Increased risk taking, not loss tolerance, drives adolescents' propensity to gamble more under peer observation

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Abstract: Relative to adults, adolescents make more welfare-decreasing decisions, especially in the presence of peers. The consequences of these decisions result in substantial individual and societal losses in terms of lives lost, injury, hospitalization costs, and foregone opportunities. In this paper, we used laboratory experiments with younger (12-17 years old) and older (18-24 years old) adolescents to identify which economic preference is affected by peer observation in adolescence — risk attitudes in gains, risk attitudes in losses, and/or loss aversion. We found that while observed by peers, older adolescents become more risk-tolerant both in gains and in losses but more loss averse. We discuss potential mechanisms driving the result and its implications for policy.

Keywords: decision-making; adolescence; observation; loss aversion; risk attitudes

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1. Introduction

Being observed by others has been shown to change people's behavior in a wide range of settings. We know that when observed people tend to give more to their opponents in standard economic games (e.g. Charness, Rigotti, & Rustichini, 2007) and generally engage in more prosocial behavior (Hoffman et al. 1994; Kurzban, DeScioli, and O'Brien 2007). People are also more likely to adhere to less articulated social norms such as ambiguity aversion when observed (Baltussen, van den Assem, and van Dolder 2016; Curley, Yates, and Abrams 1986; Trautmann, Vieider, and Wakker 2008). In the workplace, people work harder and put in more effort when observed by others (Guryan, Kroft, and Notowidigdo 2009; Mas and Moretti 2009). In all of these settings, observation is helpful. It either helps to enforce the norm, sustain cooperation, or makes people more altruistic and productive. Unfortunately, at a certain age observation by peers seems to have a dark side as well.

Statistics, research, and common wisdom all suggest that the presence of peers can have detrimental effect on people at a specific time of our lives — adolescence. We know that adolescents engage in a range of activities that adults avoid at an enormous cost to them and the society as a whole (Jefferey Arnett 1992; Gullone and Moore 2000; Spear 2010). Although they are healthier, stronger and have better reasoning capabilities than younger children, adolescents' morbidity and mortality rates are twice to three times higher (Australian Bureau of Statistics, 2020; Center for Disease Control and Prevention, 2017 & 2018). Unintentional injury, mostly attributed to own wrong decisions, is the biggest cause of death and hospitalization among adolescents in the developed countries (Center for Disease Control and Prevention, 2017) resulting in tens of millions of dollars in medical costs each year (Florence et al., 2015; Mitchell et al., 2018; Polinder et al. 2010). Adolescents have the highest rates of sexually transmitted diseases (Gittes and Irwin 1993), highest frequency of criminal behaviors (Jeffrey Arnett 1996) and are known to drive more recklessly than adults (Jonah 1986).

These welfare-decreasing behaviors seem to be exacerbated in the presence of peers. Adolescents typically exhibit more risky and delinquent behaviors in peer groups, whereas adults more frequently do so alone (Dustin Albert and Steinberg 2011). Relative to older age groups, adolescents commit more crimes in groups (Zimring 1998), and have more car accidents when driving with passengers (Chen 2000). In the past 15 years, these effects have been replicated in laboratory studies by developmental psychologists. An influential paper by Gardner & Steinberg (2005) presented evidence that in a driving simulator game, adolescents are more likely to crash when observed by peers. Other studies in psychology have shown that when observed or merely led to believe that they

are observed by peers, adolescents gamble more (Smith et al., 2014), are less likely to wait for larger rewards (Silva et al., 2016; Weigard et al., 2014), and have diminished cognitive control to positive social cues (Breiner et al. 2018). Animal studies revealed that the effect is not limited only to human adolescents and for example adolescent rodents drink more alcohol when their peers are present (Logue et al., 2014). Research using functional magnetic resonance imaging (fMRI) revealed that in adolescence (but not in adulthood) the mere presence of a peer increases activity in the reward-processing areas such as orbitofrontal cortex and ventral striatum (Albert et al., 2013; Weigard et al., 2014) and evokes strong physiological arousal (Somerville 2013; Somerville et al. 2013). Clearly adolescence is a period in our lives when our behavior and biology change in the presence of peers in ways that do not happen later in life.

Existing studies in developmental psychology have also helped us to begin to understand how to minimize these unwanted behavioral effects caused by peer presence. For example, the presence of an adult mitigates the negative effect of peers' presence on driving behavior (Silva et al., 2016) and working memory training decreases the laboratory risk taking in the presence of peers (Rosenbaum et al., 2017). Behavioral economists can contribute to alleviating the burden of the welfare-decreasing behaviors in adolescence by providing a deeper understanding of these behaviors in the framework of the economic model of choice. Observational data and studies in developmental psychology often make this impossible because they do not allow for separate identification of different economic preferences. It is therefore impossible to tell whether the observed effects are driven by a change in risk preferences, time preferences, loss aversion, subjective probability distortions, mistakes, and/or randomness in choice. Two recent laboratory studies began to fill in this gap in knowledge. Tymula (2019) used standard tasks from experimental economics to show that adolescents' risk attitudes and ambiguity attitudes in the domain of gains are not affected under peer observation. Instead, adolescents become more impatient when observed by a peer. Another study by Tymula & Whitehair (2018) found that in the domain of gains older adolescents (university students) are less likely to choose gambles with unknown odds of winning over a sure amount when observed by a peer but observation does not affect the likelihood of choosing gambles with known odds of winning.

The goal of this paper is to provide an economic understanding of the effect of peer observation on adolescents' behavior specifically in the much less explored domain of losses. Even though the research on how the presence of peers affects adolescents' decisions is motivated by the negative outcomes of these decisions, the existing laboratory studies predominantly focused only on the gain

domain or used tasks that make it impossible to separately identify risk preference and loss aversion. In the most closely related study, Smith et al. (2014) asked adolescent participants to make hypothetical choices between passing on or playing a gain-loss gamble with clearly stated probabilities. Participants who were led to believe that they were being watched by another adolescent were more likely to take the risk. Unfortunately, it is not clear whether this is because they become less loss averse or because they become more risk-taking as there were no lottery choices purely in the gain and purely in the loss domain that would allow us to separate risk preferences from loss aversion, a crucial difference for theory as well as from the policy intervention perspective.

To fill in this gap, we designed an experiment that allows us to separately estimate each participant's loss aversion and risk attitudes in gains and losses in private and when observed by a peer sitting next to them. Our experimental design permits for both within-subject and between-subject approach to hypothesis testing, thus allowing us to access the advantages of both methods (Charness et al. 2012) within one experiment and the same sample. Given previously documented associations between state anxiety and performing tasks in public (Horwitz and McCaffrey 2008) and associations between anxiety and risk tolerance (Peng et al., 2014; Raghunathan & Pham, 1999), we investigated state anxiety as a potential mediator of the behavioral change. Consistent with Smith et al. (2014) we found that older adolescents (18-24 years old) are more likely to accept gain-loss gambles when observed. This effect is driven by an increased risk tolerance in both gain and loss domains, rather than reduced loss aversion. The effect is not mediated by state anxiety which is not affected by the perspective of being observed in our study. For younger adolescents (12-17 years old), neither their risk attitudes nor their loss aversion is affected by peer observation. We discuss the potential reasons for this age dichotomy in susceptibility to observation in the results and discussion sections of the paper.

2. Materials and Methods

146 (59 male) adolescents participated in two studies (mean age 18.175 with standard deviation 3.208, see age histogram in Figure 1). Sixty-two (28 male) 18 to 24 years old participants were recruited from the University of Sydney student database using ORSEE (Greiner 2004) and participated in sessions that took place in March 2018. Eighty-four (31 male) 12 to 17 years old participants (all high school students) were recruited using announcements placed on Facebook and Instagram and participated in sessions that took place in May 2018. Therefore, younger and older participants took part in separate sessions and were never mixed together in one session. Each

session lasted approximately 60 minutes. All participants and, in the case of minors, also caregivers gave informed consent and the study was approved by the Human Research Ethics Committee at the University of Sydney. Before commencing the task, all participants read instructions (available in Appendix A).

2.1 *Experimental Task*

We used the same experimental task with younger and older participants to address the need for new studies that use the same experimental tasks with participants from a wide age range (Hartley & Somerville, 2015). To assess participants' risk attitudes and loss aversion we asked them 120 questions where they could choose between a guaranteed amount of money and a lottery that offered a larger or smaller amount, each with 50% probability. Participants could also indicate indifference between the options. If they chose indifferent, the program would randomly allocate them to either the fixed option or the lottery with equal chance. After indicating their choice, participants moved to the next trial without receiving any feedback. Participants knew that one of their choices will be randomly selected for payment at the end of the experiment. They were not allowed to skip trials. All questions were presented on a computer screen. The questions were presented in an order independently randomized for each participant. Figure 2 illustrates examples of how the questions were presented.

The specific questions asked in the study were a subset of questions asked in Sokol-Hessner et al. (2013). To assess risk attitudes in the gain domain, 30 of the 120 questions (gain trials) featured a choice between receiving a fixed amount (that varied between $1 and $13 from trial to trial) and a lottery that offered a greater sum (that varied between $3 and $28 from trial to trial) or nothing. To assess risk attitude over the loss domain, 30 of the 120 questions (loss trials) featured a choice between losing a fixed amount and a lottery that offered a larger loss or nothing. In loss trials, the amounts were the same as in the gain trials but multiplied by -1. The remaining 60 questions (mixed trials) allowed us to assess participant's loss aversion by presenting a choice between a guaranteed $0 and a mixed lottery offering a 50% chance of a gain (that varied between $2 and $12) and a 50% of a loss (that varied between -$0.5 and -$24).

2.2 *Observation Implementation*

Upon arrival, each participant was seated at a computer station and randomly allocated to be either a Choice-Maker or an Observer. Choice-Makers completed the experimental task twice; once in private (*private condition*) and once under observation from an Observer (*observed condition*).

Observers completed the task only once in private. The order of the private and observed conditions was randomized for each session. The timeline of the experiment is summarized in Figure 3A.

The experimental design allowed the use of a within-participant analysis of the effect of observation on decision-making by comparing the same Choice-Makers' decisions in private and under observation. The same effect could also be investigated through a between-participant comparison of the choices made only in stage 2 by Choice-Makers in Order 1 (observed) and Choice-Makers in Order 2 (private).

Sessions were conducted at the University of Sydney School of Economics experimental laboratory, which consists of 32 computer stations, separated by tall partition walls on the sides and front. Figure 3B presents the seating map for the private and observed conditions. To enhance privacy during the private condition, participants were randomly allocated seats with empty horizontally adjacent cubicle(s).

For the observed condition, each Observer moved to sit to the right of a Choice-Maker with whom they had been randomly partnered. Choice-Makers and Observers were not allowed to verbally communicate. The physical distance between the Observer and the Choice-Maker was controlled by strapping their chairs together. To incentivize Observers to pay attention to the Decision-Maker's choices, we told them that they will be asked to recall three randomly selected choices by the Choice-Maker and will receive $1 for each correct recollection (Stage 4 – Test in Figure 3A). Observers could not write down notes whilst observing. Payment opportunities were equalized by asking Choice-Makers to guess three of the Observer's choices. Participants were told that decisions during the observed condition would only impact the Choice-Maker's payment and that the Observer would not be informed of the Choice-Maker's final payment.

To measure whether participant's emotional state mediated the influence of observation on their decision-making, participants completed a state anxiety measure (Marteau & Bekker, 1992, available in Appendix B) twice during the session: before commencing the private condition, and before starting the observed condition.

After the decision-making task was completed, all participants filled out a questionnaire about their demographics, perceptions of their partner and themselves, and the overall aims of the experiment (see full questionnaire in Appendix B).

2.3 *Payment*

Participants' final compensation consisted of three parts: $35 they received at the beginning of the experiment, the outcome from one randomly selected decision that they had made during the experiment, and outcome from the test stage where each participant was asked to recall or guess their partner's choice for three randomly selected decision scenarios. If in the one randomly selected decision they chose the fixed option, they received (or lost, in the case of a negative sum) that amount. If they chose the lottery, they rolled a 6-sided die to determine the lottery's outcome. Participants rolled the die themselves to avoid potential distrust in the payment procedure. If the dice came up as a 1, 2 or 3, the participant received the payoff presented on top of the lottery. If the dice came up as a 4, 5 or 6, the participant received the payoff presented on the bottom of the lottery, meaning that they had 50% chance of either outcome. All payments were made in cash.

2.4 *Econometric approach*

We used structural model-based analysis to estimate the participants' preferences because this approach allows us to estimate loss aversion separately from risk attitudes in gains and losses. To check the validity of our results given the concerns over the reliability of the estimates from such approach (Apesteguia and Ballester 2018), in parallel for risk preferences we conducted the same analysis using ordinal logistic regressions and paired t-tests with a simple, descriptive measure of risk tolerance. We find the results of this analysis to be qualitatively in agreement with our structural estimation approach. To calculate this simple descriptive index of risk attitude, for each individual we calculate the proportion of risky choices in each trial type. We counted indifference as a half risky choice. Although we calculated this index for mixed trials as well, this is not a proper measure of loss aversion.

We modelled each option's utility using a power utility function, where the utility of a given outcome, x, is defined as:

$$U(x) = \begin{cases} x^{1+a^g}, & when\ x \geq 0 \\ -\lambda(-x)^{1-a^l}, & when\ x < 0 \end{cases}$$

where x is the lottery outcome, $a^g$is the individual's risk tolerance in gains, a^l is the individual's risk tolerance in losses, and λ is the individual's loss attitude parameter. $a > 0 (< 0)$indicates risk seeking (aversion). $a = 0$ for a risk neutral chooser. $\lambda > 1$ indicates loss aversion.

To account for stochasticity in choice, we modelled the decisions as susceptible to an error $\varepsilon \sim (0, \sigma^2)$ and assumed that participants chose the risky lottery when $EU_R - EU_s + \varepsilon > 0$, where EU_R and EU_s

denote the expected utilities of the risky and safe options respectively. We related this latent index to observed choice by a logistic function. The probability of choosing the risky lottery can then be expressed as:

$$\Pr(ChoseRisky) = \frac{1}{1 + \exp\left(-\frac{EU_R - EU_s}{\sigma}\right)}$$

In all of the analysis, we clustered standard errors on the level of the participant. To investigate the effect of observation on preferences, we replaced the utility functions as follows:

$$1 + a^g = 1 + a_0^g + a_1^g \times observed + \sum_i a_i^g \times Z_i$$

$$1 - a^l = 1 - a_0^l - a_1^l \times observed - \sum_i a_i^l \times Z_i$$

$$\lambda = \lambda_0 + \lambda_1 \times observed + \sum_i \lambda_i \times Z_i$$

where Z_i is a set of control variables and $observed$ is an indicator variable of whether the participant is observed (=1) or not (=0).

3. Results

3.1 *Preliminary overall results*

Our participants were more likely to choose the lottery if it offered a higher expected profit and less often, the more attractive the safe option was (Table C1) and only 9 participants out of 164 (7 younger adolescents and 2 older adolescents) incorrectly answered more than 1 comprehension question (see Figure 4 for the distribution of comprehension scores), indicating that they understood the task.

Choice-Makers subjectively felt observed, with 93.15% reporting that their partner had paid attention to at least half of their choices (see Figure 5A). The perceived attention is not significantly different between younger and older adolescents ($X^2 = 1.6863, p = 0.640$). An objective way to test whether Observers indeed paid attention to Choice-Maker's decisions is to check whether they scored higher when recalling their partner's choices (that they have seen) than Choice-Makers who did not have a chance to see their partner's choices and had to guess. Overall, Observers on average scored 2.274

out of 3 when asked to recall their partner's choices on 3 randomly selected questions, which is higher than the Choice-Makers average score of 2 (p=0.0407) from guessing their partner's choices (see Figure 5B). This difference was more prominent for older adolescents (2.355 versus 1.936, p=0.0613) than for younger adolescents (2.214 versus 2.048, p=0.3159) although on average the recollection scores between the two age groups were not statistically different (2.131 for younger and 2.145 for older adolescents, p=0.9190). Overall, evidence is consistent with the Observers paying attention to the Choice-Maker's decisions and Choice-Makers feeling observed.

Pulling together data of the Choice-Makers of all ages, both in private and under observation, the estimated model parameters on the sample level are a_g = -0.1649 (SE=0.0464) indicating risk aversion in gains, a_l = -0.2374 (SE = 0.0329) indicating risk aversion in losses, λ = 1.2822 (SE=0.1722) indicating low levels of loss aversion, and noise 2.5973 (SE = 0.4232). These are in agreement with our analysis of risk preferences based on simple counts.

3.2 *Effect of observation*

3.2.1 Effect of observation in older adolescents (18-24 years old)

Using simple proportions of lottery choices, we found that when observed compared to when in private, older adolescents select lotteries more often. This effect is significant in gain trials (0.567 vs. 0.292, p<0.001), in loss trials (0.206 vs. 0.106, p<0.001), and in mixed trials (0.409 vs. 0.207, p<0.001) (see Figure 6). Ordinal logit regressions presented in Table C1 (models 1-3) are in line with these paired t-test results.

Importantly though, the finding that participants choose lotteries more often in the mixed lotteries is not equivalent to saying that they are more loss tolerant when observed. To isolate loss aversion, we switch to structural estimation of preferences. As shown in Table 1 (models 1-4), we reconfirm that 18- to 24-year-olds are more risk tolerant in gains and in losses and additionally find out that they are more loss averse under observation. The size of the effect is substantial. Under observation, for 18- to 24-year-olds, the CRRA utility curvature parameter increases by 0.5137 in gains, by 0.1612 in losses, and loss aversion increases by 0.3542. The effects are present both with and without age, gender, and wealth controls separately.

3.2.2 Effect of observation in younger adolescents (12-17 years old)

For younger adolescents, we did not see a significant effect of observation on participants' choices. Using simple proportions of lottery choices, we found that younger adolescents select lotteries slightly more in private compared to when observed. However, this difference is not significant in any of the trial types (see Figure 6).[1] Ordinal logit regressions presented in Table C1 (models 4-6) are in line with this result.

To isolate loss aversion and risk attitude in losses, we then switch to the structural estimation of preferences. In Table 1 (models 5-8), we reconfirm that 12- to 17-year-olds do not change their risk attitude in gains and losses and loss aversion under observation.

To assess whether the effect of observation is becoming gradually stronger as adolescents age or whether instead there is a sharp difference in how observation affects our younger and older adolescent participants, in Figure 7 we plotted the proportions of risky choices in observed (dark gray) and private (light gray) by age. Our data is suggestive that the latter is true. An increasing effect of observation with age would manifest itself with gradually increasing difference between the dark gray and light gray bars and we do not see such pattern in our data. Instead, we find that older adolescents of all ages always make more risky choices (in gain, loss and mixed trials) when observed, while we do not see any consistent and increasing effect of observation for younger adolescents.

3.2.3 Anxiety and behavioral changes under observation

We next investigated whether state anxiety, a measure that was previously associated with risk taking behaviors (Peng et al. 2014; Raghunathan and Pham 1999) and increases when we anticipate to perform tasks in public (Brooks 2014), mediates the effects of observation on preferences. Before participants commenced the decision-making task, we asked them to fill in a short questionnaire that measures state anxiety, i.e. anxiety felt in the current moment, in 6 different dimensions: calmness, tense, upset, relaxed, content and worried (Marteau and Bekker 1992) . Each participant filled in this questionnaire twice: once after being told that they are about to start decision-making task in private but before the commencement of task, and once after being told that they are about to start decision-making task under observation but before the commencement of task. We can therefore check if the

[1] In gain trials, the difference between the proportion of lottery choices when observed and that in private is -0.0625 ($p = 0.243$), in loss trials the difference is -0.029 ($p = 0.234$), and in mixed trials the difference is -0.032 ($p = 0.539$).

prospect of being observed increases individuals' state anxiety and whether the magnitude of this increase is related to a change in preferences.

As shown in Table 2, participants' anxiety scores in five dimensions — calmness, tense, relaxed, content and worried — are all highly correlated with one another. We therefore summed them up to form one anxiety score: *anxiety = tense + worried – calmness – relaxed – content.* How *upset* participants were, is not systematically correlated with the other dimension of anxiety, so we investigated this score separately.

Our conjecture that the prospect of being observed increases state anxiety turns out to be untrue. The *anxiety* and *upset* scores are not different when participants have just learned that they will be performing the decision-making task under observation and when they have just learned that they will be deciding in private. This holds for both older and younger adolescents. For older adolescents *anxiety* difference is -0.613 which is not statistically different from 0 ($p = 0.123$), and *upset* difference is 0.097 which also is not statistically different from 0 ($p = 0.448$). For younger adolescents *anxiety* (*upset*) difference is -0.214 (-0.024) which is also not statistically different from 0. Generally, younger adolescents have higher anxiety scores (-5.202) than older adolescents (-7.210), and this difference is significant from 0 ($p = 0.004$).

Approximately half of our participants first completed the task under observation and then in private and the other half in the opposite order. It is therefore possible that if anxiety levels change over the course of the experiment, for example participants are more anxious in the beginning of the study than towards its end, this can obscure the effect that the prospect of observation has on state anxiety. To verify whether this is the case, we regressed individual *anxiety* and *upset* scores on whether the participant is about to start the task under observation and on whether this is the first or the second time they are completing the anxiety questionnaire. As shown in Table 3, the state anxiety scores are neither affected by the prospect of being observed nor by whether participants were completing the questionnaire for the first or second time.[2]

As expected, given that prospect of observation does not increase anxiety, changes in anxiety scores do not moderate the strength of the effect of observation on risk preferences. To establish this, for each individual we created a descriptive measure of a change in their risk preference under observation by taking the difference between the proportion of times the participant selected risky

[2] The results remain the same when we redo the analysis only for the group that was affected by observation, that is 18- to 24-year-olds.

lottery under observation and in private. We then regressed this variable on a change in individual anxiety scores given by: $anxiety(upset)_{diff}$ = anxiety(upset) before observation – anxiety(upset) before private. Table 4 shows that the change in risk preference cannot be explained by the change in anxiety or upset measurements neither in older nor in younger adolescents. Since the change in the frequency of risky choices under observation and in private does not relate to changes in state anxiety scores in any of the trial types (gain, loss, and mixed), we can indirectly conclude that changes in the anxiety scores cannot explain changes in loss aversion under observation as well.

3.2.4 Other factors and behavioral changes under observation

The propensity to change behavior in a particular way under observation could be mediated by other individual characteristics of the Choice-Makers as well as the characteristics of their Observers. We investigated some obvious candidates including familiarity with the observer, the likelihood to interact with the observer in the future, perceived observation intensity captured by the degree to which the Choice-Makers believed that the observer is paying attention to their choices, and self-assessed wealth. To reveal any other significant differences between the two age groups, we compared them on all questionnaire variables (Table 5) with a plan to then test whether the variables on which the two age groups significantly differ mediate the effect of observation. We address each of these variables in turn.

To assess familiarity between Choice-Makers and Observers, in the questionnaire, we asked participants if they had known and if they had seen their partner before they came to the experiment. To construct a measure of familiarity, we summed the responses to these two questions together. Our data reveal that more 12- to 17-year-old participants knew or met one another before (Table 5). It could be possible then that the effect of observation is stronger among strangers and should be attributed to the level of familiarity between Choice-Makers and Observers. We do not find convincing evidence that this is the case (Table C2 and Table 6). In the ordinal logit regressions, the coefficient on the variable that interacts familiarity with observed is never significant (Table C2) and controlling for it does not eliminate the significance of the observed condition on decisions (Table C2) and preferences (Table 6).[3] Structurally estimated model (1) in Table 6 suggests that those who were familiar were more prone to change their behavior under observation in gain trials but this finding does not replicate in the regression analysis (Table C2). The effect of observation could also be moderated by the participants' expected future interactions with their partner which we elicited by

[3] For a similar result, see Tymula (2019).

asking how likely Choice-Makers expect to interact with their Observers after the experiment. In our ordinal logit regressions but not in the structural analysis, in gain and loss trials we find a weak effect of the decreased effect of observation among those who expect to interact with their partners in the future. It however does not eliminate the general effect of observation on decision-making which remains highly significant (Table C2). Overall the analysis in Table 6 and Table C2 leads us to conclude that expected future interactions with partners do not mediate the effect of observation in our study. We note though that the effect of observation on risk attitudes in losses and on loss aversion is no longer significant in the structural model after we control for expected future interactions (Table 6, model (2)).

Another obvious candidate that may mediate the effect of observation is its intensity. In the questionnaire, we asked each Choice-Maker what proportion of their choices they think their Observer paid attention to. This perceived attention does not differ between younger and older adolescents (Table 5). Counterintuitively, the ordinal regressions show that in all types of trials Choice-Makers who subjectively felt to be observed more intensively are slightly less affected by observation (Table C2). In the structural estimation, we find the same effect in gain trials only (Table 6). We, therefore, consistently find that the Choice-Makers who reported that their Observers paid more attention during observation display lower increases in risk tolerance under observation in the gain domain. However, attention of the observer does not fully explain the effects of observation in our study as it does not remove the effect of observation and decisions in all types of trials (Table C2) and on risk attitudes in gains (Table 6).

Individual level of wealth has been shown to influence the degree of risk-taking in many studies of risky behavior. We investigated whether it also mediates the effect of observation on risky behavior. Younger and older adolescents did not report different levels of their own wealth but their assessment of their partners' wealth is higher for younger adolescents. Moreover, while younger adolescents perceive themselves to be slightly poorer than their partners (3.429 vs 3.691, p=0.078), older adolescents perceived themselves to be slightly, although insignificantly, richer than their partners (3.258 vs 3.129, p=0.380). To investigate whether these differences in the relative perception of own versus partner's wealth modulate the effect of observation on choices, we constructed a new variable, *wealth difference,* equal to the difference between own self-reported wealth and the perception of partner's wealth. In Table 6 model (4) and Table C2, we show that wealth difference neither mediates nor eliminates the effect of observation on behavior and preferences.

When comparing younger and older adolescents on all questionnaire variables (Table 5), we find that an additional difference between the age groups is that more 12- to 17-year-olds reported to be less focused when observed by a partner. At the same time, somewhat contradictory, they also reported being more consistent in their decisions under observation. To assess whether indeed the consistency in the choice is affected by observation, we checked whether the size of the noise parameter in our structural model is influenced by observation. In Table 6 model (5) we show that the estimated level of noise in teenagers' decisions is not affected by observation.[4]

Finally, we note that more 12- to 17-year-olds than 18- to 24-year-olds reported that they became more risk-tolerant under observation (the difference is on the border of significance with p=0.011). This self-report is in contradiction to the results based on the actual choice data highlighting the importance of collecting incentive-compatible choice data in addition to questionnaires.

3.3 *Within-subject vs. between-subject*

So far, our analysis was based on within-subject comparisons of choices made by the same participants under observation and in private. Our design allows us to investigate, whether similar effects would also be observed using a between-subject approach. Half of the Choice-Makers completed the decision-making task first in the private condition and the other half under observation (Figure 3, stage 2). To investigate the effect of observation between-subjects, we focused only on this first set of decisions made in stage 2 and compared the choices made by Choice-Makers in order 1 (36 participants, 19 12- to 17-year-olds) who made these decisions while being observed with those made by Choice-Makers in order 2 (37 participants, 23 12- to 17-year-olds) who made these decisions in private.

To make the results directly and easily comparable, we combined data from Choice-Makers in both studies and captured the age-related difference in their behavior using indicator (12-17 y. o.) and interaction variables (12-17 y.o. X observed) as justified by earlier analysis (Figure 7). We then run our analysis using the within-subject approach by using all of the data and comparing the same individuals' behavior when they are in private and when they are observed (model (1) in Table 7 and Table C3). As a second step, we run the between-subject analysis by using only data from stage 2

[4] This also rules out the possibility that participants' increase in risky choices under observation could be attributed to increase in choice stochasticity rather than to risk tolerance.

and comparing preferences and decisions of individuals who were in private to different individuals who were observed at that stage (model (2) in Table 7 and Table C4).

Using both structural estimation (Table 7) and ordinal logit regressions (Table C3 and Table C4) we find that results across the two methods are consistent. We find that participants who are observed take more risks in both gains and losses and are more loss averse than participants who make their decisions in private. Comparing the between- and within-subject approach, we discover that all of the estimated coefficients are of the same sign, but generally the coefficients are bigger and the results are more significant in the between-subject analysis. The especially stark difference holds for the estimated effects of observation on risk attitudes in losses and loss aversion, which are respectively 2.6 and 3.3 times larger using the between subject approach. The effect of observation on risk attitudes in gains is 11.4% higher in between-subject than in within-subject analysis. This comparison highlights that when we want to extrapolate from the laboratory findings to real life, it is important to consider whether the problem we are interested in resembles more a within- or between-subject design. Our comparison of the two methods suggests that in environments where adolescents repeatedly face the same choices, sometimes in private and sometimes while observed, the between-subject approach would be overestimating the effect of observation on decisions.

4. Discussion

Children differ from adults. A better economic understanding of children's and adolescent's behavior is important for economic, scientific, and societal reasons (Brocas & Carillo, 2020; Sutter et al., 2019) and will have an impact on how societies are organized. To give an example, recent discoveries in developmental psychology about the evolution of decision-making from childhood to adolescence have already had a substantial impact on the jurisdiction in the US (Steinberg 2017). Moreover, the decisions that adolescents make on their own, independent of their parents, have important consequences for future economics outcomes. For instance, studies show that misbehaviour during childhood and adolescence has long term consequences on earnings (Heckman et al., 2006; Segal, 2013). Economists only recently started to more frequently expand the study of economic preferences to include children. Sometimes, the findings of these studies turn out to be in contrast to common wisdom (e.g. Tymula, 2019; Tymula et al., 2012) stressing the importance of the scientific research on the preferences of different age groups. All of this new research is now beginning to impact how we think about children and adolescents as economic agents who systematically make different decisions than adults.

In this paper, using a laboratory experiment, we investigated how being observed by a peer affects adolescents' risky decision making in the monetary gain and loss domains. We focused on adolescents from 12 to 24 years old. Over this long period of transition from childhood to adolescence, we have more and more opportunities to make important and impactful decisions. Over this period, we also experience substantial biological changes that make us more aware of our social surroundings and more susceptible to changing our behavior in the presence of peers.

Participants in our study repeatedly chose between a fixed amount of money and a lottery either in private or in the presence of an adolescent observer. We found that older adolescents (18-24 years old) choose the risky option more often when they are observed by a peer compared to when they are in private. Unlike in previous studies that investigated the effects of peer observation on choice, we can distinguish whether the change in behavior is due to changes in risk preferences or changes in attitudes towards losses (loss aversion). We found that the increase in risky lottery choices is driven by an increased risk tolerance in the gain and loss domains. In the gain domain, risk tolerance, defined by the CRRA utility curvature, increases by 0.459 - 0.513. In losses, under observation, risk tolerance increases by 0.129-0.161 an approximately four times smaller change in risk attitude under losses than under gains. If one wanted to explain the increased real life "risk taking" in adolescence in the presence of peers, such as an increase in careless driving, by changes in loss aversion, it would have to be that adolescents become less loss averse when observed but our study participants do not become more loss tolerant when observed. On the contrary, once we accounted for age-related differences in preferences, under observation loss aversion increases by 0.235-0.354 suggesting that desensitization towards losses relative to gains is unlikely to explain the adolescent real-life "risk-taking" behaviors in the presence of peers.[5]

We reinforce that these changes in risk tolerance manifest themselves even though our treatment of observation is completely payoff irrelevant. Decision-makers' decisions do not influence the payoffs of the observers and the observers cannot explicitly affect decision-makers' payoffs with their actions (other than through mere observation). We decided to study this most basic type of observation as a starting point as it is usually present in most environments where observation occurs, also those where payoff interdependencies between observers and those being observed exist. Our approach allows us to identify the pure effect of observation that is not related to payoff interdependencies which could be added to our framework in future studies. Trautmann & Vieider

[5] The average estimate of loss aversion across both treatments in our sample is anyway low (λ=1.282) in line with recent literature (Gal and Rucker 2018).

(2011) provided a review and classification of observation types in an economic context that can be useful in thinking of the extensions of our approach and what our results mean for these other types of observation.

We demonstrate that our results are the same whether we use between-subject or within-subject analysis. We designed our experiment in a way that allows to compare the same participants when they make decisions in private and under observation as well as compare two different groups of individuals: a group that is under observation with a group that is making decisions in private. With both approaches, our conclusions are qualitatively the same. However, the strength of the result is remarkably different, with the between-subject analysis yielding much stronger results. The fact that our results are qualitatively the same but their strength remarkably different under the two design approaches means that the choice of the between-subject versus within-subject method is important. Both of the methods have their pros and cons (Charness et al. 2012) and our paper by providing an example how to combine the within-subject and between-subject approach in one experiment illustrates that it is possible to access the advantages of both methods in one experiment.

Our finding that in gains older adolescents become more risk-tolerant under observation is in contrast to the results in our previous studies that used the same experimental design to implement observation. In Tymula & Whitehair (2018), we recruited 310 volunteers (mean age 22.28, standard deviation 3.95) to test whether their attitudes towards known risks (risk attitude) and unknown risks (ambiguity attitude) in the gain domain change under observation. We found that participants become more ambiguity averse when observed and their risk attitudes are not affected by observation. In Tymula (2019), we recruited 186 adolescents (12-24 years old, mean age 18.59, standard deviation 3.26) and found that under observation they become more impatient and more inconsistent but their risk attitudes in the gain domain do not change. The experimental design in these three papers is almost identical with the only modification in the decision scenarios that participants face. Otherwise, the structure of the experiment, recruitment, and the implementation of observation are all the same. However, in these previous studies participants faced decision scenarios with consequences always in the gain domain while the current study additionally involves negative monetary outcomes. It is, therefore, possible that the presence of negative payoffs changed participants' perception of rewards, perhaps by changing the reference point, which resulted in different responses to treatment even in the gain domain. While this explanation is only speculative, it is worthwhile to note that previous studies in developmental psychology that concluded that adolescents become more risk-tolerant under observation, often included scenarios that can result

both in gains and losses, such as in driving games where participants can either gain points or lose them (Gardner and Steinberg 2005), or hypothetical gain-loss gambles (Smith, Chein, and Steinberg 2014).

Another notable finding in our data is the difference in results for younger adolescents (12-17 years old and attending high school) and older adolescents (18-24 years old and attending university). We considered some not age-related possible explanations for this phenomenon by investigating whether the control variables on which these two groups differ moderate the effect instead of age. None of these control variables can account for this dichotomy in our results. In the end, we cannot definitively conclude whether it is the chronological age, graduating from high school to university, recruitment method or something else not captured in our study that makes our older adolescents' response to observation so different from their younger counterparts.

Given how upsetting some of the statistics on adolescent decision-making are and the amount of the policy effort that specifically addresses behavior in adolescence, we still have relatively little economic understanding of why this group so often ends up in trouble. Among other things, to protect young people from their own choices, governments employ legal age limits for gambling, voting, driving, use of alcohol and tobacco. Many countries have restrictions for minors on transporting other teen passengers during initial months of licensing and required hours of adult supervision. Billions of dollars are spent each year on informational and educational campaigns aimed at adolescents. There have been attempts to mix as well as to separate high-risk and low-risk students at schools. All these interventions are supposed to improve adolescents' welfare but the findings on their effectiveness are mixed. Part of the reason is likely that these policies were designed without an in-depth understanding of the economic preferences of adolescents. For example, it would be tempting to think that in the presence of peers, adolescents stop paying attention to the potential negative consequences of their actions. Our results show that this is not the case and that instead in the presence of peers, adolescents' relative weighting of losses to gains (loss aversion) increases. This is good news for policy suggesting that appealing to loss aversion should be especially effective at reducing harmful behaviors of adolescents committed in the presence of peers.

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Figures

Figure 1. Distribution of age in our sample.

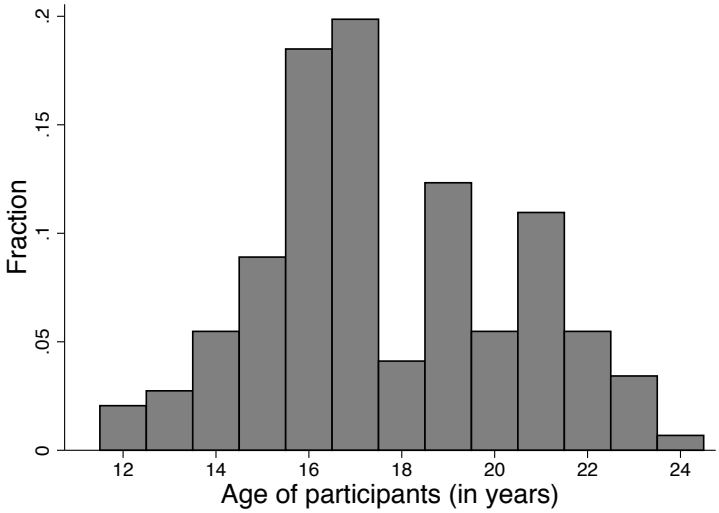
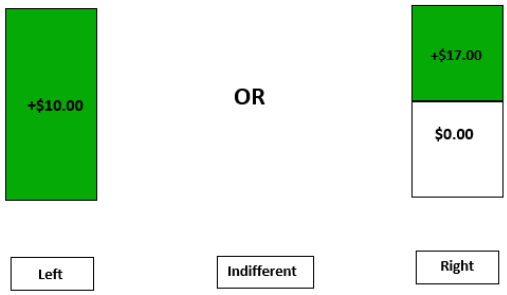


Figure 2. Examples of decision scenarios in A: gain trial, B: loss trial, C: mixed trial.

A.



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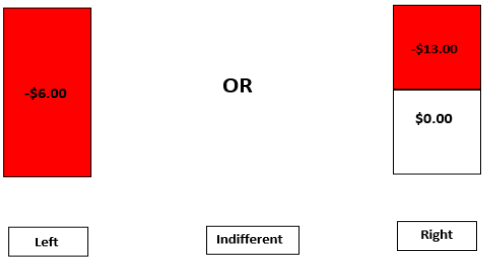


C.

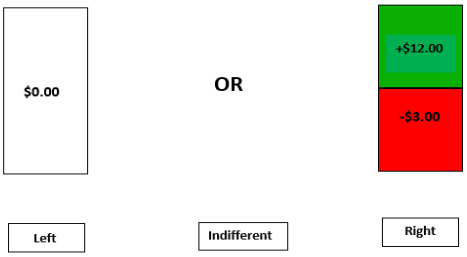


Figure 3. Experimental design. A: Timeline of the experiment. B: seating map in private and observed conditions. Each cell indicates a computer station. x indicates a student sitting at a computer station.

A.

Session Structure				
	Order 1		Order 2	
Stage	Choice-Maker	Observer	Choice-Maker	Observer
1	Instructions			
2	Observed	Observer	Private	Private
3	Private	Private	Observed	Observer
4	Test			
5	Questionnaire			
6	Payment			

B. Private condition

x		x		aisle	x		x	
x		x			x		x	
x		x			x		x	
x		x			x		x	

Observed condition

xx				aisle	xx			
		xx			xx			
xx							xx	
xx							xx	

Figure 4. Task comprehension. Histogram of the number of correctly answered comprehension questions (out of three).

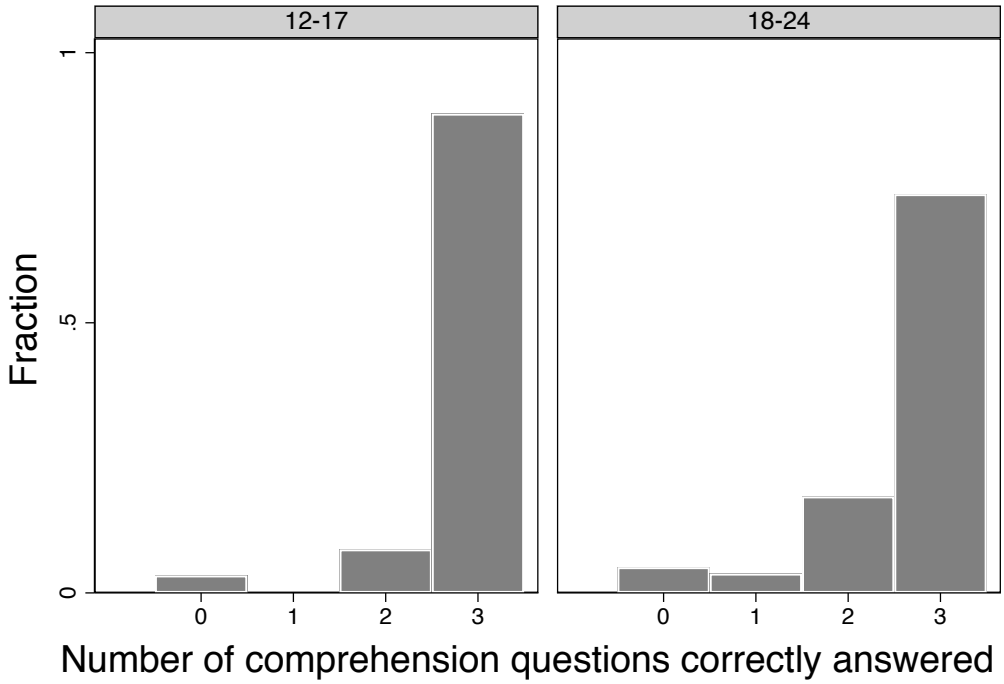
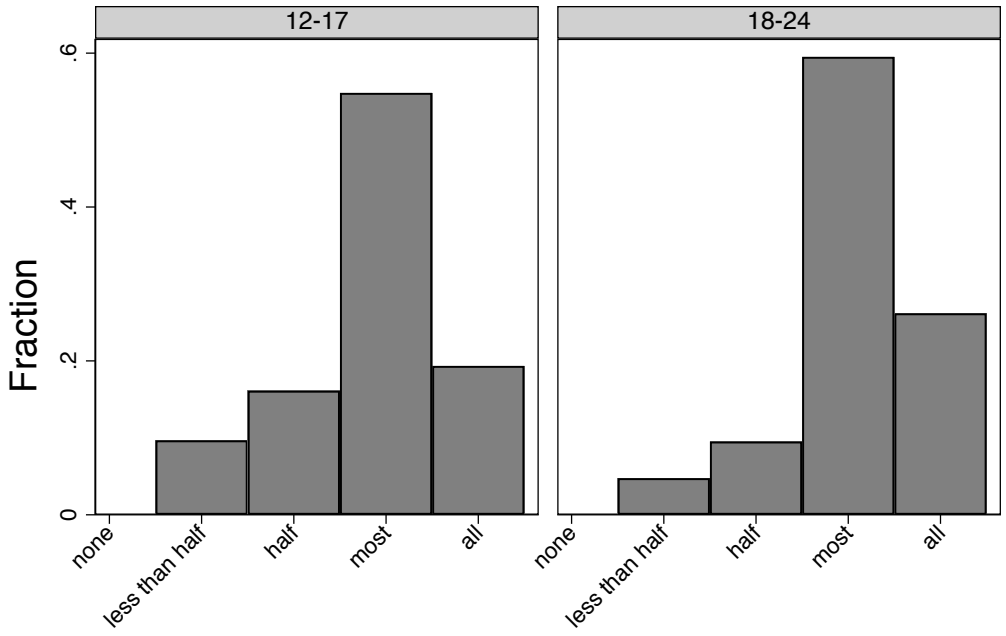


Figure 5 Observation intensity. A: Choice-Makers' answers to "*What proportion of your choices did the person observing you pay attention to?*". B: Observer's recollection of their partner's choices is higher than Choice-Makers', consistent with them paying attention to partner's choices. Error bars are 95% confidence intervals.

A.



B.

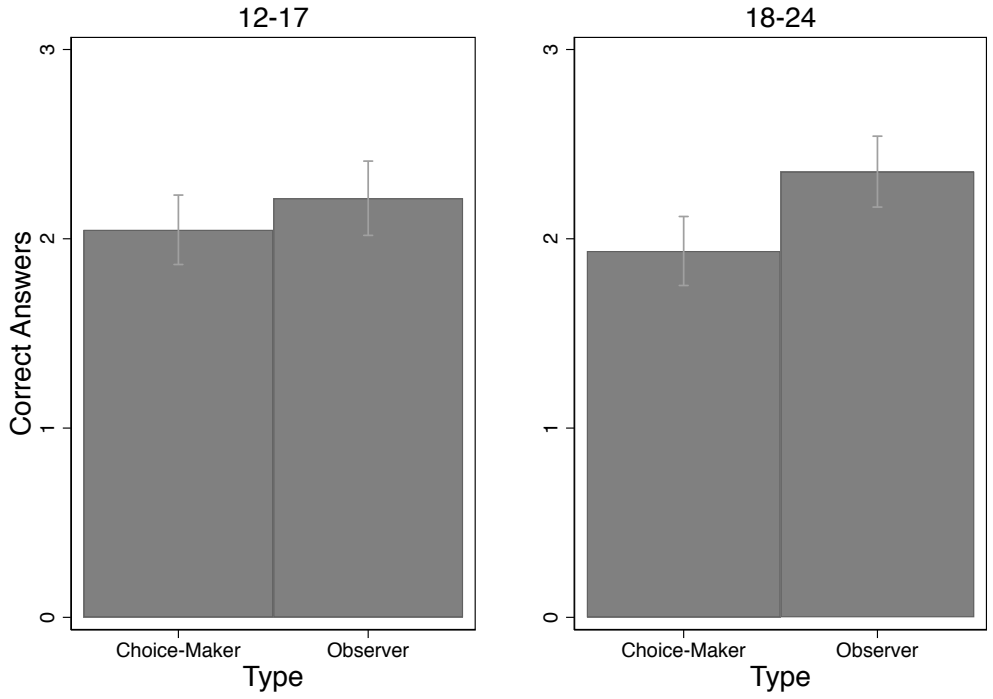


Figure 6. Proportion of risky choices made by Choice-Makers by age group and treatment in A: all choices, B: gain trials, C: loss trials, D: mixed trials. Bars are 95% confidence intervals.

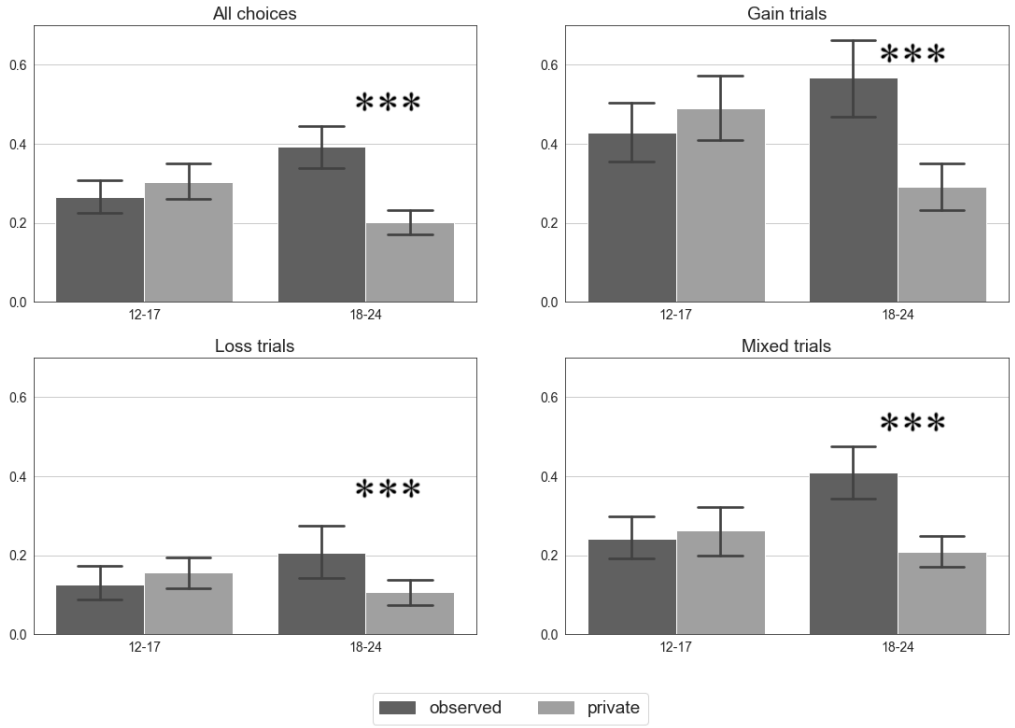
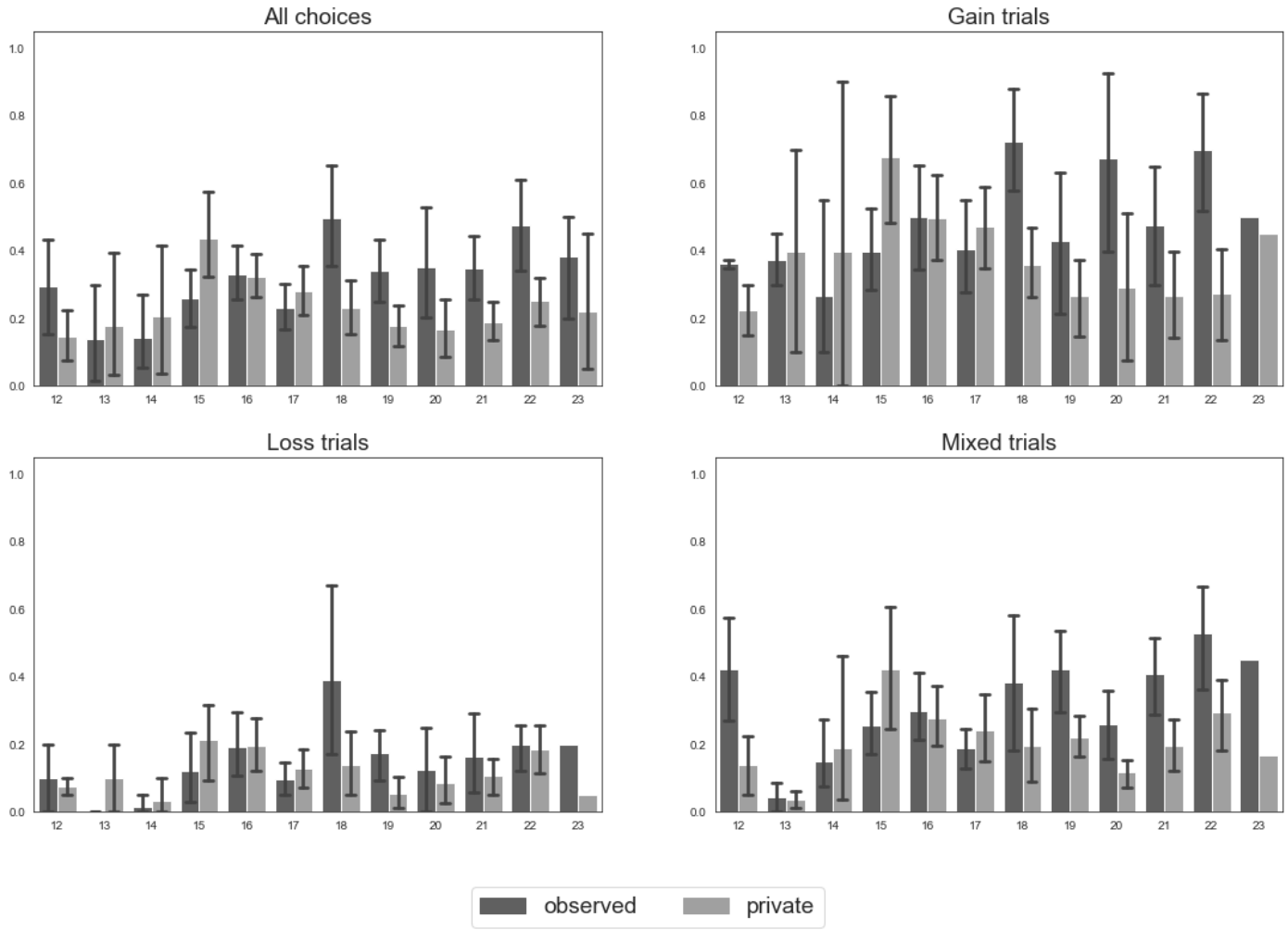


Figure 7. Proportion of risky choices made by Choice-Makers by age and treatment. Bars are 95% confidence intervals. There is only one participant at 23 years old and thus the confidence interval for each trial type is omitted.



Tables

Table 1. Effect of observation. Maximum likelihood estimates of risk attitudes and loss aversion for all Choice-Makers. observed is equal to 1 if made decisions under observation, and 0 if made decisions in private; male is an indicator variable for male subjects; age is age in years; wealth is self-reported wealth on a scale from 1 (very poor) to 5 (very rich). Models (1) - (4) use data from older adolescents (18-24 years old) and models (5) - (8) use data from younger adolescents (12-17 years old).

	18-24 years old				12-17 years old			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Risk tolerance in gains (α^g)								
observed	0.5137***	0.4802***	0.5018***	0.4770***	-0.0979	-0.0922	-0.1237	-0.0550
	(0.0515)	(0.0588)	(0.0690)	(0.0868)	(0.1162)	(0.1217)	(0.1223)	(0.1508)
male		0.0798				0.2472+		
		(0.0936)				(0.1283)		
age			0.0055				0.0318	
			(0.0439)				(0.0301)	
wealth				0.0815				-0.0441
				(0.0787)				(0.0784)
constant	-0.6022***	-0.6117***	-0.7011	-0.8390***	-0.0552	-0.2184	-0.5448	0.0760
	(0.0710)	(0.0794)	(0.9439)	(0.2338)	(0.0828)	(0.1364)	(0.4742)	(0.2614)
Risk tolerance in lossess (α^l)								
observed	0.1612***	0.1429***	0.1427***	0.1475**	-0.0219	-0.0462	-0.0370	0.0458
	(0.0352)	(0.0427)	(0.0388)	(0.0512)	(0.0540)	(0.0566)	(0.0626)	(0.1300)
male		0.0811				-0.0536		
		(0.1002)				(0.0776)		
age			-0.0443				0.0410+	
			(0.0344)				(0.0210)	
wealth				-0.0567				-0.0273
				(0.0544)				(0.1207)

constant	-0.2822***	-0.3113***	0.6095	-0.0926	-0.2598***	-0.2351***	-0.9021**	-0.2067
	(0.0534)	(0.0624)	(0.7050)	(0.1842)	(0.0350)	(0.0506)	(0.3239)	(0.3326)
Loss aversion (λ)								
observed	0.3542***	0.2960*	0.2990**	0.3052+	-0.0068	-0.0683	-0.1018	0.3048
	(0.0882)	(0.1151)	(0.1058)	(0.1761)	(0.2316)	(0.2753)	(0.3003)	(0.7065)
male		0.2671				0.6897*		
		(0.2279)				(0.3441)		
age			-0.1168				0.0731	
			(0.0897)				(0.1077)	
wealth				0.0965				-0.3509
				(0.1951)				(0.5429)
constant	0.7257***	0.6393***	3.1072	0.4320	1.7124***	1.2403***	0.5967	2.7650+
	(0.1404)	(0.1292)	(1.9372)	(0.5454)	(0.3603)	(0.3306)	(1.6740)	(1.6534)
noise								
constant	1.3414***	1.3399***	1.3469***	1.3067***	4.0756***	3.3059***	4.0429***	4.0679***
	(0.2603)	(0.2661)	(0.2754)	(0.2323)	(1.0410)	(0.7934)	(1.0728)	(1.1370)
N	7440	7440	7440	7440	10080	10080	10080	10080

Standard errors clustered on individual in parentheses
+p<0.1, *p<0.05, **p<0.01, ***p<0.001

Table 2. Correlation matrix of anxiety scores. N=73

	Calmness	Tense	Upset	Relaxed	Content	Worried
Calmness	1.00					
Tense	-0.621***	1.00				
Upset	-0.145	0.168	1.00			
Relaxed	0.779***	-0.631***	-0.147	1.00		
Content	0.487***	-0.307**	-0.144	0.549***	1.00	
Worried	-0.351***	0.561***	0.304***	-0.465***	-0.309***	1.00

Table 3. Impact of the prospect of observation and questionnaire repetition on anxiety and upset scores. Ordinal least squares regression with anxiety (middle column) or upset (column on the right) as dependent variables. observed equals 1 when the participant knows (s)he is about to start the decision-making task under observation and 0 otherwise. number equals 1 when the participant is completing the anxiety questionnaire the first time and it is equal to 2 when the participant is completing the anxiety questionnaire the second time. Fixed effects included and standard errors clustered on the level of participant.

	anxiety	upset
observed	-0.382	0.0278
	(0.252)	(0.0594)
number	-0.132	-0.0278
	(0.252)	(0.0594)
constant	-5.666***	1.192***
	(0.322)	(0.0682)
N	146	146

Standard errors clustered on individual in parentheses
+p<0.1, *p<0.05, **p<0.01, ***p<0.001

Table 4. Impact of the anxiety and upset scores on risk preferences. Linear regression with dependent variable equal to the difference between the proportion of times an individual selected risky lottery under observation and in private. $anxiety_{diff}$ and $upset_{diff}$ are equal to the difference between anxiety scores and upset scores measured before observation stage and that measured before private stage. Models (1) – (3) use data from older adolescents (18-24 years old) and models (4) – (6) use data from younger adolescents (12-17 years old).

	18-24 years old			12-17 years old		
	(1)	(2)	(3)	(4)	(5)	(6)
	gains	losses	mixed	gains	losses	mixed
$anxiety_{diff}$	-0.0065	-0.0003	-0.0114	0.0054	-0.0082	0.0029
	(0.0115)	(0.0075)	(0.0125)	(0.0171)	(0.0077)	(0.0207)
$upset_{diff}$	0.0603+	0.0116	-0.0291	-0.0444	0.0028	-0.0911
	(0.0353)	(0.0231)	(0.0385)	(0.1337)	(0.0600)	(0.1621)
constant	0.1719***	0.0535**	0.2404***	-0.0388	-0.0168	-0.0261
	(0.0255)	(0.0167)	(0.0278)	(0.0359)	(0.0161)	(0.0435)
N	31	31	31	42	42	42

Standard errors clustered on individual in parentheses
+p<0.1, *p<0.05, **p<0.01, ***p<0.001

Table 5. Comparison of 12- to 17-year-olds and 18- to 24-year-olds on the questionnaire variables. p-values are based on two-sided, unpaired t-test of means and when indexed with ^ they are based on Pearson's chi-squared test.

	12-17 y.o. mean	18-24 y.o. mean	p-value
Individual characteristics			
Male	0.3810	0.4839	0.3862
Siblings	1.6190	1.1935	0.0640
Attractiveness	3.3333	3.4516	0.5855
Strength	3.3571	3.6129	0.2627
Wealth	3.4286	3.2581	0.3536
Practicality	3.6667	3.9032	0.2810
Responsibility	3.9048	4.1290	0.1943
Perceptions about the partner			
Partner's attractiveness	3.5000	3.0645	0.0612
Partner's strength	3.3095	2.9677	0.0896
Partner's wealth	3.6905	3.1290	0.0002
Partner's practicality	3.4048	3.4516	0.8326
Partner's responsibility	4.0000	3.7742	0.2472
Familiarity (knowing the partner)			
Familiar	0.3333	0.0323	0.0146
Interact after	2.2857	1.5161	0.0098
Observation intensity as perceived by choice-maker			
Partner's correctness	2.0952	2.1935	0.5930
Perceived attention	4.0714	3.8387	0.640^
Perceived care	0.7857	0.6452	0.1882
Self-reported change in behaviour under observation			
Consistency	0.3691	0.2258	0.0646
Focus	1.8333	2.3226	0.025^
Risk tolerance	0.6429	0.3548	0.011^
Attention	1.0952	1.1612	0.296^
Anxiety			
Anxiety difference	-0.2142	-0.6129	0.4322
Upset difference	-0.0238	0.0968	0.3110

Table 6. Effect of observation. Maximum likelihood estimates of risk attitudes and loss aversion for Choice-Makers. observed is equal to 1 if made decisions under observation, and 0 if made decisions in private; 12-17 y. o. is an indicator variable equal to one for participants who are 12 to 17 years old; familiar is the familiarity score between Choice-Maker and Observer from the post-experiment questionnaire; interact after is how likely Choice-Makers expect to interact with their Observers after the experiment; attention is the perceived attention score Choice-Maker believe to be observed during the task from the post-experiment questionnaire; wealth difference is the difference between own self-reported wealth and the perception of partner's wealth.

	(1)	(2)	(3)	(4)	(5)
Risk tolerance in gains (α^g)					
observed	0.4599***	0.6483**	1.7966***	0.4291***	0.4161***
	(0.0485)	(0.2149)	(0.5284)	(0.0437)	(0.0643)
12-17 y.o.	0.2968**	0.1869	0.4609**	0.1579	0.4871***
	(0.1048)	(0.2307)	(0.1640)	(0.1556)	(0.1126)
12-17 y.o. X observed	-0.5416***	-0.4131+	-0.7708***	-0.4896*	-0.5588***
	(0.1124)	(0.2408)	(0.2152)	(0.1929)	(0.1150)
familiar	-22.4413***				
	(0.8571)				
familiar X observed	21.3213***				
	(1.0497)				
interact after		0.0651			
		(0.0775)			
interact after X observed		-0.1281			
		(0.1483)			
attention			0.2039**		
			(0.0746)		
attention X observed			-0.2816**		
			(0.0995)		
wealth difference				-0.1003	
				(0.1278)	
wealth difference X observed				0.1187	
				(0.1300)	
constant	-0.4607***	-0.5547***	-1.4911***	-0.4083***	-0.5216***
	(0.0694)	(0.1349)	(0.4331)	(0.0697)	(0.0879)
Risk tolerance in losses (α^l)					
observed	0.1305***	0.2884	0.5384	0.0998*	0.1874***
	(0.0364)	(0.2195)	(0.3985)	(0.0453)	(0.0380)
12-17 y.o.	0.0827	0.0278	0.1830+	0.0288	0.0296
	(0.0625)	(0.0945)	(0.0995)	(0.1036)	(0.0703)
12-17 y.o. X observed	-0.1898**	-0.0712	-0.2594*	-0.1408	-0.1919**
	(0.0666)	(0.1309)	(0.1286)	(0.1072)	(0.0688)
familiar	-0.2694				
	(0.1876)				

familiar X observed	-0.0265				
	(0.1351)				
interact after		0.0631			
		(0.0451)			
interact after X observed		-0.1139			
		(0.1630)			
attention			0.0091		
			(0.0695)		
attention X observed			-0.0881		
			(0.0872)		
wealth difference				-0.0350	
				(0.0399)	
wealth difference X observed				-0.0521	
				(0.0423)	
constant	-0.2728***	-0.4030***	-0.4048	-0.2706***	-0.2978***
	(0.0492)	(0.0906)	(0.3431)	(0.0595)	(0.0568)
Loss aversion (λ)					
observed	0.2774**	0.8294	2.0491	0.1433	0.1593
	(0.0990)	(0.5648)	(1.4700)	(0.1575)	(0.1400)
12-17 y.o.	0.1034	-0.0511	0.4054	-0.1443	0.9279*
	(0.1675)	(0.4274)	(0.2743)	(0.3600)	(0.4658)
12-17 y.o. X observed	-0.2788	0.1373	-0.6437	-0.1674	-0.4075
	(0.1745)	(0.5369)	(0.4600)	(0.3533)	(0.4305)
familiar	-0.4976***				
	(0.1072)				
familiar X observed	-0.0334				
	(0.1040)				
interact after		0.1723			
		(0.2219)			
interact after X observed		-0.4269			
		(0.4231)			
attention			0.1129		
			(0.1401)		
attention X observed			-0.3979		
			(0.3313)		
wealth difference				-0.1956	
				(0.1538)	
wealth difference X observed				0.1059	
				(0.1757)	
constant	0.9964***	0.8119*	0.3771	1.2018***	0.8922***
	(0.1541)	(0.3724)	(0.7439)	(0.2474)	(0.1786)
noise					
observed					-0.5389

					(0.3980)
12-17 y.o.					2.7344+
					(1.5314)
12-17 y.o. X observed					-0.3652
					(1.5483)
constant	1.8210***	2.2171***	2.1000***	2.1981***	1.7699***
	(0.2531)	(0.3661)	(0.3262)	(0.3578)	(0.4688)
N	17520	17520	17520	17520	17520

Standard errors clustered on individual in parentheses
+p<0.1, *p<0.05, **p<0.01, ***p<0.001

Table 7. Comparison of the within and between-subject estimation of the effect of observation on preferences. Maximum likelihood estimates of risk attitudes and loss aversion for Choice-Makers. observed is 1 if made decisions under observation, and 0 if made decisions in private; 12-17 y. o. is an indicator variable for participants who are 12 to 17 years old.

	(1) within	(2) between
Risk tolerance in gains (α^g)		
observed	0.4857***	0.5411***
	(0.0467)	(0.1371)
12-17 y.o.	0.2854*	0.5287***
	(0.1121)	(0.1344)
12-17 y.o. X observed	-0.5793***	-0.6148***
	(0.1312)	(0.1566)
constant	-0.4684***	-0.5156***
	(0.0640)	(0.1295)
Risk tolerance in losses (α^l)		
observed	0.1297***	0.3381***
	(0.0368)	(0.0853)
12-17 y.o.	0.1066	0.2255**
	(0.0665)	(0.0715)
12-17 y.o. X observed	-0.1606*	-0.2870*
	(0.0674)	(0.1231)
constant	-0.3138***	-0.3939***
	(0.0524)	(0.0562)
Loss aversion (λ)		
observed	0.2353*	0.7786**
	(0.1107)	(0.2990)
12-17 y.o.	0.1582	0.4867*
	(0.2091)	(0.2344)
12-17 y.o. X observed	-0.2864	-0.6682
	(0.2154)	(0.4383)
constant	1.0623***	0.8303***
	(0.1931)	(0.1541)
noise		
constant	2.2710***	2.0213***
	(0.3790)	(0.3371)
N	17520	8760

Standard errors clustered on individual in parentheses
+p<0.1, *p<0.05, **p<0.01, ***p<0.001

Appendix A. Instructions

The text in italics indicates the script that was read aloud but not written. The rest of the instructions were provided in the written form to the participants on their computer screens and read aloud by the experimenter.

Instructions for Order 1 (Observed then Private)

Arrival instructions

Please form a single line and have your student card out so I can mark your names off. Take a piece of paper at random from the table, on the back will be your seat number. There is a seating map on the front of the room if you have trouble finding your seat. Make sure you take a seat at one of the cubicles with an information sheet on the desk. Do not touch the computers until I give further instructions. Mobile phones and other devices must be switched off when you take your seat. Also, please no talking to each other once you enter the room.

Please read and sign the consent form so that I can come and collect it as you go through the session.

Take down names, subjects to their seats, collect signed consent forms.

Opening instructions

Thank you for participating in today's study with the School of Economics. This session will last around 60 minutes. Please let the supervisor know if you do not understand something along the way by raising your hand.

The choices you are making during the study are important because some of your payment will be based on them. There are no wrong choices in this experiment. We will ask you what you prefer and by responding truthfully you make sure that you receive your preferred payment.

Payment

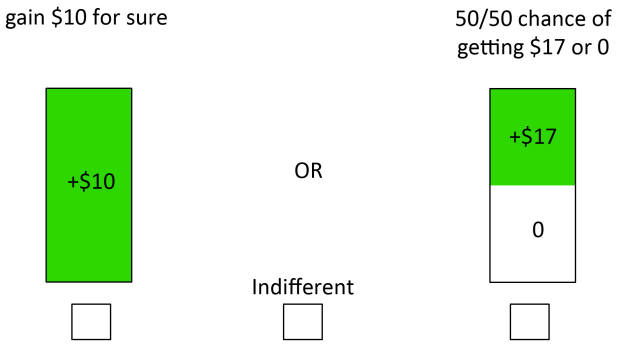
You start the experiment with $35.

There is an envelope on your desk. Inside it, you will find $35.

Your final compensation will depend on one randomly selected decision that you made in the experiment. Based on this decision, you may make more money or lose some of the $35 you now have. Each of your decisions has equal chance to be selected for payment. In addition, you can earn up to $3 in a test that we explain later. You will receive the total of your earnings in cash at the conclusion of the experiment. Only you and the experimenter will know how much you earned.

Task instructions

In this task, you will be repeatedly choosing between different monetary options. In every trial, you will be offered a choice between a sure and uncertain payoff. Some trials will involve only positive amounts. Here is an example:



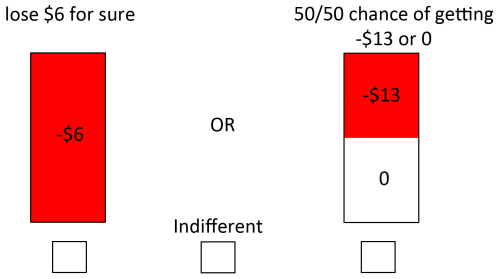
The green rectangle on the left represents a sure payment of $10. The green and white rectangle on the right represents an uncertain option with equal chance of getting $17 or nothing. Your task is to indicate which option you prefer by ticking a box under it.

Suppose this trial was selected for payment.

- If you picked the option on the left, you will receive an additional $10 for sure.
- If you picked the option on the right, you will roll a six-sided die. If the number that comes up on the die is 1, 2, or 3, then you will receive an additional $17. If the number on the die is 4, 5, or 6, you will not receive any additional money. In other words, you are equally likely to get $17 or nothing.
- If you chose indifferent, the computer will make the decision for you. The sure and uncertain options are equally likely to be picked.

Green colour and a plus sign will always represent a positive amount of money (gain).
If you gain additional money in the experiment, the experimenter will give it to you at the end of the session.

Some questions will include negative amounts (losses). Here is an example:

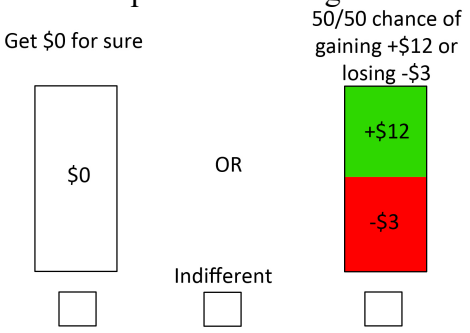


The red rectangle on the left is a sure loss of $6. The red and white rectangle on the right is an uncertain option with equal chance of losing $13 or losing nothing. Your task is to indicate which option you prefer by ticking a box under it.
Suppose this trial was selected for payment.

- If you picked the option on the left, you will lose $6 for sure.
- If you picked the option on the right, you will roll a six-sided die. If the number that comes up on the die is 1, 2, or 3, you will lose $13. If you roll 4, 5, or 6 you do not lose anything. In other words, you are equally likely to lose $13 or nothing.
- If you chose indifferent, the computer will make the decision for you. The sure and uncertain options are equally likely to be picked.

Red colour and a minus sign will always represent a negative amount of money (loss).
If you lose money in the experiment, you will have to give it to the experimenter at the end of the session.

Some questions will involve gambles with positive and negative amounts. Here is an example:



The white rectangle on the left is a sure payment of $0.
The green and red rectangle on the right is an uncertain option with equal chance of getting additional $12 or losing $3. Your task is to indicate which option you prefer by ticking a box under it.

Suppose this trial was selected for payment.

- If you picked the option on the left, you will not receive or lose any additional money.
- If you picked the option on the right, you will roll a six-sided die. If the number that comes up on the die is 1, 2, or 3, you will gain additional $12. If you roll 4, 5, or 6 you will lose $3. In other words, you are equally likely to gain $12 or lose $3.
- If you chose indifferent, the computer will make the decision for you with the sure and uncertain option being equally likely to be picked.

If you gain money in the experiment, the experimenter will give it to you at the end of the session. If you lose money in the experiment, you will have to give it to the experimenter at the end of the session.

Any questions?
Remember that at the end of the experiment one of the questions will be picked for payment and you will receive the option that you selected.

Practice questions
We want to make sure that you understand the task and payment. We will ask you to answer what would happen and how much money you would make in three different scenarios. This is not the task yet. This is just to make sure that you understand everything. If you have trouble answering the question, put your hand up and the experimenter will come over to help you.

[Insert here a picture of a gain trial with a choice between a gamble that pays $13 on the right and sure outcome of $6 on the left. On the top have a sign "Practice Question"]
Suppose that this trial gets selected for payment. Imagine that in this trial you selected the option on the left. Select ALL answers that are true:

a) I get additional $6
b) My total payment is $41 ($35 I received in the beginning of the study + $6)
c) I lose $6
d) My total payment is $29 ($35 I received in the beginning of the study - $6)
e) I get additional $13
f) My total payment is $48 ($35 I received in the beginning of the study + $13)
g) I roll a die to determine my payment

[Insert here a picture of a gain trial with a choice between a gamble that pays -$8 on the left and sure outcome of -$4 on the right. On the top have a sign "Practice Question"]
Suppose that this trial gets selected for payment. Imagine that in this trial you selected the option on the left. Select all answers that are true:

a) I roll a die to determine my payment
b) I lose $4 for sure
c) I gain $4 for sure
d) I either lose $8 or nothing
e) My total payment is either $35 or $28 ($35 I received in the beginning of the study - $8)
f) My total payment is for sure $35

[Insert here a picture of a mixed trial with a choice between a gamble that pays -$8 or $10 on the right and sure outcome of $0 on the left. On the top have a sign "Practice Question"]
Suppose that this trial gets selected for payment. Imagine that in this trial you selected the option on the left. Select all answers that are true:

a) I roll a die to determine my payment
b) I lose $8 for sure
c) I gain $10 for sure

d) I do not gain or lose anything
e) My total payment is $35
f) My total payment is $45 ($35 I received in the beginning of the study + $10)

Practice Question 1: Answers

a). This is TRUE. I selected the sure outcome of $6 on the left, so I can get additional $6 for sure.
b). This is TRUE, because my total payment is the sum of $35 I received in the beginning of the study and payoff from my decisions, which equals $35 + $6 = $41.
c). This is FALSE, because the sure outcome of $6 means I gain $6, not I lose $6.
d). This is FALSE, because my total payment is the sum of $35 I received in the beginning of the study and payoff from my decisions, which equals $6. $35 + $6 = $41.
e). This is FALSE, because I selected the option on the left, which is a sure outcome of $6.
f). This is FALSE, because my total payment is the sum of $35 I received in the beginning of the study and payoff from my decisions, which equals $6. $35 + $6 = $41.
g). This is FALSE, because I selected the left option on the left, which is a sure outcome. There is no need to roll a die to determine payment.

Practice Question 2: Answers

a). This is TRUE, because I selected the option on the left, which is a gamble.
b). This is FALSE, because I need to roll a die to determine my payment.
c). This is FALSE, because I need to roll a die to determine my payment.
d). This is TRUE, because the option on the left is a gamble with 50% chance to lose nothing or 50% chance to lose $8.
e). This is TRUE, because I either lose $8 or nothing, and my total payment is the sum of $35 I received in the beginning of the study and the outcome from my choice, which equals to either $35-$0 = $35 or $35 - $8 = $27.
f). This is FALSE, because I need to roll a die to determine my payment.

Practice Question 3: Answers

a). This is FALSE, because I selected the option on the left, which is a sure outcome.
b). This is FALSE, the option on the left is a sure outcome of $0.
c). This is FALSE, the option on the left is a sure outcome of $0.
d). This is TRUE, the sure outcome on the left is $0.
e). This is TRUE, because my total payment is the sum of $35 I received in the beginning of the study and the outcome from my choice, which equals to $35 + $0 =$35.
f). This is FALSE, because the sure outcome on the left is $0.

If you have any questions please raise your hand now.
We will now start part 1 of the session. Press ok to bring up the next instructions.

Part 1: Observation
I will now read out the next set of instructions on your screens. Please follow along.

You have been randomly paired with another person in the room for the next part of the session. You have also been randomly selected to be either a choice-maker or an observer of the choices being made in this next section.

Your screen will be displaying whether you are a Choice-Maker or an Observer.

In this part of the session there are 120 choices to be made.

From here there are different instructions for Choice-Makers and Observers. I will read out the instructions for both starting with Choice-Makers:

When instructed by the supervisor, your partner will come over and sit down to the right of you. You may not speak to each other during this stage of the session.
You will be making choices while your partner is observing. It is in your partner's best interest to pay attention to the choices you make. Later in the session, your partner will be shown a few randomly selected choices from this set, and then asked to recall which option you chose. The observer will earn money for each correctly recalled choice.
Also, one of your choices may be selected at random at the end of the session to be paid-out for real. The choices will only impact your own payment, with no effect on how much money your partner receives.

Now I will read the instructions for the Observers:

When instructed by the supervisor, you will come over and sit down to the right of your partner. You may not speak to each other during this stage of the session.
You will be observing while your partner is making choices. It is in your best interest to pay attention to the choices your partner makes. Later in the session, you will be shown a few randomly selected choices from this set, and then asked to recall which option your partner chose. You will earn money for each correctly recalled choice.
Also, one of your partner's choices may be selected at random at the end of the session to be paid-out for real. The choices will only impact your partner's payment, with no effect on how much money you receive.

Now everybody please listen. Before we tell you who you are partnered with, we would like you to fill in a short questionnaire. To continue you need to type in a password. The password is dog.

I will now read the instructions displayed on screen for the observers:

When instructed by the supervisor, you can start moving over to your partner and sit down to the right of them.

Below this should be displayed the seat number of your partner.

Ask me if you need assistance finding the right seat. You may not speak to each other during this stage of the session.

Now for everyone:

Once all 120 choices have been made, wait quietly until everyone else has finished at which point I will give instructions on the next part of the session. Observers can now press the OK button and start moving over to your partner's seat.

The password to start the choices is "choice5" all one word. You may now begin.

Part 2:
Now that everyone is finished with that, please return to your original seats.

You will now be given 120 choices to complete. **If you are an observer**, one of these choices will be paid out at the end of the session. **If you are a Choice-Maker** one of these choices may be paid out at the end of the session or one of your choices from the previous set may be paid out.

Before you start working on your choices, we would like you to fill in a short questionnaire.
To continue you need to type in a password. The password is table

Testing and Questionnaire
You will now complete a test to see how well you know your partner.

Again, there are 2 sets of different instructions for observers and choice-makers. I will read the instructions for Choice-Makers first.

Choice-makers

You will see a selection of 3 choices that your partner was asked to make. Select the option you think they would most likely have made. You will receive $1 for each correct answer.

Observers

You will see a selection of 3 choices that your partner made while you were observing. Select the option you think they chose. You will receive $1 for each correct answer.

Now for everyone

When you finish the test, you need to answer several questions. Answer honestly, remembering all data is collected and stored anonymously. After you have completed the questions, you will see a screen showing your payment from the session along with how it was calculated. Once everyone finishes, you will be able to collect your payment. Please wait seated until instructed by the experimenter.

The password to continue to the tests is "tested".

Payment instructions
The computer will now select one of your choices at random for payment. Press "continue"
You will be paid based on the decision scenario shown below.

Appendix B. Questionnaires

a. State anxiety questionnaire

	Not at all	Somewhat	Moderate	Very much
I feel calm	1	2	3	4
I am tense	1	2	3	4
I feel upset	1	2	3	4
I am relaxed	1	2	3	4
I feel content	1	2	3	4
I am worried	1	2	3	4

b. Post-experiment questionnaire

1) What do you think the experiment was about?

Demographics & about experiment

1) Gender
2) Age

Choice-Maker

3) How many of the test questions do you think your partner remembered correctly?
   0 1 2 3

4) For what proportion of your choices do you think your partner was paying attention?
   all most half less than half none

5) Do you think your session partner cared about what your choices were?
   yes no

6) Did you try to be more consistent with your choices for your observer's benefit?
   yes no

7) When you were being observed did you feel more focused on the task or more distracted?

more distracted	slightly more distracted	no change	slightly more focused	more focused

8) Compared to the private choice making stage, do you think having your session partner watching made you take:
   more risks less risks no change

9) Compared to the private choice making stage, do you think having your session partner watching made you pay:
   more attention to the task less attention to the task no change

   Please explain how your choices were different.

Observer

3) For what proportion of your partner's choice were you paying attention?
   all most half less than half none

4) Did you care about what your session partner's choices were?

yes no

5) Compared to their choices in the private stage, do you think having you watching made your partner take:
more risks less risks no change

6) Compared to their choices in the private stage, do you think having you watching made your partner pay:
more attention to the task less attention to the task no change

Please explain how you think their choices were different.

About your partner

1) Have you met your session partner before this study?
yes no

2) Do you remember ever seeing your session partner before this study?
yes no

3) Do you think it is likely that your will interact with your partner after the session has ended?

4) Rate your partner on a scale 1 to 5 for the following characteristics:
Attractive
Strong
Wealth
Practical
Responsible

About yourself

5) Rate yourself on a scale of 1 to 5 for the following characteristics:
Attractive
Strong
Wealth
Practical
Responsible

6) (For university students) Home faculty:
Second home faculty (for combined degree):
Year of study: 1st, 2nd, 3rd, 4th, 5th, 6th+
(For high school students) Name of high school:
Year of study: 7, 8, 9

7) Are you an international student?
yes no

8) How many siblings do you have?
How many of your siblings are younger than you?

9) What do you identify as your nationality?

10) If you do not identify as Australian, how long have you been living in Australia?

less than 6 months between 6 months and 1 year between 1 and 3 years
more than 3 years Not applicable (I am Australian)

11) Out of the following options how would you identify your predominant ethnic heritage?

African
East Asian
European
Indigenous Australian
Middle Eastern
North/South/Central American
Pacific Islander
South Asian
South-East Asian
Other (specify _____)

Appendix C Additional results

Table C1. Ordinal logit regressions. Dependent variable = 1 if participant chose the lottery, = 0.5 if indifferent, = 0 if selected the safe option. observed =1 if the participant is observed and 0 otherwise. lottery amount 1 and lottery amount 2 are possible earnings from the lottery and safe amount is the amount associated with the safe choice. Models (1) – (3) use data from older adolescents (18-24 years old) and models (4) – (6) use data from younger adolescents (12-17 years old).

	18-24 years old			12-17 years old		
	(1)	(2)	(3)	(4)	(5)	(6)
	gains	losses	mixed	gains	losses	mixed
observed	1.2223***	0.9280***	1.2650***	-0.2625	-0.2797	-0.1194
	(0.1782)	(0.1849)	(0.0939)	(0.2210)	(0.2194)	(0.2029)
safe amount	-0.4050***	-0.7510***		-0.2818***	-0.4287***	
	(0.0802)	(0.1564)		(0.0457)	(0.0753)	
lottery amount 1	0.1695***	0.3970***	0.2784***	0.1168***	0.2220***	0.2227***
	(0.0386)	(0.0926)	(0.0324)	(0.0208)	(0.0441)	(0.0295)
lottery amount 2			0.4463***			0.3441***
			(0.0517)			(0.0537)
male	0.1036	0.7896+	-0.0706	0.0949	-0.6017+	-0.4259
	(0.3270)	(0.4167)	(0.3618)	(0.2858)	(0.3434)	(0.2883)
age	-0.0003	-0.1346	0.0971	0.0855	0.1956	0.1041
	(0.0997)	(0.1460)	(0.1275)	(0.0981)	(0.1294)	(0.1185)
wealth	0.1565	-0.1530	-0.0242	0.0297	0.3500+	0.1802
	(0.2596)	(0.2622)	(0.2123)	(0.1807)	(0.2067)	(0.1770)
N	1240	1240	4960	1680	1680	6720

Marginal effects

Standard errors clustered on participant in parentheses

+ p<0.1, * p<0.01, ** p<0.05, *** p<0.001

Table C2. Effect of observation in ordinal logit regressions. Dependent variable = 1 if participant chose the lottery, = 0.5 if indifferent, = 0 if selected the safe option. observed =1 if the participant is observed and 0 otherwise. lottery amount is the possible earning from the lottery and safe amount is the amount associated with the safe choice. familiar denotes the familiarity score collected from post-experiment questionnaire. interact after is how likely Choice-Makers expect to interact with their Observers after the experiment. attention is the perceived attention intensity collected from post-experiment questionnaire. wealth difference is the difference between own wealth and the perception of partner's wealth.

A. Gains

	(1)	(2)	(3)	(4)
observed	1.1586***	1.4809***	3.1505***	1.1234***
	(0.1698)	(0.2635)	(0.6748)	(0.1672)
safe amount	-0.3290***	-0.3299***	-0.3320***	-0.3294***
	(0.0415)	(0.0416)	(0.0415)	(0.0417)
lottery amount 1	0.1369***	0.1373***	0.1382***	0.1371***
	(0.0195)	(0.0196)	(0.0196)	(0.0196)
12-17 y.o.	0.8462***	0.7137**	0.8127***	0.7934***
	(0.2446)	(0.2491)	(0.2432)	(0.2404)
12-17 y.o. X observed	-1.3627***	-1.2636***	-1.3415***	-1.3411***
	(0.3025)	(0.3179)	(0.2866)	(0.2889)
familiar	-0.0161			
	(0.3607)			
familiar X observed	-0.2149			
	(0.3162)			
interact after		0.1684		
		(0.1180)		
interact after X observed		-0.2123+		
		(0.1267)		
attention			0.1883	
			(0.1582)	
attention X observed			-0.5143**	
			(0.1838)	
wealth difference				-0.1393
				(0.1375)
wealth difference X observed				0.2366
				(0.1507)
N	2920	2920	2920	2920

Marginal effects
Standard errors clustered on participant in parentheses
+ p<0.1, * p<0.01, ** p<0.05, *** p<0.001

B. Losses

	(1)	(2)	(3)	(4)
observed	0.8757***	1.3059***	2.1864***	0.8536***
	(0.1766)	(0.2953)	(0.6003)	(0.1787)
safe amount	-0.5446***	-0.5471***	-0.5451***	-0.5447***
	(0.0770)	(0.0778)	(0.0775)	(0.0772)
lottery amount 1	0.2849***	0.2861***	0.2853***	0.2849***
	(0.0450)	(0.0455)	(0.0452)	(0.0451)
12-17 y.o.	0.4366	0.3758	0.5194+	0.5553+
	(0.2863)	(0.2923)	(0.2730)	(0.2891)
12-17 y.o. X observed	-1.1487***	-0.9336***	-1.0840***	-1.1188***
	(0.2929)	(0.2760)	(0.2821)	(0.2853)
familiar	0.2875			
	(0.2898)			
familiar X observed	-0.0258			
	(0.3511)			
interact after		0.1917+		
		(0.1111)		
interact after X observed		-0.2815+		
		(0.1525)		
attention			0.0694	
			(0.1677)	
attention X observed			-0.3435*	
			(0.1525)	
wealth difference				0.0556
				(0.1672)
wealth difference X observed				0.1140
				(0.1468)
N	2920	2920	2920	2920

Marginal effects
Standard errors clustered on participant in parentheses
+ p<0.1, * p<0.01, ** p<0.05, *** p<0.001

C. Mixed

	(1)	(2)	(3)	(4)
observed	1.1776***	1.3008***	2.5779***	1.1936***
	(0.0874)	(0.2304)	(0.6217)	(0.0822)
lottery amount 1	0.2435***	0.2439***	0.2439***	0.2430***
	(0.0231)	(0.0231)	(0.0238)	(0.0234)
lottery amount 2	0.3848***	0.3851***	0.3854***	0.3841***
	(0.0399)	(0.0400)	(0.0412)	(0.0407)
12-17 y.o.	0.3873	0.2294	0.2849	0.3637

	(0.2597)	(0.2801)	(0.2582)	(0.2710)
12-17 y.o. X observed	-1.4356***	-1.2564***	-1.2371***	-1.3283***
	(0.2407)	(0.2339)	(0.2207)	(0.2290)
familiar	-0.1502			
	(0.4173)			
familiar X observed	0.3805			
	(0.3379)			
interact after		0.1379		
		(0.1312)		
interact after X observed		-0.0714		
		(0.1337)		
attention			0.2599	
			(0.1631)	
attention X observed			-0.3589*	
			(0.1546)	
wealth difference				0.0616
				(0.1732)
wealth difference X observed				-0.0404
				(0.1485)
N	11680	11680	11680	11680

Marginal effects
Standard errors clustered on participant in parentheses
+ p<0.1, * p<0.01, ** p<0.05, *** p<0.001

Table C3. Ordinal least squares regression for effect of observation using within-subject comparison. Dependent variable = 1 if participant chose the lottery, = 0.5 if indifferent, = 0 if selected the safe option. observed = 1 if the participant is observed and 0 otherwise. lottery amount 1 and lottery amount 2 are possible earnings from the lottery and safe amount is the amount associated with the safe choice. Model (1) includes data from gain trials only. Model (2) includes data from loss trials only. Model (3) includes data from mixed trials only. Lottery amount 2 is omitted in models (1) and (2) because it's always zero in gain and loss trials. Safe amount is omitted in model (3) because it's always zero in mixed trials.

	(1) gains	(2) losses	(3) mixed
observed	1.1125***	0.6424**	1.6999***
	(0.1871)	(0.2153)	(0.1558)
safe amount	-0.3235***	-0.4974***	
	(0.0312)	(0.0558)	
lottery amount 1	0.1339***	0.2553***	0.3264***
	(0.0145)	(0.0325)	(0.0323)
lottery amount 2			0.6008***
			(0.0555)
12-17 y.o.	0.6854***	0.1709	0.7655**
	(0.1691)	(0.2153)	(0.2720)
12-17 y.o. X observed	-1.2711***	-0.7904*	-1.1049***
	(0.2779)	(0.3138)	(0.2425)
N	4380	4380	26280

Marginal effects

Standard errors clustered on participant in parentheses

+ p<0.1, * p<0.01, ** p<0.05, *** p<0.001

Table C4. Ordinal least squares regression for effect of observation using between-subject comparison. Dependent variable = 1 if participant chose the lottery, = 0.5 if indifferent, = 0 if selected the safe option. observed = 1 if the participant is observed and 0 otherwise. lottery amount 1 and lottery amount 2 are possible earnings from the lottery and safe amount is the amount associated with the safe choice. Model (1) includes data from gain trials only. Model (2) includes data from loss trials only. Model (3) includes data from mixed trials only. Lottery amount 2 is omitted in models (1) and (2) because it's always zero in gain and loss trials. Safe amount is omitted in model (3) because it's always zero in mixed trials.

	(1) Gain trials	(2) Loss trials	(3) Mixed trials
observed	1.5080***	1.6870***	1.3673***
	(0.3672)	(0.3930)	(0.3501)
safe amount	-0.4719***	-0.5565***	
	(0.0611)	(0.0828)	
lottery amount 1	0.2036***	0.2874***	0.2853***
	(0.0298)	(0.0466)	(0.0289)
lottery amount 2			0.4228***
			(0.0476)
12-17 y.o.	1.6320***	1.1612**	1.0192**
	(0.3846)	(0.3976)	(0.3517)
12-17 y.o. X observed	-1.7734***	-1.9326***	-1.6424**
	(0.5244)	(0.5468)	(0.5154)
N	1460	1460	5840

Marginal effects
Standard errors clustered on participant in parentheses
+ p<0.1, * p<0.01, ** p<0.05, *** p<0.001