CURRENT ISSUES IN PERSONALITY PSYCHOLOGY · VOLUME 6(2), 2018
DOI: HTTPS://DOI.ORG/10.5114/CIPP.2018.72268

ORIGINAL ARTICLE

Many face(t)s of young people's risk-taking: Individual and situational determinants

Karolina Czernecka[1·A,D,E,F,G], *Joanna Fryt*[1·A,B,D,E,F,G], *Monika Szczygieł*[1·B,E], *Amelia La Torre*[2·B,E], *Tomasz Smolen*[1·A,C,E,G]

[1]Department of Psychology, Pedagogical University of Cracow, Poland
[2]Institute of Psychology, Jagiellonian University, Cracow, Poland

BACKGROUND
Adolescence and young adulthood are frequently characterised by a strong propensity to take risks. Yet, empirical data shows that personality traits, type and features of risk measures, or presence of additional incentives can significantly influence one's risk-taking tendency. Our aim was to investigate young people's risk-taking and point out when and how individual and situational factors may increase or decrease their risk-taking propensity.

PARTICIPANTS AND PROCEDURE
Participants were adolescents and emerging adults (N = 173, age range: 13-30). Each completed two behavioural risk measures ("hot" and "cold" decision tasks) in two conditions, with or without financial incentives. Questionnaires assessing self-declared risk-taking, sensation seeking, and impulsivity were also used. Statistical analyses were conducted with gender and age as additional factors.

RESULTS
In "hot" risk tasks all participants risked the same, while the tendency to take risks in "cold" tasks was higher for older participants, especially in the presence of incentives. Males risked more than females, apart from "hot" incentivised tasks where no gender differences were found. Sensation seeking and impulsivity were significant predictors of risk-taking in "hot" incentivised tasks, while performance in "cold" non-incentivised tasks depended on sensation seeking only.

CONCLUSIONS
Our results show that risk-taking is not a unitary phenomenon, and young people are not universal risk-takers. Certain personality traits seem to predispose this group to taking risks, but only in some circumstances (e.g. "hot" decisions). Factors such as task context or additional incentives can not only increase but also decrease risk-taking in young people, resulting in more caution on their behalf.

KEY WORDS
impulsivity; adolescents; young adults; sensation-seeking; risk-taking

CORRESPONDING AUTHOR – Karolina Czernecka, Ph.D., Pedagogical University of Cracow · 2 Podchorążych Str., 30-084 Cracow, Poland, e-mail: czernecka.karolina@gmail.com

AUTHORS' CONTRIBUTIONS – A: Study design · B: Data collection · C: Statistical analysis · D: Data interpretation · E: Manuscript preparation F: Literature search G: Funds collection

TO CITE THIS ARTICLE – Czernecka, K., Fryt, J., Szczygieł, M., La Torre, A., & Smolen, T. (2018). Many face(t)s of young people's risk-taking: individual and situational determinants. *Current Issues in Personality Psychology, 6*(2), 112–121.

RECEIVED 01.05.2017 · REVIEWED 01.07.2017 · ACCEPTED 21.08.2017 · PUBLISHED 27.12.2017

BACKGROUND

Although taking risks and witnessing outcomes of our choices are common everyday experiences, both risk and risk-taking are extremely difficult to define. As Aven (2012) states, there is no single agreed upon definition of those concepts, although most of the conceptualisations seem to follow one of two lines. First, risk can be understood as an objective uncertainty in the decision-making process, concerning possible end-results of available options. Risk-taking could then be described as a propensity to choose the alternative with greater variability of possible outcomes, either positive or negative (e.g. Figner & Weber, 2011). The second group of definitions focus on the probability and severity of expected loss bound to each option. An individual who chooses the alternative with high probability of occurrence of undesired consequences, especially when those outcomes outweigh the expected reward, can be deemed a risk-taker (e.g. Gullone, Moore, Moss, & Boyd, 2000). Albeit far from consensus, the latter approach seems to be keenly adopted in psychological research (e.g. the Mokotow study, surveying risk-taking tendencies in Polish children and youths every four years since the 1980s; Ostaszewski et al., 2013). Because negative outcomes of risky decisions in various real-life domains can be grave (e.g. debts, injuries, addictions, criminal offences), attempts to better understand the determinants and mechanisms of risk-taking – and, in consequence, foresee and prevent it – are of special importance.

Conceptual difficulties, shared by many other psychological phenomena such as intelligence or creativity to name just a few, are mirrored in the empirical conundrum of how to properly measure risk-taking. The first of two general approaches employ behavioural decision tasks. Those can take the form of monetary gambles with varying probabilities of gains and losses (e.g. choosing between a certain reward of $7 or a chance at winning $10 with .5 probability; Apicella, Dreber, & Mollerstrom, 2014) or sequential decision tasks, where risky choices are made in a stepwise manner, increasing the amount to be lost and decreasing the subjective value of the amount gained with every step. Such tests, like the *Balloon Analogue Risk Task* (BART; Lejuez et al., 2002) or a variant of the *Columbia Card Task* (CCT; Figner, Mackinlay, Wilkening, & Weber, 2009), usually engage some degree of learning, concerning the probability and subjective value of each outcome. Decision tasks can also take the form of a fast-paced driving game (*Stoplight Task*, Chein, Albert, O'Brien, Uckert, & Steinberg, 2011; driving simulators, Cascio et al., 2015), allowing us to place risk in a context more similar to everyday situations. The alternative approach uses self-report measures that require individual assessment of one's own inclination to take risks in a variety of hypothetical scenarios or situations. The examples are Gullone et al.'s (2000) *Adolescent Risk-Taking Questionnaire*, measuring various aspects of risky behaviour in teenagers (e.g. thrill-seeking or rebellious tendencies) or the DOSPERT questionnaire (Blais & Weber, 2006), assessing an individual's risk inclination in several life domains separately (e.g. financial, health, social).

Both approaches have their merits and shortcomings (e.g. Lönnqvist, Verkasalo, Walkowitz, & Wichardt, 2014; Rolison & Pachur, 2016). Behavioural measures are performance-based, and therefore objective, and enable execution of well-controlled manipulations of parameters of each decision (e.g. values and probabilities of outcomes). However, complying with the rules and goals might depend on additional cognitive processes (e.g. working memory capacity or executive functions) and therefore be difficult to grasp for some participants. On the other hand, risk-taking questionnaires are typically more convenient and easier to understand for participants, yet lack of insight on their behalf or inclination to hide one's own engagement in reckless or illegal activities might confound the data. It is impossible to unequivocally proclaim a supremacy of one method over the other, especially if we take into consideration the well-known fact of low-to-moderate correlations between their scores. Certainly, this effect can be attributed to measurement flaws, yet many researchers believe that both approaches should be accounted for because they offer an insight into unique aspects of risk-taking (e.g. Mamerow, Frey, & Mata, 2016). This viewpoint seems to be supported by results such as Josef et al.'s (2016), showing that – although cross-correlations are indeed low or non-existent – self-reports and behavioural tasks scores do follow the same developmental trajectories of continuous rise of risk-taking tendencies to middle adulthood and a subsequent decline in older age.

The assessment of risk-taking propensity depends not only upon the type of measurement chosen, but also on the structure of the method itself. Results obtained with single-factor questionnaires may differ from domain-specific inventories – the same person can be a risk-taker in some domains (e.g. financial) and risk-avoider in others (e.g. social; Hanoch, Johnson, & Wilke, 2006). The prognostic value of such measurements also varies depending on the type of real-life behaviour to predict. For instance, one's engagement in extreme sports or substance abuse can be anticipated more precisely on the basis of specific subscales, assessing health or recreational risk-taking propensity, rather than by a score obtained in a general risk-taking questionnaire. The problem at hand is even more palpable in case of behavioural tasks. Many seem to inherently measure different aspects of risk-taking, even if their structure is seemingly similar. BART and (a version of) CCT tasks are

both sequential decision tasks, yet when factor analysis is conducted both tasks load the same factor only weakly, suggesting different decision processes involved (Buelow & Blain, 2013). Even if only one task is chosen, introducing a few changes in the procedure might be enough to produce significant differences in people's propensity to take risks. For example, CCT task has "hot" and "cold" version (see Figner et al., 2009). The former is characterised by increasing riskiness of the task and immediate feedback, creating a sense of tension or thrill, while the latter consists of trials of singular decisions without any information about one's gains or losses nor causal links between them. Decisions made in CCT-hot are believed to be (at least partially) influenced by arousal and affective processes, while behaviour in the CCT-cold version of the task is expected to be guided by calculation and deliberate reasoning. Studies show that people behave differently in "hot" and "cold" tasks – participants are generally more prone to take risks in "hot" variants (e.g. Figner et al., 2009). It is believed that during "cold" decision tasks people try to arrive at some conclusion utilising as much information as possible (e.g. probability distributions, expected amounts of gain/loss), while in "hot" decision tasks they use simplified heuristics, usually based on a single parameter (Markiewicz & Kubińska, 2015). Therefore, task design alone can trigger different modes of information processing leading to more conservative or hazardous behaviours.

The task of measuring one's propensity to take risks becomes even more difficult if we take under consideration the fact that risk-taking is not only a situation-specific response pattern, but rests upon individual characteristics of the decision-maker as well. One of the most fundamental difference concerns gender – meta-analyses such as Byrnes, Miller, and Schafer's (1999) or Charness and Gneezy's (2012) clearly show that men are more eager than women to take risks. However, when risk is assessed as a domain-specific propensity, the differences appear to be domain-specific rather than general. For instance, females take significantly greater risks in the social domain than men, but avoid risks in other areas (e.g. Harris, Jenkins, & Glasser, 2006). Some researchers believe that the "appetite" for risk is roughly the same in women and men, but there are context-specific, culturally mediated differences in perceived benefits and risks. When the probability of negative outcome is seen as high and the expected value of positive outcome is low, the overall tendency to choose the risky option diminishes. Women expect greater losses and smaller gains from financial, physical, and recreational risk-taking, and therefore are risk-aversive in those areas, while the opposite is true for the social domain (Figner & Weber, 2011).

Some personality traits are also of importance, with sensation seeking and impulsivity being hallmark examples. The former can be roughly defined as a need to experience novel, complex, and/or intense stimuli, while the latter is usually understood as a tendency to respond rapidly to various cues, without deliberation or consideration of potential dangers. High levels of both traits have been linked to a number of risky behaviours, such as substance abuse, unprotected sex, gambling, or dangerous driving habits in adolescents and adults (e.g. Zuckerman & Kuhlman, 2000; Janssen et al., 2015). Sensation seeking and impulsivity also exhibit gender differences, favouring men (Cross, Copping, & Campbell, 2010; Cross, Cyrenne, & Brown, 2013). What is interesting, the root of those differences seems to lie in different degrees of sensitivity towards rewards and punishments for each gender, complementing the above-described gender differences in domain-specific risk perception.

When all the above intricacies are taken under consideration, it is clear that risk-taking is not a simple, unitary phenomenon. Instead, it is influenced by the choice of measurement methods, contextual cues of the decision tasks, and personal features of the risk-taker. Thus, unequivocally branding an individual or a group of individuals as "permanent" risk-takers or risk-avoiders seems rather perplexing, if not unjustified. Yet, life-span studies on developmental trajectories of risk-taking seem to advocate the exact opposite. Different life periods are characterised by increases or decreases in risk-taking tendencies with a marked rise from mid-adolescence to early adulthood (e.g. Figner et al., 2009). Young people are believed to risk the most in a variety of different scenarios and to experience negative outcomes of such actions most frequently, with typical examples being psychoactive substance abuse or reckless sexual behaviour (e.g. Mahalik et al., 2013; Shulman & Cauffman, 2014). Theories such as the dual systems model by Steinberg (2008) view heightened risk-taking tendencies in this age group as a by-product of an imbalance between cognitive and motivational systems. Mismatched maturation rates result in an increased sensitivity towards rewards and a deficient ability to control one's behaviour, translating to a higher propensity to take risks. Differential approaches also point out that the combination of sensation seeking and impulsivity levels favouring risk-taking is also characteristic of adolescence and early adulthood (Harden & Tucker-Drob, 2011).

Yet, as Willoughby, Good, Adachi, and Tavernier (2013) argue, is it actually possible that young people are universal risk-takers? Statistics and a growing pool of experimental data seem to indicate otherwise. First of all, nation-wide health surveys reveal a gradual decline in the prevalence of almost all types of risky behaviours undertaken by young people. The frequency rates of vehicular accidents, violence-related injuries, substance abuse, or

engaging in unprotected sex have been steadily decreasing over the last decades (e.g. Blum & Qureshi, 2011; Dzielska & Kowalewska, 2014), clearly showing moderating effects of newly introduced laws, health education campaigns, and changing social norms on young people's propensity to take risks. Moreover, laboratory studies (e.g. Van Leijenhorst, Westenberg, & Crone, 2008; Tymula, Rosenberg Belmaker, Ruderman, Glimcher, & Levy, 2013; Barkley-Levenson, Van Leijenhorst, & Galván, 2013) also show that assessments of various components of risk or risk-taking tendencies *per se* do not necessarily "stand out" in the youngest participants; rather, observed age differences are mediated by specific task demands. For example, young people do risk more, but only in specific conditions such as arousing "hot" versions of a decision task (e.g. Chein et al., 2011; Cascio et al., 2015). When affective processes are not in play, there is no difference between adult and youth risk-taking, making "deficient" cognitive processing, attributed to young people, questionable (e.g. Figner et al., 2009; Figner & Weber, 2011). Finally, recent studies have focused on another age-group with well-known propensity to *avoid* risk – older adults – also pointing to the tremendous role of contextual cues in risk-taking tendencies, such as learning demands, information integration, or simple experience with decision tasks. When those factors are accounted for, older adults risk just as much – and sometimes even more – than young people (see e.g. Huang, Wood, Berger, & Hanoch, 2013; Mamerow et al., 2016; Rolison & Pachur, 2016). In light of all the above, it is plausible that youths' overall higher propensity to take all kinds of risks is also only a "reasonable speculation" (Willoughby et al., 2013), validating a targeted research approach.

The main aim of our study was to decompose risk-taking in adolescents and early adults and challenge its supposed universality by identifying factors – both interpersonal and contextual – that change the probability of taking risks in these particular age groups. Taking all the briefly described issues concerning conceptualisation and measurement into account, we decided to use both a questionnaire and behavioural tasks to assess risk-taking propensity. As we were not interested in domain-specific risks, we chose a general risk-taking inventory, making sure that the items were varied and described options actually available to young people. Second, we employed two diverse risk-taking tasks, being inherently "hot" and "cold". The former task took the form of a race game (see below for details), fast-paced and sensorically stimulating, while the latter – a form of Stock Market exchange, encouraging strategic, deliberative decisions. What is more, we created both controlled and incentivised conditions *within* each task by rewarding participants' performance, which allowed us to track interactions between internal properties of the tools and external context of decision-making processes. Third, we controlled individual differences in sensation seeking and impulsivity, suspecting they might have a moderating effect on in-task manipulations. Fourth and finally, as biological maturation and hormonal activation marks the rise of gender differences in risk-taking, we explicitly looked for discrepancies between behaviours of male and female participants.

To sum up, our study sought answers to the following broad questions: how does age affect risk-taking tendency? Is risk-taking propensity gender-specific? What is the influence of personality traits on risk-taking with both age and gender being considered? We hypothesised that when all the above factors are accounted for, diverse patterns of behaviour would emerge with unique arrays of vulnerability and resilience to risk-taking.

PARTICIPANTS AND PROCEDURE

PARTICIPANTS

In total 173 volunteers were tested (76 male), recruited from two distinct age groups: adolescents (N = 90, mean age = 13.82, SD = 0.89, range = [13, 16]), and young adults (N = 83, mean age = 23.84, SD = 2.79, range = [18, 30]). Adult participants were recruited via online advertisements. Apart from age, no further requirements or restrictions were introduced, creating a random sample in terms of other demographic variables. Adolescents were recruited during parent-teacher conferences in local schools. Parental consent was obtained for all underage participants.

For a full attendance in the study, participants were given vouchers (to a clothing store, a bookstore, or a movie theatre), valued from $5 to $15 (mean $10, equivalents in PLN), depending on the individual level of performance in the rewarded condition (see below).

MEASURES

Two computer tasks were designed to test participants' risk-taking propensity in both "hot" and "cold" conditions (*Spaceride* task, *Stock Market* task, respectively). Three questionnaires: *Eysenck's Impulsivity Inventory* (IVE), *Arnett Inventory of Sensation Seeking* (AISS), and *Risk-Taking Questionnaire* (RTQ) were also employed to investigate personality traits and self-reported tendency to take risks. Additionally, participants completed two measures of cognitive control (*Stroop* and *Antisaccade* tasks) and SUPIN arousal scale – the results are described elsewhere (Fryt, Smolen, Czernecka, La Torre, & Szczygieł, 2017).

Spaceride. The task was inspired by the *Stoplight Task* (Chein et al., 2011) where participants drove a virtual car and had to decide whether to risk an accident and go through a yellow light to reach their destination quicker or wait for a green light and loose time, obtaining lower game score. The *Spaceride* task was similar, resembling a game where participants drove a spaceship seen from above with the goal of reaching the end of a cosmic route as quickly as possible. During the flight, there were "danger zones", where the spaceship could collide with an asteroid passing nearby. A sound signal, light on a radar, and distance asteroids in the background signalled that the spaceship was inside the danger zone. While piloting through danger zones, the participant could also come across a cloud of fog covering the spaceship and its surroundings for a number of seconds. As it was not possible to see the asteroid, the fog additionally increased environmental uncertainty. In each danger zone, the participant could speed ahead, risking collision with the asteroid, or slow down to avoid it. The collision would immobilise the spaceship for a time longer than it would take to drive though a danger zone.

Stock Market. The task took the form of a financial game in which participants used virtual money to buy stocks of two fictitious companies with the goal of earning as much as possible in 20 rounds. In each one-minute round participants could buy any number and combination of shares – their choices were restricted only by the amount of money they had available (the information about their assets was available on-screen). After each round the prices changed, the purchased stocks were sold, and the amount lost or gained was added or subtracted from the overall amount of owned money. Throughout the game participants could follow the history of changes in stock prices for both companies on graphs visible on the screen. The average change of two stocks prices (expected gain) was the same, but the variance of the price changes was small for one (safe option) and large for the other company (risky option). The participants were informed about the differences between the companies at the beginning of the game. All changes in stock prices were probabilistic.

IVE Questionnaire. Eysenck's Impulsivity Inventory (Polish adaptation by Jaworowska, 2011) assesses three personality traits: impulsivity (the tendency to take risks without regard to the consequences), venturesomeness (the readiness to take risks with awareness of the consequences), and empathy (the ability to notice, understand, and react to other people's emotions). IVE contains 54 questions to be answered with "Yes" or "No", indicating whether participants agree or not with each statement.

Arnett Inventory of Sensation Seeking (AISS). The original scale (Arnett, 1994) was introduced to measure sensation seeking in adults and adolescents aged 16 to 18 years. Sensation seeking was defined here as "the need for novelty and intensity of stimulation" (Arnett, 1994, p. 290). The AISS contains 20 items to be answered on a four-point *Likert scale*. We translated the AISS to Polish for the sole purpose of the study and pretested it in a pilot study on 197 participants (91 adolescents aged 13-15 and 106 adults aged 19-38), achieving acceptable reliability after minor linguistic changes. Two items were removed due to their low reliability. Eventually, 18 items were included in the inventory and used in the study.

Risk-Taking Questionnaire (*RTQ*). This original tool is based on the *Adolescent Risk-Taking Questionnaire* (ARQ) by Gullone et al. (2000), developed to study adolescents aged 11-18 years. ARQ is divided into two parts, each describing the same set of 22 risky behaviours (thrill-seeking, rebellious, reckless, antisocial). In the first part (*Risk Behaviour Questionnaire*), participants indicate how often they are involved in the described behaviour, using a five-point scale. In the second part (*Risk Beliefs Questionnaire*), the participants assess the degree of risk in each of 22 given behaviours. We translated all original items of the inventory into Polish and added 22 new items, describing risky behaviours typical for young adults, thereby creating a *Risk-Taking Questionnaire* applicable to all of our age samples. The reliability of this tool was tested by us during the same pilot study as AISS. Fifteen items were removed and the remaining 29 risky behaviours were included in the final version of the questionnaire.

PROCEDURE

The study was conducted in the university laboratory (adults) and in public schools (adolescents). Before the experiment all participants were assured of anonymity and were given information about the purpose of the research and the procedure. They were informed that they are free to ask questions, can withdraw their participation at any moment and receive performance feedback after the study ended, if indicated.

The experiment lasted for approximately 90 minutes. During the session, each participant performed computer tasks in two conditions: "rewarded" with computer test scores determining the value of the received voucher; and "non-rewarded", with fifteen-minutes break between the two. In each condition participants performed four tasks. Two of the tasks measured cognitive control (*Stroop* task, *Antisaccade* task), and two others – the risk-taking tendencies (*Spaceride* task, *Stock Market* task). Each task was preceded by a short training and instruction read aloud by the experimenter. The order of the conditions and of the tasks within each condition were randomised. In the middle of each condition (after

performing two tasks) participants completed the SUPIN arousal scale. At the end of the experiment participants completed AISS, RTQ, and IVE questionnaires in fixed order.

RESULTS

Due to the fact that two original inventories were employed in the study, we first analysed the reliability of these tools. Subsequently, we examined the relationships between both self-assessed and performance-based risk measures, measures of personality traits (impulsivity, sensation seeking), gender, and age.

Empathy subscale scores of IVE for all participants were not analysed because the measure was not related to the aim of the study. Scores in RTQ obtained by two participants were excluded as outliers (3.5 standard deviations above the mean). One person did not finish whole set of tasks, but the results were nevertheless used in analyses that did not include the missing measures.

ORIGINAL QUESTIONNAIRE RELIABILITY

Cronbach's standardised alphas were estimated for the scales used in the study. The consistency of the sensation-seeking scale AISS was acceptable ($\alpha = .74$, items' whole correlation with overall score corrected for item overlap and scale reliability varied from .15 to .53, mean .37). The consistency of impulsivity subscale of IVE also was acceptable ($\alpha = .78$, items' correlation with overall score varied from .17 to .68, mean .4), just as venturesomeness subscale of IVE ($\alpha = .79$, items' correlation with overall score varied from .16 to .61, mean .44). The consistency of the *Risk Behaviour Questionnaire*, the first part of RTQ, was again good ($\alpha = .88$, items' correlation with overall score varied from .27 to .64, mean .47). Finally, the consistency of the *Risk Beliefs Questionnaire*, the second part of the RTQ, was excellent ($\alpha = .93$, items' correlation with overall score varied from .38 to .71, mean .56).

DETERMINANTS OF RISK-TAKING

In all questionnaires scores were mean values of responses (taking into account reversed items). The *Stock Market* task score included the number of stocks (both safe and risky) bought by participants in all rounds. The *Spaceride* score was a logarithm of the mean number of seconds participants pressed break or accelerate buttons in danger zones. As the distribution of raw means was positively skewed ($\gamma_1 = 2.06$), it was logarithmised to remove skewness ($\gamma_1 = 0.23$ after transformation). Because not all tested variables had normal distribution a general linear model was used to estimate relations between the variables instead of *t* test – more customary in similar cases. All R^2s were adjusted to take into account the complexity of the models.

We examined the influence of age on sensation seeking as measured by AISS, both subscales of IVE, *Risk Behaviour Questionnaire* and *Risk Beliefs Questionnaire* (parts of RTQ), and risk measures in behavioural tasks. The dependence of AISS sensation seeking score on age was not significant ($p = .570$). Impulsivity scores (IVE) decreased with age ($B = -.01$, $R^2 = .09$, $p < .001$). On the other hand, there was no significant change with age in the venturesomeness subscale of IVE ($p = .700$) nor in the *Risk Behaviour Questionnaire* ($p = .130$). In the *Risk Beliefs Questionnaire* scores decreased with age ($B = -.02$, $R^2 = .03$, $p = .014$). Older participants risked more in the *Stock Market* task, both in non-rewarded ($B = 3.85$, $R^2 = .02$, $p = .030$) and rewarded ($B = 5.83$, $R^2 = .07$, $p < .001$) conditions. On the other hand, there was no significant relation between age and risk in the *Spaceride* task in both non-rewarded ($p = .810$) and rewarded conditions ($p = .065$).

We also tested the effect of gender on the measures described above. Men obtained higher scores in sensation seeking than women ($B = .34$, $R^2 = .14$, $p < .001$). Men scored higher than women both in the impulsivity ($B = .08$, $R^2 = .03$, $p = .019$) and venturesomeness ($B = .15$, $R^2 = .10$, $p < .001$) subscales of IVE. Men also obtained higher score in *Risk Behaviour Questionnaire* ($B = .31$, $R^2 = .17$, $p < .001$), but there was no difference between genders in the *Risk Belief Questionnaire* score ($p = .100$). In the *Stock Market* task men risked more both in non-rewarded ($B = 58.59$, $R^2 = .05$, $p = .002$) and rewarded ($B = 43.59$, $R^2 = .03$, $p = .017$) conditions. In the *Spaceride* task men risked more only in the non-rewarded condition ($B = .18$, $R^2 = .02$, $p = .029$), but there was no difference in the rewarded one ($p = .470$). Table 1 presents correlation coefficients between risk measures. There were 10 significant correlations, varying in strength from .15 to .8.

We also examined relations between questionnaires and risk in behavioural tasks in both conditions (behavioural tasks being dependent variables). There was no significant relation between sensation seeking score and the *Spaceride* task in non-rewarded condition ($p = .210$), but there was one in rewarded condition ($B = .22$, $R^2 = .02$, $p = .037$). Similarly, the impulsivity subscale of IVE was not related to the *Spaceride* in non-rewarded condition ($p = .820$), but the relation was significant in the rewarded condition ($B = .57$, $R^2 = .04$, $p = .007$). On the other hand, both venturesomeness subscales of IVE and *Risk Behaviour Questionnaire* were significantly related to Spaceride scores in non-rewarded condition ($B = .41$, $R^2 = .03$, $p = .022$; and $B = .27$, $R^2 = .03$, $p = .027$; respec-

Table 1

Correlations between risk measures

Risk measure	Variables					
		2	3	4	5	6
Risk Behaviour Questionnaire	1	.47***	.31***	.23**	.19*	.18*
Venturesomeness subscale of IVE	2	–	.15*	.13	.18*	.15
Stock Market, non-rewarded	3	–	–	.80***	.17*	.14
Stock Market, rewarded	4	–	–	–	.15	.08
Spaceride, non-rewarded	5	–	–	–	–	.28***
Spaceride, rewarded	6	–	–	–	–	–

Note. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

tively) but not in rewarded condition (p = .050; and p = .240; respectively).

There was a significant relation between sensation seeking score and risk in the *Stock Market* in non-rewarded condition (B = 48.33, R^2 = .023, p = .029), but there was none in rewarded condition (p = .230). The venturesomeness subscale of IVE questionnaire explained a significant part of *Stock Market* score variance in non-rewarded condition (B = 81.35, R^2 = .02, p = .049), but not in rewarded condition (p = .970). The impulsivity subscale was not significantly related to the *Stock Market* score in non-rewarded (p = .190) nor in rewarded (p = .660) condition. Finally, the relation between *Risk Behaviour Questionnaire* and *Stock Market* score was significant in both non-rewarded (B = 77.98, R^2 = .05, p = .003) and rewarded (B = 57.21, R^2 = .03, p = .024) conditions.

DISCUSSION

AGE AND RISK-TAKING

In line with studies showing different developmental trajectories for sensation seeking and impulsivity (Steinberg et al., 2008; Harden & Tucker-Drob, 2011), we observed a decrease in impulsivity scores with age and no changes in sensation seeking – both in the whole sample. Age also did not differentiate self-reported tendency towards risk, measured by both venturesomeness subscales of IVE and RTQ. Interestingly, younger participants assessed behaviours presented in RTQ as more risky than older participants did. Overall, these results are in agreement with the view that adolescence is the time when the two personality correlates of risk-taking in question are both high (Harden & Tucker-Drob, 2011), but this does not entail an increased tendency towards risk. Data from *Risk Beliefs Questionnaire* suggest that teenagers may perceive consequences of risk as more severe than young adults, which could lead to greater risk aversion. Further research could help to identify factors determining perception of risk in different age groups (e.g. certain life experiences, allowing assessment of consequences of risk more realistically, could reduce risk aversion).

Data from behavioural tasks provide additional information on age differences in risk-taking. Similarly to other authors (Figner et al., 2009), we observed that the type of task had a significant impact on the number of risky decisions. In the "cold" task requiring deliberative reasoning (*Stock Market*) younger participants risked significantly *less* than older ones, both in rewarded and non-rewarded conditions. In the "hot" task involving affective processes (*Spaceride*) the amount of risk undertaken in both conditions was independent of age. These results indicate that under certain conditions adolescents can be more risk-averse than young adults. It might be speculated that the lack of familiarity or experience with the task context (e.g. purchasing shares, investing money) might have resulted in avoiding risk (see e.g. Harris et al., 2006; Huang et al., 2013). Further studies should determine whether using another gambling task ("cold", but with more familiar context) will produce different results in the youngest participants.

GENDER AND RISK-TAKING

As expected, women reported lower sensation seeking, impulsivity, and tendency to take risks in both IVE and RTQ inventories. They also took risky decisions less frequently than men in the *Stock Market* (in both conditions) and the *Spaceride* (in non-rewarded condition only). Gender differences, however, were not present when the *Spaceride* task was additionally incentivised (rewarded condition). Women are known to avoid risk in some domains in particular, such as financial domain (Figner & Weber, 2011), which could explain their risk-aversion in the Stock Market task. Yet, the opportunity to earn rewards in the "hot" task seemed to motivate women enough to take risks to a degree similar to men. Moreover, data

from *Risk Beliefs Questionnaire* suggests that women perceive consequences of risk the same as men do, although they report taking risks less frequently. This is an interesting result, worth further investigation, suggesting that women avoid taking risks not just because they perceive the consequences as more severe or unprofitable.

PERSONALITY AND RISK-TAKING

According to our predictions, personality variables such as sensation seeking, impulsivity, as well as self-reported tendency towards risk were associated with risk-taking in behavioural measures in varying degrees, depending on the task type ("hot" or "cold") and condition (rewarded or non-rewarded). In the *Spaceride*, sensation seeking and impulsivity were associated with risk-taking only in rewarded condition. Such results mean that high levels of these personality traits favour risky decisions in highly stimulating circumstances, but may not affect risk-taking without additional incentives. On the other hand, a self-reported tendency towards risk was associated with risk-taking in the *Stock Market* task and in the *Spaceride* task, but only in non-rewarded condition. Perhaps self-reported estimations of one's own risk propensity are made with "cold" conditions in mind, thus reflecting more accurately the behaviour in non-incentivised conditions. Such a suspicion is difficult to confirm without additional research.

In the *Stock Market*, a high level of sensation seeking favoured risky decisions only in non-rewarded condition, while impulsivity was not associated with risk-taking at all. The fact that high impulsivity is related to risk-taking in "hot" but not "cold" tasks seems understandable given the differences between them. Decisions whether to take risks in the *Spaceride* are taken quickly and under momentary pressure, while the *Stock Market* requires deliberation and is less time-bound. Thus, it is more difficult to track impulsive decisions in the latter task. The association between sensation seeking and risk-taking in the non-rewarded *Stock Market* condition is, however, difficult to explain. As the frequency of risky decisions in this task is similar regardless of condition, it seems unclear why the relation between risk-taking and sensation seeking is significant only in the non-rewarded one. More studies are definitely needed, perhaps using another "cold" gambling task, to determine whether such a relationship exists and why.

CONCLUSIONS

Our study examined the impact of various factors (both individual and situational) on risk-taking tendencies in young people. Taken together, the results indicate that the risk is not a unitary, monolithic phenomenon. Traits such as impulsivity and sensation seeking may or may not favour risky decisions depending on type of task and the presence of incentives. Similarly, the impact of age and gender on risk-taking might be different, depending on situational factors. Interestingly, our study showed younger participants to be more impulsive, confirming the stereotype, but at the same they risk the same or even to a smaller degree than older participants and perceive the outcomes of risky behaviours as *more* severe. Moreover, their propensity to take risks might be diminished by unfamiliar task context. We also showed that contextual cues can augment risk-taking in some participants, even if they are usually risk-avoiders. For example, women are as willing as men to make risky decisions in the "hot" tasks and with incentives present, similarly to participants with high levels of impulsivity or sensation seeking. Therefore, stating that some groups are particularly prone to take risks or avoid risks may be unjustified and not applicable to all conditions.

The relative novelty of some tools used in our study is both a strength and a limitation. Further research should focus on placing behavioural tasks in contexts that are similarly familiar to all of participants. Because decision context is of grave importance, studies should continue to compare risk-taking in different domains. A very promising aim for future research is to determine under what circumstances young people manifest risk aversion and risk proneness, and what functions both tendencies fulfil in adolescence and early adulthood (if such functions changes with age). In addition, in order to better explain the conditions in which tendency towards risk increases, it would be worthwhile studying how young people's perceptions about risk are related to actually taking risks. A tool allowing the measurement of individual sensitivity to positive and negative consequences of risk separately is therefore needed.

ACKNOWLEDGMENTS

This work was sponsored by National Science Centre of Poland ("Sonata-bis" grant no. 2015/18/E/HS6/00152).

References

Apicella, C. L., Dreber, A., & Mollerstrom, A. (2014). Salivary testosterone change following monetary wins and losses predicts future financial risk-taking. *Psychoneuroendocrynology, 19*, 58–64.

Arnett, J. (1994). Sensation seeking: A new conceptualization and a new scale. *Personality and Individual Differences, 16*, 289–296.

Aven, T. (2012). The risk concept – historical and recent development trends. *Reliability Engineering and System Safety, 99*, 33–44.

Barkley-Levenson, E. E., Van Leijenhorst, L., & Galván, A. (2013). Behavioral and neural correlates of loss aversion and risk avoidance in adolescents and adults. *Developmental Cognitive Neuroscience, 3*, 72–83.

Blais, A-R., & Weber, E. U. (2006). A Domain-Specific Risk-Taking (DOSPERT) scale for adult populations. *Judgement and Decision Making, 1*, 33–47.

Blum, R. W., & Qureshi, F. (2011). *Morbidity and mortality among adolescents and young adults in the United States.* Baltimore, MD: Johns Hopkins Bloomberg School of Public Health.

Buelow, M. T., & Blaine, A. L. (2015). The assessment of risky decision making: a factor analysis of performance on the Iowa Gambling Task, Balloon Analogue Risk Task and Columbia Card Task. *Psychological Assessment, 27*, 777–785.

Byrnes, J. P., Miller, D. C., & Schafer, W. D. (1999). Gender differences in risk-taking: a metaanalysis. *Psychological Bulletin, 125*, 367–383.

Cascio, C. N., Carp, J., O'Donnell, M. B., Tinney, F. J., Bingham, C. R., Shope, J. T., ...Falk, E. B. (2015). Buffering social influence: neural correlates of response inhibition predict driving safety in the presence of a peer. *Journal of Cognitive Neuroscience, 27*, 83–95.

Charness, G., & Gneezy, U. (2013). Strong evidence for gender differences in risk taking. *Journal of Economic Behavior and Organization, 83*, 50–58.

Chein, J., Albert, D., O'Brien, L., Uckert, K., & Steinberg, L. (2011). Peers increase adolescent risk taking by enhancing activity in the brain's reward circuitry. *Developmental Science, 14*, F1–F10.

Cross, C. P., Copping, L. T., & Campbell, A. (2010). Sex differences in impulsivity: a meta-analysis. *Psychological Bulletin, 137*, 97–130.

Cross, C. P., Cyrenne, D.-L. M., & Brown, G. R. (2013). Sex differences in sensation seeking: a meta-analysis. *Scientific Reports, 3*, 2486.

Dzielska, A., & Kowalewska, A. (2014). Zachowania ryzykowne młodzieży – współczesne podejście do problemu [Risky behavior in adolescence]. *Studia BAS, 2*, 139–168.

Figner, B., & Weber, E. U. (2011). Who takes risks when and why?: determinants of risk taking. *Current Directions in Psychological Science, 20*, 211–216.

Figner, B., Mackinlay, R. J., Wilkening, F., & Weber, E. U. (2009). Affective and deliberative processes in risky choice: age differences in risk taking in the Columbia Card Task. *Journal of Experimental Psychology: Learning, Memory and Cognition, 35*, 709–730.

Fryt, J., Smolen, T., Czernecka, K., La Torre, A., & Szczygieł, M. (2017). Risk, cognitive control and adolescence. Challenging the Dual Systems Model. *Proceedings of the 39th Annual Conference of the Cognitive Science Society,* 2037–2042.

Gullone, E., Moore, S., Moss, S., & Boyd, C. (2000). The Adolescent Risk-Taking Questionnaire: development and psychometric evaluation. *Journal of Adolescent Research, 15*, 231–250.

Hanoch, Y., Johnson, J. G., & Wilke, A. (2006). Domain specificity in experimental measures and participant recruitment. *Psychological Science, 17*, 300–304.

Harden, K. P., & Tucker-Drob, E. M. (2011). Individual differences in the development of sensation seeking and impulsivity during adolescence: further evidence for a dual systems model. *Developmental Psychology, 47*, 739–746.

Harris, C. R., Jenkins, M., & Glaser, D. (2006). Gender differences in risk assessment: why do women take fewer risks than men? *Judgement and Decision Making, 1*, 48–63.

Huang, Y., Wood, S., Berger, D., & Hanoch, Y. (2013). Risky choice in younger versus older adults: affective context matters. *Judgement and Decision Making, 8*, 179–187.

Janssen, T., Larsen, H., Peeters, M., Boendermaker, W. J., Vollebergh, W. A. M., & Wiers, R. W. (2015). Do online assessed self-report and behavioral measures of impulsivity-related constructs predict onset of substance use in adolescents? *Addictive Behaviors Reports, 1*, 12–18.

Jaworowska, A. (2011). *Kwestionariusz Impulsywności IVE – impulsywność, skłonność do ryzyka, empatia: polska normalizacja* [IVE impulsivity questionnaire – impulsivity, risk-taking and empathy: polish normalization]. Warszawa: Pracownia Testów Psychologicznych Polskiego Towarzystwa Psychologicznego.

Josef, A. K., Richter, D., Samanez-Larkin, G. R., Wagner, G. G., Hertwig, R., & Mata, R. (2016). Stability and change in risk-taking propensity across the adult life span. *Journal of Personality and Social Psychology, 111*, 430–450.

Lejuez, C. W., Read, J. P., Kahler, C. W., Richards, J. B., Ramsey, S. E., Stuart, G. L., Strong, D. R., & Brown, R. A. (2002). Evaluation of a behavioral measure of risk taking: The Balloon Analogue Risk Task (BART). *Journal of Experimental Psychology: Applied, 8*, 75–84.

Lönnqvist, J.-A., Verkasalo, M., Walkowitz, G., & Wichardt, P. C. (2014). Measuring individual risk attitudes in the lab: task or ask? An empirical comparison. *Journal of Economic Behavior and Organization, 119,* 254–266.

Mahalik, J. R., Coley, R. L., Lombardi, C. M., Lynch, A. D., Markowitz, A., & Jaffee, S. R. (2013). Changes in health risk behaviors for males and females from early adolescence through early adulthood. *Health Psychology, 32*, 685–694.

Mamerow, L., Frey, R., & Mata, R. (2016). Risk taking across the life span: a comparison of self-report

and behavioral measures of risk taking. *Psychology and Aging, 31*, 711–723.

Markiewicz, Ł., & Kubińska, E. (2015). Information use differences in hot and cold risk processing: when does information about probability count in the Columbia Card Task? *Frontiers in Psychology, 6*, 1727.

Ostaszewski, K., Bobrowski, K., Borucka, A., Okulicz-Kozaryn, K., Pisarska, A., Raduj, J., & Biechowska, D. (2013). *Monitorowanie zachowań ryzykownych i problemów zdrowia psychicznego młodzieży. Badania mokotowskie 2012* [Monitoring risk-taking tendencies and mental health problem in adolescents. The Mokotów study 2012]. Warszawa: Instytut Psychiatrii i Neurologii.

Rolison, J. J., & Pachur, T. (2016). How well do we know our inner daredevil? probing the relationship between self-report and behavioral measures of risk taking. *Journal of Behavioral Decision Making, 30*, 647–657.

Shulman, E. P., & Cauffman, E. (2014). Deciding in the dark: age differences in intuitive risk judgment. *Developmental Psychology, 50*, 167–177.

Steinberg, L. (2008). A social neuroscience perspective on adolescent risk-taking. *Developmental Review, 28*, 78–106.

Steinberg, L., Albert, D., Cauffman, E., Banich, M., Graham, S., & Woolard, J. (2008). Age differences in sensation seeking and impulsivity as indexed by behavior and self-report: evidence for a dual systems model. *Developmental Psychology, 44*, 1764–1778.

Tymula, A., Rosenberg Belmaker, L. A., Ruderman, L., Glimcher, P. W., & Levy, I. (2013). Like cognitive function, decision making across the life span shows profound age-related changes. *Proceedings of the National Academy of Sciences of the United States of America, 110*, 17143–17148.

Van Leijenhorst, L., Westenberg, P. M., & Crone, E. A. (2008). A developmental study of risky decisions on the cake gambling task: age and gender analyses of probability estimation and reward evaluation. *Developmental Neuropsychology, 33*, 179–196.

Willoughby, T., Good, M., Adachi, P. J. C., & Tavernier, R. (2011). Examining the link between adolescent brain development and risk taking from a social-developmental perspective. *Brain and Cognition, 83*, 315–323.

Zuckerman, M., & Kuhlman, D. M. (2000). Personality and risk-taking: common biosocial factors. *Journal of Personality, 68*, 999–1029.