the CCT. A questionnaire measuring energy drink usage, physical opportunity to obtain and drink these beverages and sensation seeking was used. For the second research question, risk opportunity was manipulated, resulting in two conditions, namely a 'risky' and a 'sure/safe' condition. The analysis consisted of a factorial ANOVA with interaction effects. There was no significant relationship between sensation seeking and the intake of energy drinks (p = .159), nor was risk opportunity moderating in this relationship among adolescents (p = .329) and children (p = .617). Furthermore, there was no significant relationship between age and risk taking on the CCT, nor did risk opportunity appear to moderate in this relationship (p = .417). Future research is advised to further explore the potential role of risk opportunity and re-test it among a wider variety of youths and by reconsidering the most effective way to manipulate the risk opportunity aspect.

Adolescents are regarded as the risk-taking generation. The media write about adolescents drinking high quantities of alcohol or energy drinks and their experimentation with marijuana. This age group takes more risks than all other age groups (Steinberg, 2010). In fact, the risk of being injured or dying during adolescence is two to three times as large as that of children, despite the adolescents' great physical health (Pharo, Sim, Graham, Gross & Hayne, 2011). Leading causes of death among adolescents are for example accidents or unintended injuries (Heron, 2016). Adolescent risky behaviors, especially substance use, tend to cluster during the adolescent period (DuRant, Smith, Kreiter & Krowchuk, 1999). Risk behavior in general might have negative health outcomes, such as premature death (Marshall, 2014), disability and a lower quality of life in adulthood (Lawrence, Appleton Gootman & Sim, 2009). In 2012, approximately 1.3 million children between the age of ten to nineteen died worldwide due to interpersonal violence and health-related issues (Unicef, n.d.). As Kann et al. (2018) indicate, health-risk behaviors are among the leading causes of mortality and morbidity rates among children and adolescents. Out of the wide variety of risky behaviors (e.g. smoking tobacco, reckless driving, unsafe sex and experimenting with alcohol), this study focusses on the intake of energy drinks.

The majority of adolescents simply reach adulthood without serious psychological or physical damage caused by risk-behavior (Lawrence et al., 2009). However, adolescents who do get involved in risk-behavior are the groups attracting attention. Risk-behavior is considered behavior with a potentially unfavorable outcome (Defoe et al., 2015). Yet, this behavior is not necessarily bad, since it also can lead to new insights and valuable experiences (Dahl, 2011). Therefore, a definition is used that explains risk-taking as behavior with a higher outcome variability which does not automatically lead to negative outcomes and is not just a single personality trait (Figner & Weber, 2011). Also, the behavior is not driven by one single and easy to describe type of behavior, but by multiple processes instead. However, risk-behavior is sometimes difficult to define because of the difference between real-life behavior and behavior as seen in controlled environments. Data from the latter is usually based on (risky) decision-making tasks (Defoe et al., 2015) and surveys (Braams, Van Duijvenvoorde, Peper & Crone, 2015). Studying risky behavior directly in real-life is an ethical challenge (Horstkötter, Donker, De Kogel & Jansen, 2017).

Studies into risk-behavior have largely focused on behaviors which might lead to heightened disability and mortality rates, such as binge-drinking and experimenting with drugs. A number of these studies (Steinberg, 2010; Braams et al., 2015; Brown et al., 2015) are executed in controlled environments, which is suitable to study risk-behavior since parameters

can be controlled. For this, risky decision-making tasks such as the Columbia Card Task (CCT) and the Stoplight Game are used. These two tasks measure sensation seeking and risk-taking (Defoe et al., 2015; Chein, Albert, O'Brien, Uckert & Steinberg, 2011). Yet, such tasks have been questioned because of the generalizability to real-life situations. Gainsbury and Blaszczynski (2010) state that laboratory data of gambling may be difficult to generalize to real-world gambling. Indeed, laboratories data might differ from the real world (Defoe et al. 2015). Neurodevelopmental imbalance models (Defoe et al., 2015; Somerville & Casey; Steinberg, 2007) can help understand why adolescents are likely to take risks in laboratory and real-life situations. These models suggest a possible imbalance between affective and cognitive processes. Adolescents' hypersensitive motivational-affective cognitive system oftentimes overrides their cognitive control, which in turn illustrates tendencies of adolescents to engage in both laboratory and real-life risk-behavior. The present study is concerned with real-life self-reported behavior as well as laboratory behavior. A study by Braams et al. (2015) show that adolescents seem to take more risks than children, as measured on self-reports. This study explored risk-behavior through the BIS/BAS scale (Carver & White, 1994), measuring behavioral activation, inhibition, and sensitiveness to rewards and punishments. Monshouwer, Van Der Pol, Drost and Van Laar (2016) also used self-reported data about substance abuse among Dutch youth and Miller (2008) found through a questionnaire that the use of energy drinks can be linked to substance use. On the other hand, a meta-analysis of Defoe et al. (2015) shows that children and adolescents tend to take equal amounts of risks on risky decision-making tasks in laboratories. This study proposes that this child-adolescent difference between laboratory and real-life behavior might be explained by the opportunities to actually execute certain risk behavior, which differ for both groups in real life. These opportunities are called risk opportunity (Gibbons, Kingsbury & Gerrard, 2012).

Energy Drinks

Caffeinated energy drinks became popular among youths, especially in the past twenty years (Alsunni, 2015; Bemelmans et al., 2018) since Red Bull was introduced in 1987 (Reissig, Strain & Griffiths, 2009). Typically, users are adolescents with a median age of 17 (Gunja & Brown, 2011), but it is an appreciated beverage among children also (Bemelmans et al., 2018). In the age category of thirteen to fourteen years old Dutch children, about a quarter took energy drinks on a weekly base and in the age of eleven to twelve years, two percent drinks more than two cans of energy drinks a week (Bemelmans et al., 2018). Energy drinks are promoted as boosting ones cognitive and physical performance, such as concentration and stamina (Seifert, Schaechter, Hershorin & Lipshultz, 2011) through ingredients like taurine, caffeine and

carbohydrates (Gunja & Brown, 2011). Caffeine is a substance increasing the speed of messages between brain and body (ADF, 2018) and is also found in high doses in coffee. However, in contrast to energy drinks, coffee is usually consumed in lower quantities (Arria & O'Brien, 2011).

Studies show that harmful effects of energy drinks are due to this caffeine (Arria & O'Brien, 2011). The Dutch nutrition center (Voedingscentrum, n.d.) advices youths to not drink more than one caffeinated drink a day. Yet, this guideline is often not complied with, seeing that many youths drink three or more a day (Bemelmans et al., 2018). The caffeine in energy drinks might increase alertness and feelings of activeness. Howbeit, shaking, agitation, restlessness, dehydration, a heightened heart rate and stomach pains are possible adverse effects (ADF, 2018). Utter, Denny, Teevale and Sheridan (2017) found an association between energy drinks and emotional difficulties, poor mental health and violent behavior. When drinking the popular combination of energy drinks and alcoholic beverages (Gunja & Brown, 2011), one might underestimate the level of impairment which can result in risk-behavior such as binge drinking (Arria & O'Brien). Furthermore, it is likely that youths who drink three or more cans of energy drink a day, exhibit other risk-behavior (Bemelmans et al, 2018), such as tobacco use. Moreover, Bemelmans et al. (2018) state that issues such as having parents struggling with an addiction or a divorce within someone's family are more common among children with a high energy drink intake. However, they warn to be careful when interpreting causality. Thus, seeing the intake of energy drinks as a gateway to other risky behavior is not justified. In contrast to tobacco smoking, which seems to be more of a gateway to other risk-behavior (Małkowska-Szkutnik, Dzielska & Mazur, 2010). Indeed, all earlier mentioned negative consequences are particularly detrimental to youths, since injurious youth experiences can be taken into adulthood (Romer, 2010).

There are various factors driving youth risk-taking in general (Miller, 2008; Figner & Weber, 2011), but factors explaining the high usage rates of energy drinks are not widely studied. However, Azagba Langille and Asbridge (2014) link energy drink usage to personality traits like sensation seeking. Another element which relates to risk-taking in general (Defoe et al., 2015) and possibly also to energy drink intake is the physical opportunity to become involved in risk-behavior like drinking energy drinks. The current study will consider both sensation seeking and physical risk opportunity.

Physical risk opportunity and energy drinks. Whether youths become willing to execute certain risk-behavior depends on whether the person has a positive attitude towards the behavior and if it is possible to get away with the acts. But to actually act, having a sense of opportunity

to execute behavior is needed (Gibbons et al., 2012). This concept of 'risk opportunity', or 'exposure to risk' (Wikström & Loeber, 2000), is defined by Gibbons et al. (2012, p. 176) as a construct that "reflects the belief that much adolescent behavior, especially when it involves risk, is not premeditated or reasoned, but, instead, is a reaction to social circumstances." However, this is different from physical risk opportunity, which can be defined as having access to substances (Gerrard, Gibbons, Houlihan, Stock & Pomery, 2008) like energy drinks. Other examples of exposure to risk are driving a vehicle after taking alcohol (Gibbons & Gerrard, 1995) or using drugs at a party (Gerrard et al. 2008). Risk opportunity can possibly explain why children appear to take less real-life risks than adolescents, but equal amounts of risks on risky decision-making tasks (Defoe et al., 2015). Being of the legal age to purchase for example alcohol, is an example of (physical) risk opportunity (Defoe et al., 2015). Gibbons et al. (2012) and Reyna and Farley (2006) suggest reducing physical risk opportunities for youths by for example restricting access to substances. Indeed, energy drinks are limited available for children younger than 14 in the Netherlands (De Volkskrant, 2018) which in turn lowers the physical risk opportunity.

The role of this risk opportunity aspect is explained by a few studies and theories. A theory by Galimov et al. (2019) postulates a framework named the social ecological model, which helps to apprehend the interaction between personal and environmental factors. Thus, the environment should be considered when looking at energy drinks intake. Furthermore, Galimov et al. (2019) link access to spending money to greater usage of energy drinks, which can be considered a heightened exposure to risk. Also, the peer cluster theory (Oetting & Beauvais, 1986) have linked alcohol use, which has similarities with energy drink intake, to the (social) environment. However, this theory focusses mainly on social influences. Availability theories (Livingston, Chikritzhs & Room, 2007) look at the physical environment. An example of such a theory comes from Heather and Stockwell (2004) and states: "Greater availability of alcohol in a society will increase the average consumption of its population when such changes reduce the 'full price' of alcohol, i.e. the real price of beverages at retail markets plus the convenience costs of obtaining them" (p. 217). However, the predictive role of risk opportunity on actually drinking energy drinks is not yet widely studied.

Sensation Seeking and Energy Drinks

Sensation seeking might be illustrative for understanding adolescents' high intake of energy drinks (Miller, 2008; Newcomb, Clerkin & Mustanski, 2011; Azagba et al. 2019). A definition by Zuckerman (2015, p. 10) reads: "Sensation seeking is a trait defined by the need for varied, novel, and complex sensations and experiences and the willingness to take physical

and social risks for the sake of such experience." Snel (2011) found that this personality trait is linked to the use of psychoactive substances, such as caffeine. Earlier mentioned risky behaviors are often attributed to the developing brain of adolescents, which is characterized by heightened levels of impulsivity and sensation seeking tendencies (Romer, Reyna & Satterthwaite, 2017). During adolescence, neurobiological processes mature (Yurgelun-Todd, 2007); the prefrontal cortex is still developing, which is only completed in adulthood (Verburgh, Königs, Scherder & Oosterlaan, 2013). This brain region underlies response inhibition and goal directed-behavior. Sensation seeking is linked to this brain area (Harden & Tucker-Drob, 2011). When a reward is received, activity is measured in an area important for the brain's reward system, called the nucleus accumbens. This peaks during adolescence and according to Galvan, Hare, Voss, Glover and Casey (2007), it correlates with self-reported risk-taking in real-life. However, whether the force of one's personality also becomes visible when there is or is not an opportunity to drink energy drinks is not yet clear. Therefore, the present study investigates the link between sensation seeking and the intake of energy drinks and whether the role of sensation seeking remains the same, weakens or intensifies when a risk opportunity component is present. This relationship, as shown in Figure 1, will therefore be one of the main focus points in the present study.

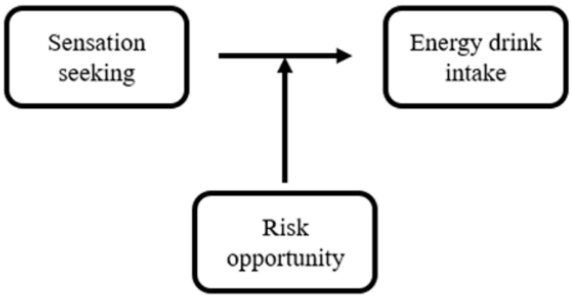

Figure 1: Moderating effect of risk opportunity to use energy drinks on the relation between sensation seeking and energy drink intake.

The relative roles of risk opportunity and age. To understand how the afore mentioned difference between children and adolescents in real-life risk-taking is driven, a model only explaining the rise and prevalence of risk-behavior during adolescence from a neuroscience model might be short falling. Figner and Weber (2011) explain that risk-taking is influenced by multiple factors, such as the characteristics of the situation in which the adolescents is in and the general exposure to risk (Wikström & Loeber, 2000). A study by Paulsen, Platt, Huettel and Brannon (2011) showed that adolescents and children show a bigger preference for the risky options in risky decision-making tasks than young adults. However,

they stated that discrepancies between laboratory results and real-life risk-taking needs more research. The meta-analysis conducted by Defoe et al. (2015) compared risk-taking tendencies of children with risk-taking of adolescents. This was tested using, next to other tests, the CCT. This is a risky decision-making task in which two conditions are included, namely a 'sure/safe' and a and 'risky' condition. The first has an option which allows the participant to take fewer risks and the risky version forces the participant to take risks (Defoe et al., 2015). The study found that adolescents take less risks compared to children when playing the 'sure/safe' version. This means that when the situation feels safer, adolescents are considered less 'risky' than children. The effect of age on the risk-tendencies was in this study moderated by this safe option. All the same, it appears that adolescents act riskier than children in real-life situations (Defoe et al., 2015; Defoe, Dubas & Romer, 2019). Defoe et al. (2015) propose that the difference between laboratory and real-life risk-taking among children and adolescents might be explained by the opportunities to actually execute certain risk behavior. And thus, seeing that age matters in explaining risk-behavior because of a possible link between age and risk opportunity, this study also answers the question whether the predictive value of age on CCT risk-taking interacts with risk opportunity (i.e. the mentioned CCT-versions; 'risky' and 'sure/sure'). These relationships are depicted in Figure 2. Indeed, more knowledge about how exactly this risk opportunity looks like and what its effect is, is needed since it can add value to preventing risk-behavior and its potential detrimental consequences.

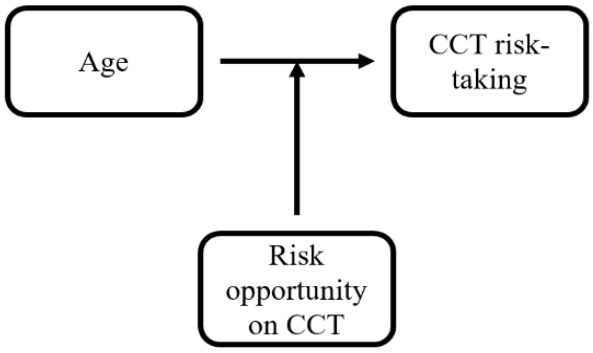

Figure 2: Moderating effect of risk opportunity on the relation between sensation seeking and energy drink intake.

The Current Study

This study examines the predictive value of sensation seeking on the use of energy drinks. A person drinking high amounts is likely to have higher levels of sensation seeking than non-users, according to Azagba et al. (2014). However, this relationship was found in Canada through the use of surveys among children from about 12 – 18. The current research uses

questionnaires and behavioral data from children aged 10 – 12 and adolescents aged 17 – 21. Other studies (O'Brien et al., 2013; Terry-McElrath, O'Malley, & Johnston, 2014; Arria et al., 2010) have also suggested the link between sensation seeking tendencies and energy drink intake. However, these studies did not focus on the role of risk opportunity, which will therefore be explored in the current study.

Sensation seeking, risk opportunity and energy drink intake. The first research question (1a) of the present study is: "Does sensation seeking predict the use of energy drinks?". The hypothesis is that higher levels of sensation seeking predict higher levels of energy drink usage, but this relationship is only expected to become visible when there is the physical opportunity to act risky. Hence, research question 1b is: "Does risk opportunity moderate the relationship between sensation seeking and the intake of energy drinks?" This means that when there is no risk opportunity, a person might not drink energy drinks, no matter the level of sensation seeking. Thus, when a person has high sensation seeking levels and a high risk opportunity, the person drinks more energy drinks than a person who has a high level of sensation seeking but not a high risk opportunity.

Age, risk opportunity and CCT risk-taking. Yet, a higher risk opportunity to use energy drinks in the real world is dependent on age. In other words, risk opportunity is confounded by age (Defoe et al., 2019). It is supposed that adolescents are more exposed to real-life risks than children, which in turn is expected to lead to more real-life risk-taking among adolescents than children. Research question 2a stating "Does age predict CCT risk-taking?" will be investigated using a risky decision-making task (CCT). Risk opportunity will be manipulated on the CCT to have a low risk and a high risk opportunity condition, to explore differences in risk-taking when both groups are equally exposed to risk. Both children and adolescents are assigned to these two conditions. This results in four groups, namely children in both a high and low risk condition and adolescents in both a high and low risk condition. The fourth research question (2b) reads: "Does risk opportunity moderate the relationship between age and CCT risk-taking?" It is expected that there will be an interaction between risk opportunity and age, similar to what the meta-analysis of Defoe et al. (2015) shows: Adolescents take less risks comparing to children when the risky decision-making task contains a 'sure/safe' option. The hypothesis is that the size of the nature of the relation between age and the score on the CCT changes as a function of the risk opportunity element and that children are taking more risks than adolescents on the 'sure/safe' (i.e. the version where there is less exposure to risk) CCT-version, but that both groups take equal amounts of risks when they have equal opportunities to do so (i.e. in the 'risky' condition).

Method

Participants

A total of 82 children in 7th grade (*N* = 70) and 8th grade (*N* = 12) were selectively recruited via four elementary schools. Additionally, 68 adolescents were selectively recruited in the first (*N* = 28) and second (*N* = 40) grade of level four mbo-schools (secondary vocational education). Elementary schools and mbo-schools which participated are located in the Twente region, the Netherlands. The mean age among children was 10,8 (SD = .69, age range: 10-12) and 18 (SD = 1,5, age range: 16-23) among adolescents. The most common nationality among the sample was Dutch (84,0%) followed by other nationalities (7,3%), Syrian (6,0%) and Turkish (2,7%). Gender was relatively evenly distributed (46,0% males; 54,0% females). From the total sample of 150, only one participant lives with boyfriend/girlfriend and most (62,0%) was non-religious while 22,7% and 8,0% were Christian and Islamic respectively.

All participants, their parents/caregivers and teachers were made aware of the study via passive informed consent, stating the nature of the study. Involved people were informed about the incentive for participation, which was either a €5,- gift-card or the opportunity to participate in a raffle worth €150,-. Yet, all primary schools did not choose to participate in the raffle. The study was ethically approved by the ethics committee of the Faculty of Behavioural, Management and Social sciences (BMS) at the University of Twente, the Netherlands.

Procedure

This study used experimental and correlational data and had a between-subjects design, in which data from an experimental computer task (CCT) and a questionnaire was collected at primary schools and mbo-schools. Both were conducted in the same one-hour data-collection session among a group of either children or adolescents at their schools.

About 50 schools were approached for participation through an invitation email followed by a phone call after two to four days. Eventually, 8 schools agreed to participate, from which 4 on primary level and 4 on mbo-level. The participators below 16 years of age handed in approval of parents/caregivers before participation. Data-collections took place on various times during the day, depending on the preference of the participating schools.

After participants entered the classroom and were seated, a general speech about the procedure was given by the test-coordinators. All participants were made aware of the anonymity of the study and confidentiality of the data was ensured, both in speech and on the questionnaire through an introductory text. After the introduction, participants started executing the questionnaire on a unique computer per person in a typical classroom setting, using OpenSesame, which is a program to create and conduct experiments and questionnaires offline

(https://osdoc.cogsci.nl/). At both primary schools and mbo-schools, the questionnaire was conducted before the CCT was played on the same computer. Both actions were under the supervision of three test coordinators and a teacher of the concerning schools. The participators were distributed over the conditions of the CCT as evenly as possible. At a single session, all participants where distributed over the same condition (i.e. either 'sure/safe' or 'risky'). Thus, randomization was between schools, which means that half of the primary schools and mbo-schools were distributed over the 'risky' version and half of the primary schools and mbo-schools were distributed over 'sure/safe' version. At primary schools, 56 played the 'sure/safe' (i.e. no-card) version of the CCT, while 26 played the 'riskier' version, without the no-card option. At mbo-schools, 28 played the no-card version and 40 the without no-card version. In a debriefing, participants were handed over the incentive if they chose for this. If they chose to participate in the raffle, their first names were collected.

Measures

Sensation seeking. This concept was measured through the BAS-fun seeking scale of the BIS/BAS by Carver and White (1994), which consists of the following Dutch questions: "Vaak doe ik dingen om geen andere reden dan dat het weleens leuk zou kunnen zijn"/" I often do things for no other reason than that it might be fun", "Ik hou erg van spanning en sensatie."/I really like excitement and sensation", "Ik ben altijd bereid iets nieuws te proberen als ik denk dat het leuk zal zijn."/"I am always willing to try something new if I think it will be fun." and "Ik doe waar ik op dat moment zin in heb."/" I do what I feel like at the time.". These items were measured on a four-point scale ranging from totally disagree to totally agree. Mean scores per participant were calculated. A high score meant a higher level of sensation seeking than was the case among participants with a low score. The scale shows a meager reliability with $\alpha = .572$.

Energy drink intake. To measure the intake of energy drinks, an adjusted alcohol-intake scale was used, retrieved from Nieuwenhuijzen et al. (2009). This scale tested the energy drink intake through three questions: Drink je energy drinks? (zoals Redbull)"/" Do you drink energy drinks? (such as Redbull)", "Heb je weleens vijf of meer energy drinks op één dag gedronken?"/"Have you ever had five or more energy drinks in one day?" and "Hoe vaak heb je op één dag twee of meer energy drinks gedronken in de afgelopen maand?"/" How often did you drink two or more energy drinks in one day in the past month?". These are answered on a six-point scale ranging from never to always. The reliability of this scale is with $\alpha = .770$ good.

Risk opportunity. Through two questions, the opportunity to obtain and drink energy drinks was measured (i.e. risk opportunity). These questions were constructed by the researcher

and contain the following questions: “Ik kan gemakkelijk aan energy drinks komen.”/” I can easily get energy drinks.”, ” Ik heb iemand anders nodig om aan energy drinks te komen.”/”I need someone else to get energy drinks.”. Because the second of these two questions was negatively formulated, it was recoded. The inter-item correlation is with r = .077 low.

Risk-taking on the CCT. The Columbia Card Task (CCT) by Figner, Mackinly, Wilkening and Weber (2009) is a risky decision-making test, conducted during the present study to measure risk taking among children and adolescents. The ‘hot version’ of this task was played, which gives immediate affective feedback by showing a happy smiley when points are won and a sad smiley when points are lost during the game. During this individually played computer task, participants flip cards during each of the 24 rounds. A round starts with zero points, all of the 32 cards have face down and every round contains a timer of 30 seconds which is visible while playing. Participants can either win 10 or 30 rounds per flipped win-card. This differs per round. Directly after flipping a card, feedback is given by displaying the smiling or sad smiley. In every round, there are either one or three loss cards included which, when clicked on, lead to a loss of either 250 or 750 points. This differs per round. As soon as a loss card is flipped, the round stops. With each flipped card, the risk-taking tendencies increase because the chance of flipping a loss card becomes higher. The CCT contains a ‘no-card’ option, allowing the participant to proceed to a next round without flipping any card. However, adjustments have been made for the current study. Therefore, the CCT has two conditions: a ‘risky’ version, without the option to not flip any cards and a ‘no-card’ version, which has a ‘no-card’ option, which allows the participant to not flip any card in a round and thus not take any risks. This ‘no-card’ option was manipulated to robustly investigate risk opportunity when children and adolescents are equally exposed to risks. Every group of children and adolescents played either the ‘risky’ version or the ‘no-card’ version.

When playing the CCT, the aim was to accumulate as much points as possible. These points were explained to be eurocents, because at the end of the 24 rounds there was a raffle in which the participants were able to win a certain amount of points paid out in eurocents (max €10,-). The variation in gain and loss amount and the amount of loss cards per round, is an advantage of the CCT because it gives the possibility to assess different motives for taking risks, such as the sensitivity for losses (Figner & Weber, 2011). A psychometric property tested with the CCT is sensation seeking (Figner et al., 2009). Participants high on sensation seeking tend to flip around more cards. For a full description of the game, please consult Figner et al. (2009) (a screenshot of this game can be found in Appendix A).

Statistical Approach

Data was analyzed using statistical program IBM Statistical Package for the Social Sciences (SPSS), version 24 (IBM, n.d.) for the descriptive analysis and main analysis. The first research question was whether sensation seeking predicted energy drinks usage, and the second research question was whether this relationship was moderated by the opportunity to use energy drinks (i.e. "risk opportunity"). Furthermore, it was tested whether age predicted the CCT-score through the third research question. The fourth research question was whether risk opportunity moderated this relationship.

To examine the first (1a) and second (1b) research questions, a moderation analysis was conducted to assess whether risk opportunity to use energy drinks moderated the relationship between sensation seeking and energy drinks usage. This analyzes was executed for children and adolescents separately. A median split was executed to turn the through a Likert-scale measured continuous variable sensation seeking and the continuous moderator risk opportunity into categorical variables. This was done by calculating the median of the two variables after which new variables were created with two categories: low and high sensation seeking and low and high risk opportunity. Executing a median split allowed to use a factorial Analysis of Variance (ANOVA) for testing a possible interaction effect (Allen, 2017). An ANOVA can be preferred over a regression because it increases clarity of communication (Iaobucci, Posavac, Kardes, Schneider & Popovic, 2015). The independent variables of the test were sensation seeking, the moderator risk opportunity and the interaction between sensation seeking and risk opportunity. The variables which were tested and the relation between these is shown in Figure 1. The dependent variable of the test was energy drinks usage. If the tested interaction was significant, which means having a p-value below .05, then the hypothesized moderation was supported.

To examine the third (2a) and fourth (2b) research questions, a moderation analysis was conducted assessing whether risk opportunity (on the CCT) moderated in the relationship between age and the CCT-score (i.e. CCT risk-taking). No median split was executed since the age was already split up in categories (children and adolescents) and risk opportunity was consisting of a low and high risk exposure condition. To examine for moderation, an ANOVA was conducted. The independent variables of the test were age groups, the moderating variable risk opportunity, and the interaction between age and risk opportunity. The dependent variable of the test was the CCT-score. The variables and their expected correlations are displayed in Figure 2. The hypothesized moderation was supported if the value of the tested interaction was significant, which means that it had a p-value lower than .05.

Results

Descriptive statistics for the variables of interest are shown in Table 1. First, normality of the data was examined. The skewness of the distribution is interpreted according to Bulmer (1979), who states that when the skewness is below -1 or above 1, the distribution is skewed. When skewness was between -.5 and .5, data was considered relatively free from skewness (Bulmer (1979). A rule of thumb used for kurtosis in the current analysis is based on Lindner (2013) and Field (2016). A kurtosis smaller than -1 was regarded as a flat distribution and a kurtosis above 1 indicated a high peak in the distribution. A normal distribution was considered to have kurtosis close to 0.

The distribution of mean scores for the average CCT-score, risk opportunity linked to energy drinks, the total intake of energy drinks and the level of sensation seeking was computed. The distribution of mean scores on the CCT was rather normal distributed with a skewness of -.05 (SD = .20). The distribution had a small peak with kurtosis of .23 (SD = .39). The mean scores of the total intake of energy drink has a skewness of 1.94 (SD = .20) and kurtosis is 3.30 (SD = .40), which means the distribution was skewed. The distribution of risk opportunity related to the intake of energy drinks turned out to be slightly skewed and flattened, seeing the skewness of -.81 (SD = .19) and kurtosis of -.32 (SD = .39). Lastly, sensation seeking was not skewed with .47 (SD = .20) and had a kurtosis of .68 (SD = .40). In conclusion, the distribution of the CCT-score and level of sensation seeking seemed to be normally distributed, while the intake of energy drinks and risk opportunity related to the intake of energy drinks were not. However, although ANOVA assumes normality, because the sample size is rather large it was still possible to execute the ANOVA with these non-normal distributed variables (Blanca, Alarcón, Arnau, Bono & Bendayan, 2017).

Table 1 shows the Pearson correlations between measured variables and descriptive statistics. The intake of energy drinks correlated with sensation seeking, r = .183, meaning that it correlated positively significant when using a significance level of .05. It shows that when the sensation seeking level is higher, the intake of energy drinks is as well. Risk opportunity correlated with energy drinks also, r = .439. This means that a higher risk opportunity is related to a higher intake of energy drinks. Next, age measured as continuous variable correlated significantly with risk opportunity with r = .742, meaning that age related to having the opportunity to obtain and drink energy drinks. Also, age correlated with the intake of energy drinks, r = .440, which means that a higher age is related to a higher intake of energy drinks. Descriptive statistics of the CCT-condition show that among the 150 participators (N = 84 in the ‘sure/safe’ condition, N = 66 in the ‘risky’ condition), the average score was 8.58, which

means that the average of flipped cards during the CCT among all participants approached nine. Correlations between the CCT risk-taking and the in Table 2 (See Appendix B) depicted variables show that risk-taking when playing the 'sure/safe' version did not significantly correlate with the intake of energy drinks, nor was a significant correlation found between CCT risk-taking when playing the 'risky' version and the intake of energy drinks, as Table 3 shows (Table 3 is shown in Appendix B). Also, the mean cards flipped in the 'sure/safe' condition (M = 8.38, SD = 2.12) did not differ a lot from the mean cards flipped in the 'risky' condition (M = 8.82, SD = 2.13).

Table 1

Descriptive Statistics of the Studied Variables

Measure	1	2	3	4	5	6	*N*	*M*	*SD*
1. Sensation seeking	-						147	1.89	.49
2. Risk opportunity	.059	-					149	2.87	1.26
3. Energy drink intake	.183*	.439**	-				150	.55	.92
4. CCT-average	.040	.066	-.041	-			147	8.58	2.12
5. Age	.072	.742**	.440**	.086	-		150	13.97	3.67
6. CCT-condition	.003	.682**	.393**	.126	.912**	-	150	-	-

**. Correlation is significant at the .01 level (2-tailed).

*. Correlation is significant at the .05 level (2-tailed).

Moderation Analysis

Main effect of sensation seeking on the intake of energy drinks. Hypothesis one, which expected that a higher level of sensation seeking predicts a higher intake of energy drinks, was tested using an ANOVA. The analysis included sensation seeking and the energy drink intake variable. Two categories were computed using a median split, which led to 52,0% (N = 78) being considered high sensation seeker and 48,0% (N = 72) low sensation seeker. The assumption of homogeneity was explored, based on Levene's Test F(3.146) = 20,4, p = .00, meaning that the variances were not homogeneous. The ANOVA yielded a marginally significant effect, $F(1,146) = 3.35$, $p = .069$, $\eta^2 = .022$. This means that, to some extent, as the level of sensation seeking increases, the intake of energy drink increases also. However, the null hypothesis that there is no significant relationship between the level of sensation seeking and the intake of energy drinks was not rejected. The same analysis only including adolescents

did not show significance either, F(1,64) = 3.195, p = .079 - , η^2 = .048, just as the analysis for children, F(1,78) = .089, p = .767, η2 = .001. However, these two results approached significance, meaning that to a certain extent, the higher the sensation seeking, the higher the intake of energy drinks among children and adolescents. However, there is no proof that sensation seeking does significantly predict the intake of energy drinks.

Interaction effect of risk opportunity on the link between sensation seeking and the intake of energy drinks among children and adolescents. The second hypothesis tested whether risk opportunity functioned as a moderator in the relationship between sensation seeking and the intake of energy drinks. The main effect of the moderating variable risk opportunity was significant with F(1,146) = 19.7, p = .000, η^2 = .163. The interaction effect turned out to be non-significant, F(1,146) = 2.88, p = .092, η^2 = .019, however, it approached significance. The pattern showed that as the level of risk opportunity increased, the level of sensation seeking did the also grew, as shown in Figure 3 (Figure 3 can be found in Appendix C). Although significance was approached, the null-hypothesis stating that there is no significant interaction between sensation seeking and risk opportunity in predicting the intake of energy drinks was not rejected. The p-values of the relationships between the variables are shown in Figure 4. This analysis was also executed using a regression analysis to examine the difference between a moderation analysis with categorical and continuous variables. This analysis yielded a significant interaction effect. (See the results of this analysis in Appendix D).

Interaction effect of risk opportunity on the link between sensation seeking and the intake of energy drinks among adolescents. This analysis showed that the main effects of both sensation seeking (F(1,64) = 3.195, p = .079 - , η^2 = .048) and risk opportunity (F(1,64) = .036, p = .850, η^2 = .001 were not found to be significant. The interaction effect was also non-significant with F(1,64) = .968, p = .329, η^2 = .015.

Interaction effect of risk opportunity on the link between sensation seeking and the intake of energy drinks among children. An ANOVA only including children showed a non-significant effect of sensation seeking on the intake of energy drinks with F(1,78) = .089, p = .767, η2 = .001. However, the effect of risk opportunity on the intake of energy drinks shows significance, F(1,78) = 4.906, p = .030, η^2 = .059, meaning that a higher risk opportunity to use energy is directly causing a higher energy drink intake, as depicted in Figure 5 (Figure 5 can be found in Appendix E). The interaction effect of sensation seeking times risk opportunity on the intake of energy drinks yielded, however, a non-significant result, F(1,78) = .252. p = .617, η^2 = .003.

Figure 4. Main effect of sensation seeking on the intake of energy drinks, main effect of risk opportunity on the intake of energy drinks and the interaction effect of risk opportunity to use energy drinks on the relationship between sensation seeking and energy drink intake.

Main effect of age on the CCT-score. The third hypothesis, suggesting a main effect of age on the average number of flipped cards in the CCT, was tested using a between groups ANOVA. Levene's Test of Variances was executed and resulted in $F(3.143) = .415$, $p = .743$, which means that the error variance of the CCT-score is equal across groups. The age was split in two categories (children and adolescents). A non-significant main effect of age was found, $F(1,143) = 1,15$, $p = .285$, $\eta^2 = .008$. This means that the null-hypothesis stating that age predicts the number of flipped cards on the CCT (i.e. CCT risk-taking) was not rejected.

Interaction effect of CCT-risk opportunity on the link between age and CCT-score. The relationship between age on the CCT-score was hypothesized to interact with the risk opportunity, which is formulated as a variable having two conditions ('sure/safe' condition and 'risky' condition). The main effect of risk opportunity on the CCT-score turned out to be non-significant $F(1,143) = .663$, $p = .417$, $\eta^2 = .005$. Also, no significant interaction was found, $F(1,143) = .467$, $p = .496$, $\eta^2 = .003$. Therefore, the null-hypothesis stating that risk opportunity does not moderate the relationship between age and CCT risk-taking is not rejected. These results are depicted in Figure 6.

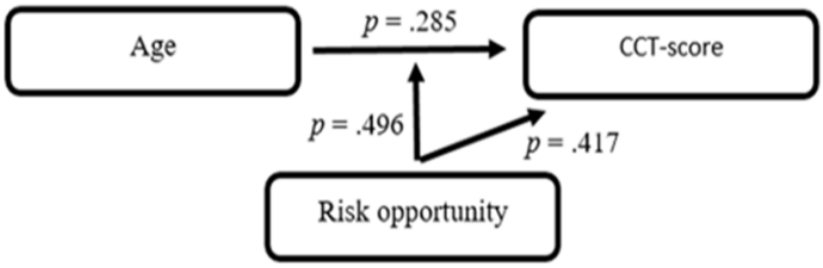

Figure 6. Main effect of age on CCT risk-taking, main effect of risk opportunity on the CCT on CCT risk-taking and the interaction effect of risk opportunity on the CCT on the relationship between age and CCT risk-taking.

Discussion

This study attempted to contribute to the knowledge about real-life risk behavior and the difference herein between children and adolescents. Risk-behavior is studied exhaustively but the factors explaining why the child-adolescent difference exists is not yet fully clear. Defoe et al. (2015) have put forward the potential role of risk opportunity (see also Gibbons et al., 2012), which can account for the reason why equal levels between children and adolescents are found in laboratory settings while adolescents are more likely to take risks in real-life (Defoe et al., 2015). Next to that, individual personality traits, such as sensation seeking (Snel 2011; Dunlop & Romer, 2010; Azagba, 2014), deem to be important. The current study hypothesized that the intake of energy drinks is predicted by sensation seeking and that there is a moderating effect of risk opportunity on this link. Finally, children were compared to adolescents on a risky decision-making task (CCT), on which risk opportunity was manipulated. It was hypothesized that children would take more risks on the CCT in the sure/safe condition than adolescents. In general, although significance was approached for research questions 1a and 1b, no substantiation of the hypothesized relations between variables was found. However, significance was approached several times.

Summary of the Findings

Energy drinks, sensation seeking and risk opportunity. A correlational relationship between the level of sensation seeking and the intake of energy drinks was found, which means that, as stated by Charfi et al. (2019), sensation seeking and the intake of energy drinks are related. However, results to proof a causal relationship between the level of sensation seeking and the intake of energy drinks were not found, although many studies did find relationships between this personality trait and the risk-behavior of energy drink usage (Charfi et al., 2019; Azagba et al., 2014; Newcomb et al., 2011). Though, it was expected that this relationship only is expressed when the person has a physical opportunity to ask risky (i.e. drink energy drinks) as stated by Gibbons et al. (2012). Deviations from previous studies are expected to be driven by the fact that risk opportunity was not included in these studies while it was in this study.

Next, a relation was found between the physical risk opportunity and the intake of energy drinks among both groups together and among only children, which means that a higher risk opportunity indeed relates to a higher energy drink intake. Considering the risk opportunity concept as stated by Defoe et al. (2015), it was expected that participants with high levels of sensation seeking only use energy drinks when there is an opportunity to act risky (i.e. obtain and drink energy drinks). A correlation was found between risk opportunity and age, explaining that a higher age is related to a higher intake of energy drinks. Also, statistical significance was

approached for the interaction between sensation seeking and risk opportunity in predicting the intake of energy drinks. This means that, although not proven, having the opportunity to act risky potentially increases the likelihood that a person being a 'sensation seeker', indeed drinks more energy drinks than a person who has less opportunities to do so. However, the absence of evidence for this interaction is not in accordance with Defoe et al. (2015), that suggest that risk opportunity moderates risk-behavior. The results deviate from the suggested relationship between sensation seeking and energy drink intake (Azagba et al., 2014) and the idea that reducing physical risk opportunities, as proposed by Gibbons et al. (2012), can serve as tool to prevent youth risk-taking. Also, the results do not comply with what the ecological model of Galimov et al. (2019) suggests, namely that the environment matter in acting risky or not. Although the current study found significance-approaching results, it deviates from Galimov et al. (2019), probably because their ecological model also includes social factors in the environment, while the current study exclusively focused on the physical environment. The results depart from the by Defoe et al. (2015) suggested developmental neuroecological model complemented with the risk opportunity element. Deviations from existing theories and literature might be because of the small number of questions in the sensation seeking scale, the challenge of social desirability in questionnaires (Van De Mortel, 2008) or the demographics of the participants, since these also influence risk-behavior a lot (Monshouwer et al., 2016; Redonnet, Chollet, Fombonne, Bowes & Melchior, 2012). As example of the latter, lower educated children drink more energy drinks than higher educated children in the Netherlands (Bemelmans et al., 2018). Also, the prevalence of laughing gas use in east Netherlands is way lower than in north Netherlands (Monshouwer et al., 2016). However, deviations can possibly be explained by other factors too. Indeed, the limitations of the current study which are described in a following section, should be considered when evaluating the results and relationships with theories.

CCT risk-taking, age and risk opportunity. The hypothesis was that age predicts the number of flipped cards on the CCT (i.e. the risk-taking tendencies) and that the risk opportunity on the CCT (i.e. the exposure to risk which was manipulated in the CCT) interacts in this relationship. Defoe et al. (2015) and Gerrard et al. (2008) explained that the role of risk opportunity might be of interest in explaining the difference in risk-taking behavior among children and adolescents. Hence, the current study ensured that children have equal chances of acting risky on the CCT as adolescents. This risk opportunity was manipulated on the CCT by creating two versions and dividing both children and adolescents over the two conditions. The data did not show a relationship between age and the number of flipped cards, which is in

accordance with findings described in the meta-analysis of Defoe et al. (2015), stating that children and adolescents tend to take equal levels of risk on a computerized risky decision-making task. However, the current study found this to be on the two versions of the CCT (i.e. 'risky' and 'sure/safe'), while Defoe et al. (2015) concluded this based on multiple tasks (e.g. Chicken Game and Stoplight Game).

The hypothesis resulting from this study tested the idea that age predicts risk-taking on the CCT, but only when the risk opportunity component interacts herein. As the meta-analysis of Defoe et al. (2015) shows, adolescents take less risks compared to children when they can opt for the 'sure/safe' option in a risky decision making task, such as the CCT, which would mean the CCT condition (e.g. the 'riskier' version and the 'sure/safe' version) interacts with age. All the same, this assumption was not met. This means that it is not necessarily the case that when the exposure to risk is kept equal for both age groups, differences in risk-taking arise. The results might differ from theories like the neuroecological model with a risk opportunity component by Defoe et al. (2015), because of the timer which was for the first time included in the CCT or because of the role of the 'no-card' option in the 'sure/safe' condition. For these two elements, recommendations can be found below. Additionally, the characteristics of the target group might have led to differences, since demographics have a big influence in risk-taking behavior (Monshouwer et al., 2016; Redonnet et al., 2012). The variety of theories and studies explaining the importance of the environment (Flay & Petraitis, 1994; Galimov 2019; Heather & Stockwell, 2004; Ajzen, 1991) do not specifically look at the physical environment and to what extent this contributes to the difference between risk-taking among children and adolescents. However, the current study did not find compelling evidence for the role of this aspect. Yet, the points of improvement of the study must be taken into account, as well as the resulting recommendations.

Strengths, Limitations, and Directions for Future Research

This study compared a self-report on real-world risk-taking, combined with an experimental setting, which is an advantage when exploring the difference between the real-life and laboratory. Next to that, the study focused on risk opportunity as driving factor behind the child-adolescent difference between real-life risk-taking and behavior as measured in a controlled environment, which is not yet widely studied and therefore potentially initiates future research. However, future research should take the limitations of the current study into account. Because all of the four primary schools which participated are not making use of desktop computers but Chrome Books instead, the researchers deviated from the pre-established research protocol, which required a computer room with computers that are compatible with

OpenSesame. This was a limitation because the Chrome Books cannot run OpenSesame, on which the CCT and questionnaire were conducted. Due to this issue, borrowed laptops had to be used, but there were not enough of these to have all children conducting either the questionnaire or CCT at the same moment. This has to be taken into account when making comparisons within groups of children and between children and adolescents. Counterbalancing can be used to avoid such confounding variables and to control for the potential risk of having different orders of making either questionnaire or CCT. This means that variation can be made in the order of the two research components (i.e. the questionnaire and the CCT). The researchers did not use this method because it was considered more feasible time wise to structure all data-collections in the same way. Second, the hypothesis advocating an interaction between sensation seeking and risk opportunity approached significance. It is expected that a larger sample can result in convergence to the center which in turn might lead to a higher probability that the expectation will be met (Field, 2016). Thirdly, the answer category of the energy drink intake scale as used in the digital version was not identical to the one included in the paper version. Although both scales used a five-point Likert scale on which 0 was the lowest and 4 the highest, this issue is a threat to the results and should therefore be taken into account when valuing the outcomes of the analysis related to this scale (Results of the analysis when this answer is excluded can be found in Appendix F). In the fourth place, the nature of the sample can be a point of improvement. When studying physical risk opportunity related to risk-behavior, it is of importance to recruit a sample wherein participants have a wide variety of backgrounds. The current study collected data among youths with mainly the Dutch nationality and either being Christian or not religious. Also, data was collected in the Twente region in the Netherlands while it can be interesting to have a sample with more variation in residence, to also create an idea of the importance of demographics and one’s socioeconomic status. This can increase the generalizability of the conclusions and lead to valuable insights in risk-behavior. A fifth possible limitation is the use of self-report data. This method has drawbacks, such as potential social desirability (Van De Mortel, 2008) and moral awareness which might influence one's choices when filling in the questionnaire (Hornsveld et al., 2017). However, it allows ethically obtaining information about real-life risk-behavior in a simple way, without interfering with someone’s day-to-day life. Indeed, a teacher was present in most data-collections, possibly resulting in the participants being worried that the teacher sees self-reported data, which promote filling in social desirable answers. Therefore, future research should make sure only coordinators are present during data-collections. Another methodological limitation is the use of a median split for research questions 1a and 1b. This

method was chosen because it allows to use ANOVA instead of regression (Grace-Martin, 2018) and can lead to an increase of clarity of communication (Iacobucci, et al., 2015). However, according to Iacobucci et al. (2015), this method can lead to a loss of power. This could have influenced the results, especially since a regression analysis for research question 1a and 1b, wherein all variables were kept continuous, yielded a significant result while the ANOVA did not (the results of this analysis are shown in Appendix D). Next, in the 'risky' CCT condition, it was still stated that there is a no-card function. However, this was not the case, which is a flaw and can have had consequences for the results of research questions about the CCT. Lastly, a timer was used in the CCT, which was not yet done before and should be taken into account when interpreting the results. The researchers did not notice whether the timer affected the performance of the participators. However, future studies should take a detailed look into the effect of the timer on CCT risk-taking.

Recommendations for future research are in line with what Defoe et al. (2015) proposed, which is a model in which risk opportunity is considered. Although no statistically significant relationships were found in the present study, significance was approached for the moderating effect of risk opportunity to obtain and drink energy drinks. This study is unique because of the use of the timer. Next to that, the usage of the CCT with its two manipulated conditions (i.e. 'sure/safe' and 'risky') in combination with a self-report aspect conducted to resemble real-life risk-taking, can instigate future research on this topic. It can be advised to reconsider the design of the manipulation. In the 'sure/safe' condition, the participants should clearly be less exposed to risks than participants in the 'risky' condition. This can be done through increasing the importance or the stakes of the no-card button by heightening the chance to lose many points, (fictive) peer approval or (fictive) money. Another option is to heighten the number of cards that has to be flipped in the 'risky' version before a round can be stopped to increase the exposure to risk. Also, the task can be adjusted to resemble real-life better, for example by having a fictive money box whereby it is clearly visible when it is filled when points are won and drastically emptied when a loss card is turned over.

Conclusion

The aim was to fill the gap in knowledge about the potential role of risk opportunity when explaining why adolescents tend to take more risks than children in real-life, while both groups take equal risks in laboratory settings. Also, it was studied whether sensation seeking plays a role in predicting the intake of energy drinks among children and adolescents and whether age predicts laboratory risk-taking when both groups have equal opportunities to do

so. Knowledge about this is of importance for understanding how risk-behavior can be prevented or led in the right direction. Although this study did not find evidence for an interaction effect of risk opportunity and sensation seeking on the intake of energy drinks, a significant effect of risk opportunity itself was found, which shows that it indeed is connected to risk-behavior. Likewise, adolescents and children seem to take equal amounts of risks when both groups have an equal opportunity to do so. However, since a higher age seems to relate to a higher energy drink intake, it can be concluded that children and adolescents take equal laboratory risks, but adolescents more in real-life, which is found more often (Defoe et al., 2015). Nonetheless, future research is needed to validate the explored relationships. Answers on how these relationships are driven are of importance in preventing risk-behavior by targeting the physical opportunity to act risky, among both children and adolescents. Also, this study could be of value for the medical sciences and policymaking. Studies exploring youth risk behavior are recommended to focus on risk-taking as it is seen in laboratories, but also as in real-life, because that is where the youth sometimes go a step too far in exploring the possibilities.

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Appendix A

Screenshot of the Columbia Card Task (CCT)

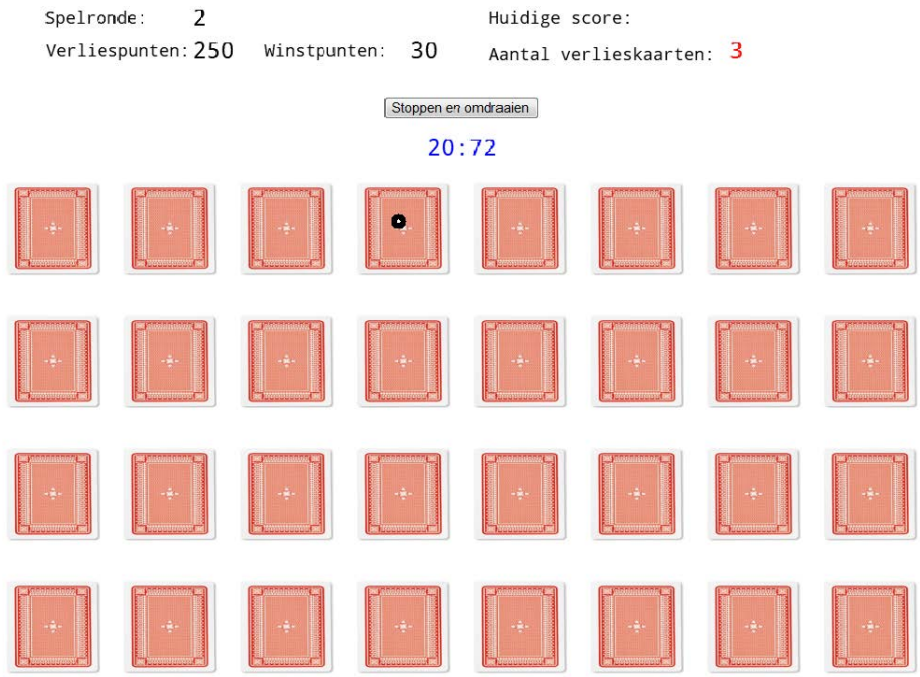

Figure 6. Screenshot of the CCT, 'risky' version, which has no 'no-card' button.

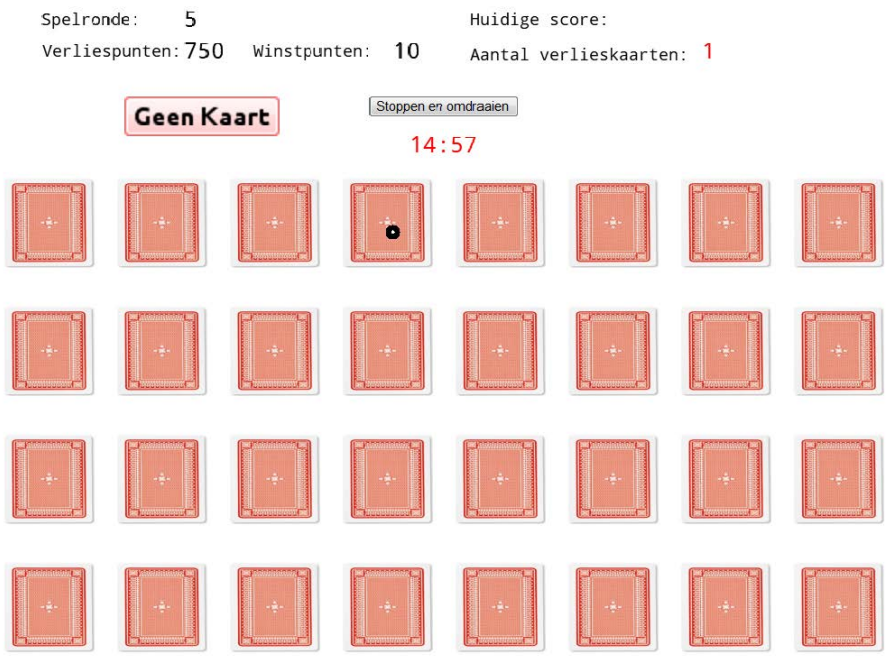

Figure 7. Screenshot of the CCT, 'sure/safe' version, which has a 'no-card' button.

Appendix B

Descriptive Statistics of the Study Variables, Split for ‘Sure/safe’ and ‘Risky’ CCT-version

Table 2

Descriptive Statistics of the Studied Variables in the ‘safe

Measure	1	2	3	4	5	*N*	*M*	*SD*
1. Sensation seeking	-					81	1.93	.51
2. Risk opportunity	.009	-				82	2.67	1.21
3. Energy drink intake	.082	.446*	-			83	.47	.90
4. CCT-average	.087	-.003	-.070	-		83	8.38	2.12
5. Age	.077	.702**	.332**	.049	-	83	13.87	3.01

**. Correlation is significant at the .01 level (2-tailed).

*. Correlation is significant at the .05 level (2-tailed).

Table 3

Descriptive Statistics of the Studied Variables no-card is links

Measure	1	2	3	4	5	*N*	*M*	*SD*
1. Sensation seeking	-					65	1.85	.48
2. Risk opportunity	.191	-				66	3.10	1.28
3. Energy drink intake	.349**	.419*	-			66	.67	.95
4. CCT-average	-.002	.060	-.024	-		63	8.82	2.13
5. Age	.179	.759**	.526**	.068	-	66	15,41	3.95

**. Correlation is significant at the .01 level (2-tailed).

*. Correlation is significant at the .05 level (2-tailed).

Appendix C

The Moderating Effect of Risk Opportunity on the Relationship between Sensation Seeking and the Intake of Energy Drinks.

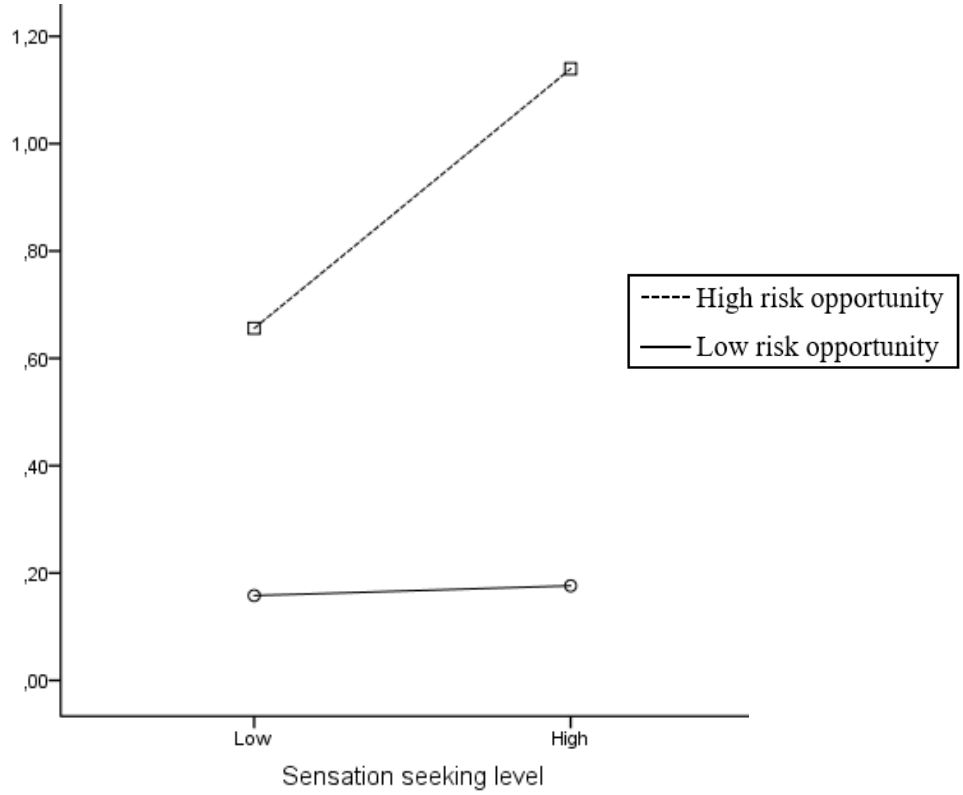

Figure 3: The interaction between the level of sensation seeking and risk opportunity to use energy drinks on the intake of energy drinks.

Appendix D

Data Analysis Addition for Research Questions One and Two; Regression

To check whether a significant interaction effect was found when using risk opportunity to obtain and drink energy drinks and sensation seeking as continuous variables, a regression analysis was executed. A significant interaction effect was found $\beta = .277$, $t(3,146) = 3.735$, $p = .000$, which means that the null-hypothesis stating that risk opportunity does not moderate in the relationship between sensation seeking and energy drink intake was rejected. This means that there is substantiation for the idea that risk opportunity moderates the relationship between sensation seeking and energy drink intake, showing a pattern wherein the growth of the level of sensation seeking goes hand in hand with that of the energy drink intake, provided that the risk opportunity is high.

Appendix E

Pattern of the Relationship Between Risk Opportunity to Use Energy Drinks and the Intake of Energy Drinks

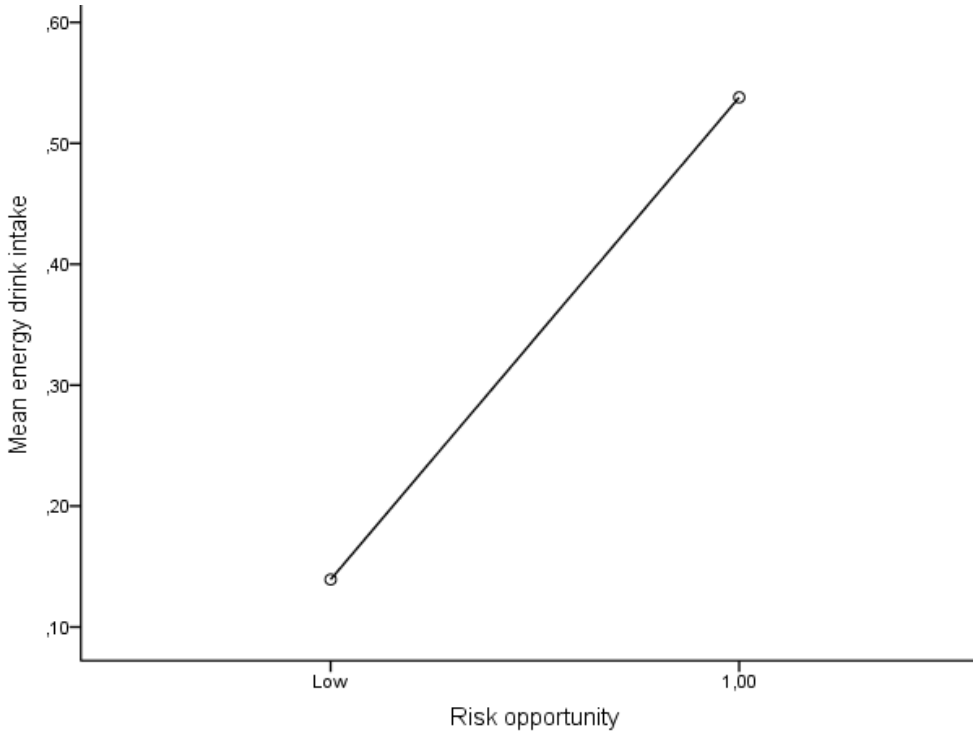

Figure 5. The pattern of the relationship between risk opportunity to use energy drinks and the intake of energy drinks.

Appendix F

Analysis with Energy Drink Question 3 Excluded

The answer categories of the energy drink intake scale, question 3, differed between the paper version and the digital version. To check for the implications of this flaw, an additional analysis was executed. The assumption of homogeneity was explored, based on Levene's Test $F(3,146) = 18{,}01$, $p = .00$, meaning that the variances are not homogeneous. The ANOVA yielded a significant relation between the level of sensation seeking and the intake of energy drinks among both children and adolescents, $F(1,146) = 4.28$, $p = .040$, $\eta^2 = .028$, meaning that the null-hypothesis stating that sensation seeking does not predict the intake of energy drinks is rejected. The same goes for the main effect of risk opportunity on the intake of energy drinks, $F(1,146) = 27.37$, $p = .000$, $\eta^2 = .158$. Lastly, the moderating value of risk opportunity on the relationship between sensation seeking and the intake of energy drinks was also significant, $F(1,146) = 4.02$, $p = 047$, $\eta^2 = .027$