Higher Order Risk Preferences: New Experimental Measures, Determinants and Related Field Behavior*

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Abstract

We study higher order risk preferences (prudence and temperance) in an experiment with 658 adolescents. Using a novel method to elicit and measure these preferences, we show that women are more risk averse, prudent and temperant than men, and high-ability students behave less risk averse and temperant. In line with theoretical predictions, we then find that higher order risk preferences – particularly prudence – are strongly related to adolescents' financial decision making, environmentally-friendly behavior, and health status, including addictive behavior. Dropping higher order risk preferences from the analysis would yield largely misleading conclusions about the relation of risk aversion to field behavior.

Keywords: Higher order risk preferences, prudence, temperance, field behavior, adolescents, health, addictive behavior, smartphone addiction, experiment
JEL classification: C93, D81, D91, J13

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1 Introduction

Risk is an inherent part of life: Decisions about occupation, education, finances or health behavior, to name just a few, regularly involve at least some degree of risk. Consequently, measuring risk is important for both, theory and applications. However, commonly used experimental measures for risk aversion often fail in predicting field behavior under risk (Sutter et al., 2013; Charness et al., 2019; Samek et al., 2019) and are usually found to correlate rather weakly with standard survey questions on risk tolerance (see, e.g., Crosetto and Filippin, 2015, or Crosetto, 2019, for a meta study). For example, in a large-scale experiment with a representative sample of the Dutch population, Charness et al. (2019) find that none of five commonly used measures of risk attitudes predicts field behavior in the financial, health and occupational domain.[1] Given that many decisions in these domains are undoubtedly connected with risk, the results of Charness et al. (2019) amplify doubts about the external validity of experimental measures of risk aversion.

However, risk comes in different forms, and a growing literature going back already to Leland (1968) suggests that for explaining certain behaviors, including financial decision making and health-related behavior, higher order risk preferences might be more relevant than standard risk aversion (Kimball, 1990, 1992; Gollier and Pratt, 1996; Courbage and Rey, 2006; Attema et al., 2019). A neglect of higher order risk preferences might therefore explain at least partially the typically weak (if not non-existent) relation between risk aversion and field behavior.

In this paper, we use a novel method to study and quantify higher order risk preferences and then relate them to several domains of field behavior, including addictive behavior, financial decision making, and eco-friendly behavior. Besides eliciting standard risk aversion, we focus on prudence and temperance as higher order risk preferences. Prudence, the third order risk preference, is often defined as the preference to allocate a mean-zero risk to the state of higher wealth instead of to the state of lower wealth (Eeckhoudt and Schlesinger, 2006). An intensity measure of prudence has also been interpreted as a measure of left-skewness aversion or equivalently a preference for right-skewness (Modica and Scarsini, 2005).Under expected utility theory, prudence is equivalent to downside risk aversion (Menezes et al., 1980). Temperance, the fourth order risk preference, can be defined as the preference to disallocate two independent mean-zero risks across two states of the world opposed to accepting both of them in the same state of the world (Eeckhoudt and Schlesinger, 2006). An intensity measure of temperance has been interpreted as

[1] Specifically, they measure risk by the methods proposed by Gneezy and Potters (1997), Holt and Laury (2002), Eckel and Grossman (2008), Tanaka et al. (2010), and Dohmen et al. (2011).

a measure of kurtosis aversion (Denuit and Eeckhoudt, 2010). Thus, via the skewness preference and the kurtosis aversion measures[2], higher order risk preferences capture important aspects of the distribution of a risk – beyond its mean and variance –, which corroborates that they deserve attention when studying risky behavior in the field.

From a theoretical perspective, higher order risk preferences are predicted to be linked to various types of behaviors, including eco-friendly behavior (e.g., Bramoullé and Treich, 2009), prevention effort to lower the probability of an undesired event (Eeckhoudt and Gollier, 2005; Menegatti, 2009) and health-related behavior (e.g., Courbage and Rey, 2006; Attema et al., 2019). Yet, except for their relation to financial decision making (Noussair et al., 2014; Trautmann and van de Kuilen, 2018), there are no empirical studies on the relationship between higher order risk preferences and field behavior of these different types.

Here, we measure the higher order risk preferences prudence and temperance as well as risk aversion in a novel way that also allows identifying their intensities in a sample of 658 children and adolescents, aged 10 to 21 years. We then relate these individual experimental measures to self-reported behavior in the field, including general risk taking, financial decision making, general prevention, eco-friendly behavior and health-related behavior, with a focus on addictive behavior. The age group covered in our sample spans the formative years for many habits that shape these adolescents' future prospects. For example, smoking, drinking, or addictive gambling in the teenage years has high predictive power for also showing this behavior in adulthood (Paul et al., 2008; Buchmann et al., 2011; DeWit, 2000; Black et al., 2015). For this reason, it is important for potential interventions to study this age group and learn which factors are predictive of such behaviors in order to help identifying youths at risk at an early age.

Our method to elicit higher order risk preferences has been developed by Schneider et al. (2019). It rests upon the elicitation of utility points, which are subsequently non-parametrically connected to a utility function with a spline smoothing approach. Based on the estimated utility functions and their derivatives, intensity measures of higher order risk preferences can be computed. In a first step, we examine the distribution and the determinants of higher order risk preferences (and of risk aversion) in our sample, taking into account cognitive abilities, family characteristics, and also time preferences as a control (see, e.g., Epper and Fehr-Duda, 2018, on the importance of accounting for time discounting when studying risk-taking behavior).

[2]See also Ebert (2012) on the moment characterizations of higher order risk preferences.

In a second step, we then relate our experimental measures to several domains of field behavior. In this way, our paper contributes to the literature in several ways.

The first contribution is to provide a unified experimental framework to measure higher order risk preferences (and risk aversion) for a large sample of children and adolescents, relying on non-parametric intensity measures. While risk aversion has been studied extensively in this age group (Sutter et al., 2019), for prudence and temperance the evidence is scarce or non-existent. Heinrich and Shachat (2018) study prudence among 362 Chinese children and adolescents, aged 8 to 17 years, by counting the number of prudent decisions from three binary choice tasks. They investigate determinants of risk aversion and prudence and examine transmission of choices from parents to their children. In contrast to our study, they are not interested in the relation of prudence to field behavior, and they don't have any measures for time preferences and cognitive abilities, which turn out to be important in our study. Moreover, they do not measure intensities of prudence and they ignore temperance. The latter has, in fact, never been studied with children or adolescents. We will identify the intensity of both prudence and temperance.[3] This will actually allow us to investigate the existence of mixed risk averters, i.e., of individuals who are risk averse, prudent, and temperant, or risk seeking, prudent, and intemperant (Crainich et al., 2013).

The second contribution of our study is that we are the first to connect higher order risk preferences with field behavior of adolescents. While in theory, higher order risk preferences have been predicted to relate to various domains of field behavior, there have been no empirical studies so far to test these relationships for adolescents. Even for adults, such empirical tests are scarce and confined to the seminal study of Noussair et al. (2014) about how higher order risk preferences of a sample of Dutch adults relates to their financial decisions. We also consider the financial behavior of our adolescents, but add several other types of field behavior. One major domain under consideration is health-related behavior. Besides smoking and drinking behavior, we focus on a relatively new phenomenon, namely excessive smartphone usage, as this has increasingly been linked to mental health issues, like depression,

[3]Even for adults, there is hardly any evidence on intensity measures of higher order risk preferences. We are aware of only two studies that have investigated non-parametric intensity measures of higher order risk preferences at all: Ebert and Wiesen (2014) and Schneider et al. (2019). Standard parametric approaches, such as maximum likelihood estimation of the parameter of a power utility function, are unable to account for all empirically observed combinations of (higher order) risk preferences and are thus not flexible enough to study all possible patterns of (higher order) risk preferences. The alternative so far has thus mostly been to report the number of decisions in binary decision tasks that are consistent with a certain trait, thus equating intensity with consistency in choice (see, e.g., the discussion on the use of count measures as measures of strength in Noussair et al., 2014).

and poor well-being of adolescents (Twenge et al., 2018; Orben and Przybylski, 2019; Przybylski and Weinstein, 2017). Nesi and Prinstein (2015) document that this relation is partly due to technology based social comparison and feedback seeking, factors that we account for in our experimental questionnaire. Cheever et al. (2014) and Clayton et al. (2015) find that separating participants from their smartphones leads to increased feelings of anxiety, higher heart rates and blood pressure. These findings illustrate the potential difficulties in decreasing smartphone usage, which calls for an early identification of factors that might relate to this type of addictive behavior. In addition to health-related behavior, we examine also adolescents' financial decision making, their behavior towards the environment, their preventive behavior to avoid undesired events, and their general risk taking behavior.

A third contribution that we make is to investigate the relation between intensity measures of higher order risk preferences and cognitive abilities. The relation between economic preferences and cognitive abilities has been of growing interest recently, as it might reinforce economic outcomes (e.g., Dohmen et al., 2010, 2018). Previous studies on higher order risk preferences have connected cognition measures to the number of choices that are consistent with a certain trait (Breaban et al., 2016; Noussair et al., 2014). Given the relative complexity of the elicitation task they employ (Eeckhoudt and Schlesinger, 2006), equating consistency with intensity might confound these results (Andersson et al., 2016). We are the first to relate intensity measures (rather than consistency) of higher order risk preferences with cognitive abilities, and our cognitive ability measures improve on those used in earlier studies in that they consist of more than three items; specifically, we use two tasks that target not only reasoning (10 items matrix task), but also processing speed (90 seconds for as many symbol-digit correspondences as possible).

A fourth contribution relates back to the weak and often inconclusive results on the relation of experimental risk aversion measures to field behavior (e.g., Sutter et al., 2013; Charness et al., 2019). We argue that such indecisive results may be due to omitting prudence and temperance as higher order risk preferences. Actually, we can show that the omission of both prudence and temperance masks the true relation of risk aversion in several cases when we relate risk preferences to field behavior. In fact, the coefficient for risk aversion can even change its sign, and also its significance, depending on whether or not prudence and temperance are taken into account. These insights demonstrate the importance of taking higher order risk preferences into account in empirical analyses and put previous work into a more encompassing perspective.

Our experimental results with respect to classification of higher order risk preferences are in line with findings on adult populations (see, e.g., the review by Traut-

mann and van de Kuilen, 2018). In the aggregate, children and adolescents are risk averse, prudent, and temperant. We find no age effect on the intensity of any higher order risk preference, which replicates earlier findings on risk aversion of adolescents (see, e.g., the review by Sutter et al., 2019) and is in line with earlier findings on the insignificance of age for higher order risk preferences of adults (Noussair et al., 2014). Moreover, we replicate the standard finding with respect to gender (Croson and Gneezy, 2009; Sutter et al., 2019): girls are more risk averse than boys. Our findings indicate that this pattern extends to higher orders of risk, as girls are also more prudent and more temperant than boys, which has also been reported with adult populations (Ebert and Wiesen, 2014). High-ability students (measured by a test using raven's matrices and a symbol correspondence task) are less risk averse and less temperant, replicating a common finding with respect to risk aversion (see the review by Dohmen et al., 2018).

Turning to the relationship of our experimental measures to behavior in the field, we find that prudence (and, to a lesser extent, temperance) complements risk aversion in predicting general risk taking behavior or financial decision making. While this matches earlier results of Noussair et al. (2014) for adults, we also uncover novel insights. Most importantly, prudence is strongly related to health-related behavior, but risk aversion is not. For example, our index capturing obsessive use of smartphones is predicted significantly by prudence, but not by risk aversion or temperance. We make the same observation when complementing this index with other addictive behavior (smoking and drinking), or forming a general health index that also includes, e.g., the body mass index or information on the regularity at which participants practice sports. Omitting higher order risk preferences in the regressions would, however, result in concluding that risk preferences and health behavior are unrelated, whereas in reality, health behavior is strongly related with prudence. The latter also matters for other domains of field behavior, such as prevention behavior and general risk taking, while the relation of risk aversion depends strongly on whether or not higher order risk preferences are taken into account.

In the next section, we describe our subject pool, the general features of the experiment and the measure with which we measure higher order risk attitudes. Section 3 presents the results on risk aversion, prudence and temperance, and how they depend on socio-demographic variables, cognitive abilities and family background. In Section 4, we introduce the different domains of field behavior that we elicit in our experimental questionnaire, and present what theoretical models would predict about their relationship to higher order risk preferences. Section 5 studies the relation between our measures of higher order risk preferences and field behavior and discusses how our findings relate to the theoretical predictions of various

Table 1: Characteristics of Participants: Age and Gender

Average Age (in years)	Grade	Total	Girls	Boys
11.6	6th	153	70	83
13.6	8th	168	80	89
15.7	10th	173	91	82
17.6	12th	162	89	73
Total		656	330	327

models. In a final part of that section, we discuss how important it is to consider prudence and temperance to determine the true relationship of risk aversion to various domains of field behavior. Section 6 discusses our main results and concludes the paper.

2 Methods and Experimental Design

2.1 General Setup

The whole study was approved by the IRB of the University of Innsbruck. Moreover, it was preregistered with the open science foundation (osf.io/n7v2y; currently embargoed), including a pre-analysis plan.

Subject Pool

We ran our experiment in four German schools in the federal states Baden-Württemberg, North Rhine-Westphalia and Rhineland-Palatinate in September and October 2018. In every school, at least one class per grade was randomly selected from grades six, eight, ten, and twelve. In total, 658 children and adolescents, aged 10 to 21 years, took part in our experiment. The distribution of students across grades and gender and their average age per grade is summarized in Table 1. Principals and teachers of the participating schools supported our study by allowing us to conduct the experiment in class during regular school hours. We informed parents about both the experiment and the collection of survey data. Schools made sure that all participating children obtained their parents' permission to participate, and more than 93% of parents gave their permission. Students were also asked whether they would be willing to participate in the experiment and no student opted out.

General Experimental Setup

The whole study was run on tablet computers. First, we elicited students' risk and time preferences in an incentivized experiment. Afterwards, students performed some tasks to measure cognitive abilities (see below) and filled in an extensive survey on field behavior (see Section 4 for a description and Online Appendix C for the entire questionnaire). In the experiment, students could earn "Taler" as our experimental currency. We explained the conversion rate from Taler to Euro carefully and varied it depending on the grade, such that the maximal amount students could earn in our study corresponded to 120% of the recommended weekly amount of pocket money according to the German Federal Ministry of Family Affairs, Senior Citizens, Women and Youth (Familien-wegweiser.de, 2018). This was done in order to comply with school requests and to hold the meaning of a Taler constant across the different age cohorts. For example, the highest possible payment of 280 Taler corresponded to €5.50, €7, €10 and €15.50 for grades 6, 8, 10 and 12, respectively. This includes a show-up fee of 70 Taler and up to 70 Taler for the cognitive ability tasks that were conducted after the experiment.[4]

Concerning the measures for cognitive abilities, we focus on fluid intelligence. Our first task, a commonly used matrix test, aims at reasoning, while our second task, a symbol-digit-correspondence task (Dohmen et al., 2010) aims at processing speed. For the first task, participants had five minutes (300 seconds) to complete eight test items, whereas for the second task subjects were given 90 seconds to complete as many symbol-digit-correspondences as possible. We compute a single measure of cognitive ability from these tasks by weighting the successfully completed items in each task with the time given for a task, i.e. (number of matrices solved * 300 + number of correct symbol-digit pairs * 90)/(300 + 90). Finally, for comparison reasons, we center and standardize this measure.

All experimental sessions were run by the first author with the help of assistants during regular school hours in students' schools. Instructions were the same in every session and were orally delivered (see Online Appendix C for instructions used). We paid all participants in cash before they left the classroom, with the exception of future payments in the time preference experiment (described below).

[4] We always paid 70 Taler to the best student in the classroom; this determined the amount of Taler paid for a correctly solved cognitive ability task in that classroom, such that other students were paid proportionally to the best student.

2.2 Elicitation of Certainty Equivalents (Risk) and Future Equivalents (Time)

The elicitation of both, risk and time preferences in our experiment is based on the elicitation of indifference values. For risk preferences, we elicit the certain amount of money that makes participants indifferent between playing a lottery and receiving a certain amount of money. Similarly, for time preferences, we elicit the amount of money that makes them indifferent between receiving the money at the day of the experiment or with a three weeks delay. We elicit indifference values using a bisection approach, sometimes referred to as staircase method. This approach is widely used in the economics literature (e.g., Falk et al., 2018) and very easy to understand for participants. Participants are faced with one decision between two options at a time. For the risk elicitation, subjects are presented a choice between a sure payoff and a lottery with two equally likely outcomes. Figure 1 presents a sample screen on which a rotating coin with a black and a white side illustrates the equal probability for both outcomes. If a subject chose the sure payoff (the left option in Figure 1), in the next iteration, the amount of the sure payoff would be decreased, whereas if she chose the lottery (the right option in Figure 1), the sure payoff would be increased for the next decision to take. From three such iterations, we deduce indifference values for a specific lottery, the so-called certainty equivalents.[5] In total, we elicit six certainty equivalents for six lotteries.

For time preferences, one option consists of a certain amount at the day of the experiment, and the other option consists of a certain amount with a three weeks delay. Depending on the choice, the amount paid with a three weeks delay is either increased or decreased, and the decision is repeated. For time preferences, we iterate this step four times.[6]

We have devoted priority and considerable care to the understanding of our experimental tasks since noise in elicited preferences obviously impedes precise predictions of field behavior and because complexity of an elicitation task can affect measured preferences, even to the extent that it masks existing patterns in the sample. For example, Charness et al. (2018) show that multiple price lists produce enough noise through confusion and inconsistencies to mask a gender difference in risk taking that is found when only a single decision of the choice list is used.

[5] See Appendix A for an example illustrating in detail the computation of a certainty equivalent for a lottery depending on participants' decisions.

[6] The exemplary illustration of the staircase method for certainty equivalents in Appendix A also applies to this case, where $L_1 = 100$ and $L_2 = 140$ are the amounts in the first iteration for immediate and delayed payments, respectively.

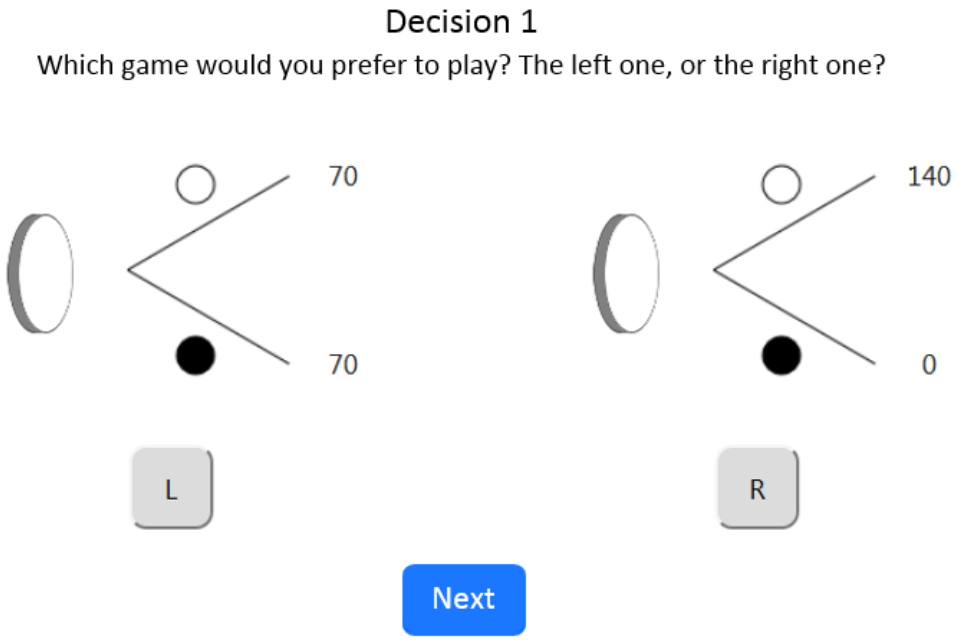

Figure 1: Elicitation of (Higher Order) Risk Preferences via Certainty Equivalents: Exemplary Decision Screen

Therefore, we do not apply choice lists but ask for one decision at a time.[7] Moreover, Charness et al. (2018) report that giving examples and reading out instructions decreases noise and inconsistencies; a finding that we incorporated in our experimental procedures and instructions.

In total, students made 18 decisions between a sure amount and a lottery with two equally likely outcomes, and four decisions between an earlier payoff and a later payoff. Among all decision tasks (i.e., decision tasks on risk and time preferences), one was randomly selected for payment by the computer. If one of the certainty equivalence tasks was selected, and the participant chose the lottery, a coin flip was simulated by the computer to determine the realization of the lottery. The payoffs in these tasks ranged from 0 to 140 Taler. If one of the time preference tasks

[7] It has been argued that the staircase method may lead subjects to not reveal their preferences truthfully in order to increase possible outcomes at later stages (e.g., Harrison, 1986). Ex-post, by analyzing choice behavior, this concern can be ruled out, and indeed, in our data there is no evidence whatsoever pointing at individuals gambling the method. To the contrary, aggregated over all lotteries, and robust to analyzing grades in isolation, students chose the safe option significantly more often in the first iteration compared to the second or third iteration, even if we control for possible learning effects by controlling for the number of the lottery played. Given that the safe outcomes that depended on participants' previous choices could not be recognized as they were not appearing at any previous stage (similar to, e.g., Abdellaoui et al., 2011, and as illustrated by an examplary calculation of certainty equivalents in Appendix A), and that even cognitively far superior populations as ours are not exploiting the chained structure of our decision tasks (e.g., students in van de Kuilen and Wakker, 2011), we anticipated this result, and deliberately opted for this method due to its suitability for our subject pool.

was selected for payment and the later payment was chosen, it was handed over to the student at the prespecified date. Headmasters and teachers administered the payment in an anonymized way, and this was announced and carefully explained before the experiment. The payoffs in the time preference tasks ranged from 100 to 140 Taler.

As our measure of time preferences (i.e., impatience) we compute the ratio of the future equivalent of the earlier payoff to the early payoff. In all time preference questions, we used 100 Taler as the early payoff option. The measures applied for higher order risk preferences are explained in the following.

2.3 Experimental Measurement of Higher Order Risk Preferences

Higher order risk preferences are now often defined as noted in the introduction, by preferences over the allocation of zero-mean lotteries (Eeckhoudt and Schlesinger, 2006). Under expected utility theory, these definitions are equivalent to definitions based on derivatives of the utility function. For example, just as risk aversion can be defined as a negative second, *prudence* is defined as a positive third, and *temperance* is defined as a negative fourth derivative of the utility function.[8]

Method

For the elicitation of intensity measures of (higher order) risk preferences, we use the publicly available oTree implementation of the method introduced by Schneider et al. (2019).[9] This method builds on the elicitation of utility points, for which we use the certainty equivalent method with equally likely outcomes.[10] In the last subsection, we have described how we elicit the sure amount of money that makes participants indifferent between playing a lottery and receiving a sure amount of money, the so-called certainty equivalent. We now describe how we can elicit utility points with this procedure. First we normalize the utility function, such that for the highest

[8]Higher orders also exist, but we are not aware of any behavioral consequence that has been attributed to, for example, *edginess* (positive fifth derivative), nor have previous results on their prevalence shown encouraging patterns that call for further investigation (Deck and Schlesinger, 2014).

[9]See `http://horp-otree-apps.sebastianschneider.eu/` for an illustration of the implementation and Schneider and Baldini (2020a) for the corresponding paper.

[10]Schneider et al. (2019) point out that the method also works with other methods to elicit utility points, such as the tradeoff method (Wakker and Deneffe, 1996), or the lottery equivalent method (McCord and de Neufville, 1986). Since many of our high school students, in particular the younger ones, are not well acquainted with the concept of probabilities, we rely on equiprobable two-outcome lotteries that are decided by a a coin flip with which all students are familiar from everyday life.

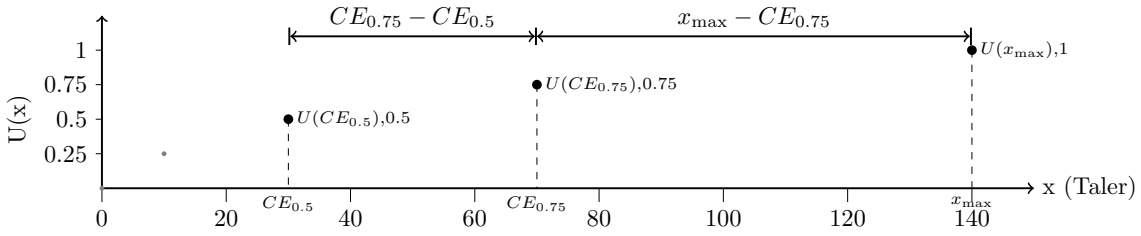

Figure 2: Adaptive Elicitation of Utility Points

possible outcome of $x_{\max} = 140$ Taler we assume $u(x_{\max}) = 1$ and for $x_{\min} = 0$ Taler, the lowest possible outcome, we have $u(x_{\min}) = 0$. Then the expected value of a lottery with these two equally likely outcomes is $0.5u(x_{\max}) + 0.5u(x_{\min}) = 0.5$. As a subject should be indifferent between receiving the elicited certainty equivalent $CE_{.5}$ and the lottery, the utility to her must be the same, thus we have for the utility of this certainty equivalent $u(CE_{.5}) = 0.5$. Iterating this procedure, and taking $CE_{.5}$ as either the high outcome of the lottery (where the low outcome remains $x_{\min} = 0$ Taler), or as the low outcome (where the high outcome remains $x_{\max} = 140$ Taler), we also elicit individual utility points $u(CE_x) = x$ for $x = .25$ and $x = .75$. Additionally, depending on the differences between certainty equivalents, we elicit either $CE_{.125}$ or $CE_{.375}$, and either $CE_{.625}$ or $CE_{.875}$. Figure 2 provides an illustration: the distance between $CE_{.5}$ and $CE_{.75}$ is smaller than the distance between $x_{\max}$ and $CE_{.75}$. Therefore, $CE_{.875}$ is elicited; otherwise, we would have elicited $CE_{.625}$. We do so in order to decrease the differences in elicited utility points on the x-axis, or, put differently, to decrease the maximal difference in subsequent elicited certainty equivalents, to get decisions over a wide range of monetary amounts for every participant. Finally, a last point is elicited to decrease the then largest difference in certainty equivalents.[11]

To connect utility points to a non-parametric utility function, Schneider et al. (2019) propose a smoothing approach based on penalized spline regression (Eilers and Marx, 1996, implemented in the R package `utilityFunctionTools` by Schnei-

[11] If, for example, up to this last step, the certainty equivalents $CE_{.125}$, $CE_{.25}$, $CE_{.5}$, $CE_{.625}$, $CE_{.75}$ have been elicited, this could be one of the following certainty equivalents: $CE_{.0625}$, $CE_{.1875}$, $CE_{.375}$, $CE_{.5625}$, $CE_{.6875}$, $CE_{.875}$.

der and Baldini, 2020b).[12] From those utility functions, derivatives can be calculated analytically with a closed form solution without the need for additional numerical computation (De Boor, 1987). Based on the derivatives of the utility function, attitude measures can be calculated as follows.

Attitude Measures

We define measures of (higher order) risk preferences based on the elicited individual utility functions and their derivatives.[13] As a measure of individual risk attitude, we use the Arrow-Pratt measure (Pratt, 1964):

$$r = -u''/u',$$

where positive (negative) values indicate risk aversion (risk loving) and risk neutrality corresponds to $r = 0$.[14] The theoretical importance of the measure is due to Pratt (1964), who shows that r is proportional to the risk premium and establishes that the measure is suitable to compare individuals regarding their risk attitude.

We measure an individual's prudence level with the measure popularized by Crainich and Eeckhoudt (2008):

$$p = u'''/u',$$

where positive (negative) values indicate (im)prudence.[15,16]

Theoretically, our measure is proportional to the prudence utility premium, i.e., the difference of utility between a prudent and an imprudent option, after conversion into monetary terms (Crainich and Eeckhoudt, 2008). Moreover, u'''/u' is also a measure of left-skewness aversion: Modica and Scarsini (2005) show that the increase

[12] The basic idea of penalized spline regression is to allow for an excessive flexibility of the function to be estimated by regressing on a large number of basis functions (e.g., $x, x^2, x^3, \ldots$) that are each defined only on a sub-interval of the function's support. A penalization term is used to balance the trade-off between smoothness and fit to the data, and ensures that just the right amount of flexibility is used. Here, the weight of the penalty term is determined by optimizing the function's predictive quality via cross-validation.

[13] In order to aggregate the derivatives of the predicted utility function for further computation, we predict for each derivative its value at 100 evenly spaced points in the interval from 0 to the highest outcome and build the mean.

[14] Positive values also correspond to aversion of mean-preserving spreads (Rothschild and Stiglitz, 1970), or an aversion to second degree risk in the terminology of stochastic dominance (Ekern, 1980).

[15] Positive values also correspond to downside risk aversion as defined by Menezes et al. (1980) or third-degree risk aversion (Ekern, 1980).

[16] Note that our measure is different from the well-known measure introduced by Kimball (1990) in order to be able to compare risk averse and risk seeking subjects: For a prudent individual, the Kimball measure $-u'''/u''$ might be positive or negative depending on her risk attitudes.

(decrease) in premium that is due to an increase (decrease) in left-skewness (right-skewness) is proportional to this measure.[17]

As an individual measure of temperance, we use the measure due to Denuit and Eeckhoudt (2010):

$$t = -u^{iv}/u',$$

where again positive (negative) values indicate (in)temperance. [18]

Denuit and Eeckhoudt (2010) show that this measure is proportional to the increase in premium due to an increase in fourth-order risk and thus the measure $-u^{iv}/u'$ is a measure for temperance and dislike of kurtosis alike.

3 Results on Higher Order Risk Preferences and Discussion

We now present results on higher order risk preferences and their influence factors and discuss our findings. For distributions of our measures of higher order risk preferences, see Figure B-1 in Appendix B.

3.1 Results

In our pre-analysis plan, we have specified directional hypotheses for the relation between the risk preferences risk aversion, prudence and temperance and the influence factors age, cognitive ability and gender. For all other possible influence factors investigated, we correct p-values for multiple hypothesis testing using the Romano-Wolf procedure with 1,000 iterations (Romano and Wolf, 2005a,b, 2016). These additional influence factors are impatience, relative math grade, relative German grade (where positive variables imply above average performance relative to the grade), the amount of pocket money per week, relative BMI, the number of siblings, the religion, migration background, parents' education (indicating separately whether mother and father have a university entrance diploma each) as well as parents' occupation (both parents full-time employed, one parent full-time and the other one part-time employed, ...).

In the main text, we report results for the whole sample. Very few participants reported a problem in handling their tablet at some point during our study. Even though our assistants were spread across the room and trained to solve such issues

[17] Note that their result appears to differ slightly from ours due to a presumably non-intended sign reversal.

[18] Positive values also correspond to an aversion to fourth-degree risk.

Table 2: Influence Factors of (Higher Order) Risk Preferences

	[1] Risk aversion		[2] Prudence		[3] Temperance	
Age (in years)	−0.011	(0.017)	−0.012	(0.017)	−0.002	(0.016)
Cognitive ability	−0.145***	(0.041)	−0.058	(0.055)	−0.121**	(0.042)
Female (=1)	0.270***	(0.087)	0.240**	(0.108)	0.182**	(0.084)
Impatience	−0.855***	(0.283)	−0.597**	(0.254)	−0.673**	(0.290)
Other Factors	10		10		10	
School controls	yes		yes		yes	
R^2	0.08		0.06		0.05	
Observations	634		634		634	

Notes: Positive coefficients imply increasing risk aversion, prudence and temperance, which are expressed in standard deviations. Cognitive ability scores are standardized, such that above average scores are positive. Other possible influence factors controlled for are relative math grade, relative German grade (where positive variables imply above average performance relative to the grade), the amount of pocket money per week, relative BMI, the number of siblings, the religion, migration background, parents' education (indicating separately whether mother and father have a university entrance diploma each) as well as parents' occupation; see Tables B-1, B-2 and B-3 for detailed regressions results and Tables B-4, B-5, B-6, and B-7 for regression results excluding participants that reported problems with handling their tablets during our study. For 24 participants, some demographic information is missing (mostly, children were unaware of their parents' education or occupation), which explains the lower number of observations in this table. Robust standard errors clustered at the session level in parentheses. P-values for factors omitted in this table and for impatience are corrected for multiple hypothesis testing using the Romano-Wolf procedure with 1,000 iterations (Romano and Wolf, 2005a,b, 2016).

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

quickly, problems with the tablet could result in noisy measurement of our timed cognitive ability tasks. However, as we document in Tables B-4 to B-7 in the Appendix, excluding these potentially noisy measurements of cognitive abilities leave our findings unaffected.[19]

Risk Aversion We find significant risk aversion in our sample. We estimate a mean (median) Arrow-Pratt coefficient of risk aversion, expressed in standard deviations, of $r = .46$ (.35), with 0 indicating risk neutrality (p-value < 0.0001, Wilcoxon signed-rank test,[20] testing whether r is different from 0). For 71% of our sample, we estimate a positive Arrow-Pratt coefficient, implying risk aversion. A regression including a measure for cognitive abilities and demographic background variables

[19] We alerted students to report any issue to make sure that entered decisions and answers were as intended and to prevent any data entry mistakes. In total, 54 subjects (8% of the total sample) reported a problem in handling their tablet at any time during participation in our study. The most frequently reported problem was, for example, a non-responding touch-screen of the tablets. In this case, a team of up to 8 assistants spread across the room was prepared to replace their tablet within less than ten seconds, allowing them to continue the study at exactly the same screen without loss of data. All other parts of the experiment and the questionnaire were not timed, and possible problems could be solved by our assistants without affecting results.

[20] For ease of exposition, all tests reported in this paper are two-sided.

is shown in column [1] of Table 2. The regression shows a gender and a cognitive ability effect, as expected: Girls are significantly more risk averse than boys. Individuals with higher cognitive abilities are significantly less risk averse. Age is unrelated with risk aversion, once we control for cognitive abilities, which is in line with our hypotheses. This suggests that risk aversion is rather affected by the increase in cognitive abilities due to an increase in age than just by growing older and becoming more experienced. One additional influence factor, impatience, is significantly related with a lower degree of risk aversion. All other independent variables mentioned above and in the legend to Table 2 are not significant (see Table B-1 for full estimation details).

Prudence On the aggregate level, we find prudence in our sample. The mean (median) estimate of the Crainich-Eeckhoudt measure expressed in standard deviations is $p = .56$ (.22), where positive (negative) values indicate (im)prudence (p-value < 0.0001, Wilcoxon signed-rank test, testing whether the prudence measure p is different from 0). For 68% of our sample, we estimate a positive Crainich-Eeckhoudt measure, implying prudence. For the relations with prudence that we had hypotheses for (age, cognitive abilities, and gender), the regression shown in column [2] of Table 2 only reveals a gender effect: Girls are significantly more prudent than boys, as expected. However, contrarily to our hypotheses, neither cognitive abilities nor age are significantly related with prudence. All other independent variables (except for impatience and the weekly amount of pocket money) are not significant once p-values are corrected for multiple hypothesis testing (see Table 2 for impatience and Table B-2 for all other variables).[21,22]

Temperance In the aggregate, our sample exhibits temperance. For the Denuit-Eeckhoudt measure of temperance, our mean (median) estimate is $t = .3$ (.02), again expressed in standard deviations (p-value < 0.0001, Wilcoxon signed-rank test, testing whether t is different from 0). Given a positive Denuit-Eeckhoudt measure, 58% of our sample can be classified as temperant. The regression of temperance on demographic background variables reported in column [3] of Table 2 shows the same pattern as the regression of risk aversion: Girls are more temperant than boys (as expected), and students with a higher value of our cognitive ability measure and

[21] Since the coefficient for the weekly amount of pocket money is economically negligible compared to the other significant factors – an increase of more than 100 Euros per week translates to an increase in prudence of less than .8 standard deviations – we have omitted this factor in Table 2).

[22] Interestingly, when excluding participants that reported a problem with handling their tablet, impatience is no longer significant; see Table B-6. These participants are not more impatient than the others, but they are more prudent. This suggests that they were overly cautios in reporting a problem, when in reality, it might have just been a delay in showing the next screen.

Table 3: Correlation Between (Higher Order) Risk Preferences

	Full Sample			Risk Seeking Subjects		Risk Averse Subjects	
	Risk aversion	Prudence	Temperance	Risk aversion	Prudence	Risk aversion	Prudence
Prudence	0.559***			-0.876***		0.928***	
Temperance	0.867***	0.652***		0.846***	-0.878***	0.917***	0.954***
Impatience	-0.133***	-0.0926**	-0.112***				
Observations	658			198		460	

Notes: Pearson correlation coefficients reported; *** denotes significance at the 1 percent level.

the more impatient ones are less temperant (no relation expected and no hypothesis formulated, respectively). There is neither an age effect, nor is any other influence factor significant, once we correct p-values for multiple hypothesis testing (see Table B-3).[23]

Relation between risk aversion, prudence and temperance The measures of risk aversion, prudence and temperance are significantly correlated in our sample, as Table 3 shows (p-value < 0.0001 for all pairwise correlations). The correlation between risk aversion and temperance is the highest ($\rho = .87$). The correlations between prudence and risk aversion ($\rho = .56$) and prudence and temperance ($\rho = .65$) are still large, but a magnitude weaker.

Dividing the sample into risk seekers ($r < 0$) and risk averters ($r > 0$) reveals that the sign of the correlation between risk aversion and prudence changes: For risk seekers, the degree of prudence increases as the degree of risk aversion and temperance decreases, while for risk averters prudence increases when risk aversion and temperance increase (note here that for risk seekers the coefficient of risk aversion is negative). The relation between risk aversion and temperance, however, is positive independent of being risk averse or not. These patterns are in line with the existence of mixed risk aversion.[24]

Finally, also our measure of impatience is significantly correlated with the (higher order) risk measures (p-value < 0.05 for all pairwise correlations) and the correlation between risk aversion and impatience is the highest ($\rho = .13$).

[23] As for prudence, when excluding participants that reported a problem with handling their tablet, impatience is no longer a significant influence factor; see Table B-7. Again, these participants are more temperant than those never reporting any problem.

[24] Further evidence comes from a principal component analysis, revealing that 96 percent of the variation can be explained by only two components. Risk aversion and temperance have the highest and roughly equal loadings on the first component. Their loadings on the second component are negative, whereas the loading of prudence is the highest on the second component (also in absolute terms).

3.2 Discussion

Overall, we find significantly risk averse, prudent, and temperant behavior in our sample of children and adolescents. This is in line with earlier studies on risk aversion or prudence with adolescents (e.g., Sutter et al., 2019; Heinrich and Shachat, 2018). Among adults, prudence is wide-spread and has been documented in a number of studies (see, e.g., the review by Trautmann and van de Kuilen, 2018). Our finding of 68% of subjects exhibiting prudent behavior is comparable to results by Tarazona-Gomez (2004) and Deck and Schlesinger (2010), for example. For temperance, however, no study has investigated the prevalence among adolescents before, and among adults, results have been mixed. Most studies document temperance, although less prevalent than prudence (Trautmann and van de Kuilen, 2018), which is also what we observe.

The correlations between (higher order) risk preferences that we find are higher than the ones reported by Noussair et al. (2014), Ebert and Wiesen (2014) and Schneider et al. (2019).[25] This is because we find a higher share of risk averters than Schneider et al. (2019) in their sample from Bogotá and because our measures are continuous, thus allowing for a higher precision. Notably, we also find support for the existence of mixed risk averters (Crainich et al., 2013) already among adolescents, which is not yet well documented among adults, but in line with findings by Deck and Schlesinger (2014) and Ebert and Wiesen (2014). However, as results by Deck and Schlesinger (2017) suggest that mixed risk aversion results mainly from the compound lottery design used in these studies, our results are a valuable contribution to this literature, as we use a completely different elicitation method with binary outcomes only, suggesting that the pattern is robust to presentation and elicitation method.

With respect to demographic correlates, we find a gender effect for all risk attitudes, but no age effect, neither for risk aversion, nor for prudence or temperance. While also previous studies among adolescents report a gender effect, but no age effect on risk aversion (Sutter et al., 2019), the finding with respect to age and prudence as well as prudence and gender is in contrast with the only other study on prudence with adolescents by Heinrich and Shachat (2018). Yet, they only use grade as a proxy for age, and they rely on binary comparisons of four-outcome lotteries without controlling for an *absolute* measure of cognitive abilities with a sample of

[25] The studies by Noussair et al. (2014) and Ebert and Wiesen (2014) report rank correlations, whereas we report Pearson correlation coefficients since we have continuous measures. However, also rank correlations between our measures are a magnitude higher and between .43 and .52, with the former being the correlation between risk aversion and prudence and the latter between risk aversion and temperance.

362 Chinese students aged 8 to 17 years. Because their measure of cognitive ability, the math grade, which is *relative* to the age cohort, is a significant predictor of more prudent choices, this suggests that increasing cognitive abilities rather than age might drive their results. However, as Sutter et al. (2019) note in their review, notable changes in risk preferences might occur before the age of 10. Since Heinrich and Shachat (2018) include one grade with children below that age, they might observe significant age effects due to inclusion of this grade. Among adults, Noussair et al. (2014) find no age effect either. Regarding the observation that females exhibit more risk averse, prudent and temperant behavior, our findings are in line with Ebert and Wiesen (2014). Similarly, Noussair et al. (2014) document females exhibiting more risk aversion and temperance, but not prudence.

We have also paid attention to the relation between cognitive abilities and higher order risk preferences, as this relation has attracted increasing interest recently (Dohmen et al., 2010, 2018; Andersson et al., 2016). Moreover, previous literature has documented a positive relation between prudence and cognitive abilities (Noussair et al., 2014; Breaban et al., 2016), but no relation between temperance and cognitive abilities (Noussair et al., 2014). Notably, Noussair et al. (2014) also fail in finding a significant relation between risk aversion and cognitive ability in their (student) sample (N=109), although a negative relationship is well documented in larger studies and when cognition measures target numeracy (see the review on experimental measures and cognitive abilities in Dohmen et al., 2018). Among adolescents, only the relationship between risk aversion and cognitive abilities has been investigated, and either no correlation has been observed, or a tendency towards risk-neutrality with increasing cognitive abilities (Sutter et al., 2019).

In our sample, we also observe a tendency towards risk-neutrality with increasing cognitive abilities. Yet, and in contrast to previous results among adults, prudence and cognitive abilities are unrelated in our sample, while for temperance we observe the same pattern as for risk aversion, namely a tendency towards temperance-neutrality. This differing finding might be due to reduced complexity in our elicitation method in combination with the way previous studies measure higher order risk preferences. Both, Noussair et al. (2014) and Breaban et al. (2016) measure prudence (as well as risk aversion and temperance, if applicable) by the number of choices consistent with the respective trait. Thus, strictly speaking, they find correlations between consistent behavior and cognitive abilities instead of showing a relation between cognitive abilities and intensity measures of higher order risk preferences. Andersson et al. (2016) have shown that such confusion is problematic when relating cognitive abilities and risk preferences in general and Dohmen et al. (2018) discuss further evidence on the topic. As the elicitation tasks for higher order

risk preferences in Noussair et al. (2014) and Breaban et al. (2016) rely on compound lotteries, it is natural to assume that – even if the whole sample would exhibit a certain trait – those with higher cognitive abilities are more likely to choose consistently, which is in line with reported findings of both studies for prudence. In our study, there is no intellectual hurdle to express prudent behavior, however, which might explain the different findings.

The argument also extends to temperance, and it might explain the whole pattern reported in Noussair et al. (2014) under consideration of the respective prevalences: Choosing consistently in the elicitation tasks they apply is more difficult for temperance than it is for prudence and it is more difficult for prudence than it is for risk aversion. However, contrarily to imprudence, intemperance can be as prevalent as temperance or even more prevalent (see, e.g., Deck and Schlesinger, 2010). Thus, whereas behaving imprudent might mostly be a result of confusion and thus be negatively related with cognitive abilities, behaving consistently intemperant in the applied elicitation tasks might be as positively related with cognitive abilities as behaving consistently temperant, resulting in a zero net effect of cognitive abilities on choosing consistently temperant.

After having presented our results on risk aversion, prudence and temperance in our sample of 658 students and the potential determinants of these (higher order) risk preferences, we turn to the second main contribution of our paper, namely their relation to students' field behavior. Because the introduction only briefly touched upon the different types of field behavior, we start in Section 4 with a more detailed description of the various types and present in particular also the theoretical predictions about the relationship between higher order risk preferences and field behavior that can be derived from a variety of theoretical papers. In Section 5 we will then show the empirical relationships between higher order risk preferences and the different types of field behavior.

4 Eliciting Different Types of Field Behavior

We have collected survey data on field behavior regarding financial decision making, the health domain, pro-environmental behavior, prevention effort in a more general sense, planning behavior and preference for competitive income (see Appendix D for all questions with answer possibilities). Additionally, we gathered information on general risk taking via standard survey questions on risk and time preferences and with the (adapted) DOSPERT questionnaire on domain specific risk-taking (Weber et al., 2002). In the following, we present each of the different types of field

behavior in more detail, including the theoretical predictions and explaining what type of questions we were asking.

4.1 General Risk Taking and Patience Behavior

Consistency of risk elicitation methods across tasks and survey questions has gained considerable attention, probably partly due to recurrently less encouraging results (Pedroni et al., 2017; Crosetto and Filippin, 2015; Deck et al., 2013). As we use a novel, not yet established elicitation method for risk preferences, we are first interested in how well the method and our implementation perform in predicting standard survey questions. Specifically, we use the by now standard question on willingness to take risk in general, first included in the German socio-economic panel (SOEP; Wagner et al., 2007; Dohmen et al., 2011; Falk et al., 2018). Then we use an adapted subsample of the DOSPERT questionnaire (Weber et al., 2002) that was built to assess risk in the domains of financial decisions, health/safety, recreational, ethical and social decisions. We use a subset of these questions to account for our underage sample: some questions (e.g., having an affair with a married person, cheating on one's tax return or betting a day's income at the horse races) would induce low variation and seem inappropriate to ask to adolescents as young as of age 10. Moreover, we adapted some questions (e.g., using a helmet when riding a bike instead of riding a motor bike) and added some more that might be relevant to our sample (e.g., having a date with someone that they have met via the internet/social media/apps). The questions we have used for our adapted DOSPERT questionnaire are printed in Appendix D.1, together with the question on willingness to take risk.

To check whether our measure of impatience actually measures impatience, we also added the standard time survey question from the SOEP and the global preferences survey (e.g., Wagner et al., 2007; Vischer et al., 2013; Falk et al., 2018) and three general questions on patience and self-control (e.g., "I always do my homework as early as possible."), see the survey questions and our 'General Impatience Scale' in Appendix D.1.

4.2 Financial Decision Making

A positive third derivative of the utility function was linked to financial decision making, in particular precautionary saving, by Leland (1968) long before Kimball (1990) coined the term prudence and introduced the now well-known measure for its strength. Temperance is theoretically related with less risky investments as reaction to greater background risk (Kimball, 1992; Gollier and Pratt, 1996). The demand for insurance and its positive relation to risk aversion is usually already

discussed in basic economics textbooks, and it has been connected to prudence and temperance in the presence of background risk (e.g., Eeckhoudt and Kimball, 1992). Theory remains inconclusive about the impact of prudence and temperance on insurance demand: According to Fei and Schlesinger (2008), for example, a more risk averse, but less prudent individual purchases more insurance if background risk appears in the state of the world, where no loss occurs, whereas a more risk averse and more prudent individual has a higher insurance demand if background risk occurs in the 'loss state'.[26] Noussair et al. (2014) were the first to examine the mentioned relationships with experimental risk measures. They explore higher order risk preferences and financial decision making among the general population in the Netherlands, and base their risk measures on the elicitation method by Eeckhoudt and Schlesinger (2006). While they find support for the relation between saving and prudence, and less risky investment and temperance, they report that there is no robust connection between insurance and their risk measures.

To study whether decision making in our sample follows the same general patterns, we include questions on saving, risky investments and insurance coverage: To collect field behavior on saving, we ask students for example what fraction of a gifted 50 Euro bill they would save, or how they handle their pocket money, where possible answers range from "I spend everything quickly" to "I save everything". A preference for risky investment is assessed with questions like "Have you ever used money that was originally intended for something else at a subsequent date (e.g. for holidays or a present), for a bet or invested it in stocks"? To address insurance demand, we ask for the possession of a bike or phone insurance, and whether students bought it themselves. See Section D.2 in Appendix D for the full list of items included in the questionnaire to target financial behavior.

4.3 Health-Related Behavior

Without clear-cut prediction about its impact on behavior, prudence has been linked theoretically to the health domain, for example by studying multivariate risk taking (e.g., Eeckhoudt et al., 2007), prevention effort[27] (e.g., Courbage and Rey, 2006), the demand for medical care (e.g., Dardanoni and Wagstaff, 1990), or medical treatment decisions (e.g., Bleichrodt et al., 2003; Krieger and Mayrhofer, 2012). Yet, we are not aware of any empirical study connecting higher order risk preferences with

[26] The following scenario is an example for the first case: Wealth consists of a cash and a non-cash component with uncertain value that can be insured (a painting, or a house). Here, wealth is certain if the the non-cash component is stolen or destroyed, and will remain uncertain in the no-loss state until it is sold.

[27] See also the section on prevention, where some of our questions target prevention in the health domain.

behavior that may risk one's health status, such as smoking, drinking or also excessive use of smartphones. This is surprising given the interpretation of prudence as downside risk aversion (Menezes et al., 1980) and aversion to left-skewness (Ebert, 2012; Modica and Scarsini, 2005). For example, as smoking increases the probability of cardiovascular diseases, it may be seen as a typical example of a downside risk, or where the distribution of risk is left-skewed: There may be a relatively small positive outcome with a high probability resulting from enjoyment of smoking, which, however, is combined with a low-probability but high-impact negative outcome due to a cardiovascular disease.

To test the importance of higher order risk preferences for behavior putting one's health status at risk, we include several questions in our questionnaire to capture this behavior. Notably, we include a novel, self-constructed scale consisting of 6 questions to capture smartphone and social media addiction, as this kind of addictive behavior has gained tremendous attention over the last decade (e.g., Karaiskos et al., 2010; Hormes et al., 2014; Andreassen, 2015; Andreassen et al., 2017; He et al., 2017; Bányai et al., 2017; Turel et al., 2018). Yet, to our knowledge, it has been ignored in the risk taking literature so far. Abusive smarthpone usage is assessed with questions such as "When I feel bad or when I face a difficult task, I distract myself with my smartphone.", "I feel uncomfortable (e.g., nervous or fretful or disquiet or a bit sad) when I cannot use my smartphone for a considerable time, because of an empty battery, no signal, or because my smartphone was taken away.", or "I often check my phone while eating with my family to see if there are any news." In addition to abusive smartphone usage, our addictive behavior index comprises smoking and drinking behavior, which is assessed by the respective frequency. Behavior that generally is a risk to health is measured, e.g., by the BMI or by physical inactivity. See Section D.3 in Appendix D for the full list of items addressing health-related behavior.

4.4 General Prevention and Environmentally Friendly Behavior

Prevention in the sense of self-protection is understood as effort that lowers the probability of the occurrence of an adverse event (Ehrlich and Becker, 1972). It has been theoretically connected to prudence (Eeckhoudt and Gollier, 2005; Menegatti, 2009). In one-period models, the preventative effort and the potential loss are contemporaneous. Contrary to intuition, in this setting, prudence has a negative impact on the optimal level of prevention, since the prudent agent prefers to accumulate wealth to face future risks (Eeckhoudt and Gollier, 2005). In two-period models,

the preventative effort precedes the potential loss. In that setting, the relation between prudence and the optimal level of prevention is positive (Menegatti, 2009).[28] In the abstract setting of a laboratory experiment, Krieger and Mayrhofer (2016) find empirical support for the predictions of the one-period models in the literature: Prudent subjects invest significantly less money than nonprudent subjects to reduce the probability of a loss. We are unaware of any study empirically investigating prevention in a two-period framework.

For the purpose of studying real world preventative and pro-environmental efforts and their relation with prudence, we include several questions in our questionnaire. We distinguish between actions preventing an unwanted event that might arguably happen on the same day (one-period model) and those that aim to prevent events happening in the more distant future (two-period model). For example, agreement to the statement "Since I think of packing something to eat and drink during longer journeys by bus, train or car, I am not hungry or thirsty in such situations." indicates effort provision in order to prevent hunger, an event that is likely to happen on the same day. Contrarily, agreement to the statement "Since I do not know yet what I would like to become later, I try to get good grades to keep all possibilities open to me." indicates effort provision in order to prevent a missed chance to become, e.g., a medical doctor or a lawyer; an event that will happen only with considerable time delay in the future. Additionally, we add questions on environmentally-friendly behavior. For example, we ask whether students separate their waste, use reusable coffee cups and bottles, use reusable bags for shopping, take their bike when possible (instead of a bus or car), or turn down the heating if leaving a room. See Section D.4 in Appendix D for the full list of items included in the questionnaire to target prevention effort and environmentally-friendly behavior.

4.5 Preference for Competitive Income

In the context of the German reunification "experiment", Fuchs-Schündeln and Schündeln (2005) discuss self-selection of risk averse individuals into low-risk occupations and its importance for precautionary savings. They compare the difference in precautionary savings between civil servants and the remaining population in the East of Germany with this difference in the West of Germany. From a larger difference in the East of Germany, where all occupations were basically risk free before reunification, they infer that risk averse individuals self-select into jobs as civil servants in the West of Germany. They explicitly mention that their argument builds on the

[28] Strictly speaking, those are the predictions for a loss that occurs with the same probability as it does not occur. For other probabilities, the predictions are more nuanced, but perfectly opposed in the two models.

assumption that – at least on average – risk aversion equals prudence. Dohmen and Falk (2011) provide support for self-selection of risk-averse individuals into riskier payment schemes, but lack a control for prudence.

As we have separate, direct measures of these preferences, we include two questions on occupational choice in our questionnaire ("Would you like to be a civil servant?", "Would you like to be self-employed?") and two hypothetical questions to ask whether our participants would prefer a fixed or a tournament payment over a piece-rate payment for the cognitive ability tasks. See Section D.5 in Appendix D for the exact wording of the items used.

4.6 Planning Behavior

In his seminal paper in which he developed the "theory of the optimal response of decision variables to risk (which includes precautionary saving as a subcase)", Kimball (1990, p. 54) *defined* prudence as the "sensitivity of the optimal choice of a decision variable to risk", thus the degree to which plans are adapted to risk.

Using two questions (plus an additional question for the 12-th graders), we test if we find support for prudence in this more general sense as a measure of cautious planning. The decision situations considered are preparation for a class test, being on time for a meeting or handing in an assignment. We ask participants how much more time they invest in the given situations, if risk increases by a more uncertain scope of the class test, or by red lights on the way to the meeting, or any incident that may delay handing in an assignment. See Section D.6 in Appendix D for the exact wording of the items used.

4.7 Building Indices for the Different Types of Field Behavior

For most of the questionnaire, we obtained data for all 658 students.[29] We build indices for the different domains of behavior, involving between three (planning behavior) and 25 questions (adapted DOSPERT catalogue). Importantly, all indices contain all information that we have obtained for an individual in the respective area. For example, the index capturing environmentally friendly behavior is composed of all items that we have included in the questionnaire targeting at this kind of

[29]Some questions, however, were not asked to the youngest students (e.g., drinking or dating behavior), in accordance with our agreements with participating schools and to get meaningful results (see the respective column for a question in Appendix D).

behavior.[30] To aggregate results for a varying number of questions across age cohorts with possibly also differing meaning and variation, we first build indices per age cohort using weights from a principal component analysis (PCA), which we then center and standardize for final aggregation, in accordance with our pre-registered analysis plan.[31] Therefore, all of our dependent variables are centered, standardized and continuous and we thus use least squares regression.

5 Higher Order Risk Preferences and Field Behavior

Now we turn to the relationship between higher order risk preferences and field behavior. For comparison reasons, we standardize our measures of risk and time preferences. Hence, coefficients report the effect of a one standard deviation increase in these measures. Recall from Table 3 that our measures of risk and time preferences are highly correlated. To ease interpretation of coefficients and to avoid multicollinearity, we orthogonalize these measures.[32] For example, we remove the variation from the temperance measure that is already explained by prudence, risk aversion and impatience. We do so by predicting temperance on the individual level, using each individual's risk aversion, prudence and impatience measure. Then we subtract this prediction from the actual measure to obtain the variation not yet explained by prudence, risk aversion and impatience. Before, the same is done iteratively for prudence, risk aversion and time preference. This way, either the risk aversion, the prudence, or the temperance measure remains as is, and we pick the

[30] Our indices on health and investment behavior arguably can be additionally complemented with some questions from the (adapted) DOSPERT questionnaire or the questions on prevention. For example, the question "Have you ever used an entire week's pocket money for a bet?", which is part of the (adapted) DOSPERT questionnaire, could be interpreted as a preference for risky investment, although not part of the set of items that we intentionally included in the questionnaire to ask for that specific behavior. Using items like these, we can build additional indices, consisting of all items from the original index, and additionally other items that might be relevant for the behavior under study. Adding additional items that target the behavior under study to the corresponding index yields qualitatively the same results as those shown in the next section (see Appendix B for these robustness checks).

[31] One index, the preference for competitive income index, is not aggregated using PCA. As it consists of only 4 binary questions, the support of the index consists of only 16 elements. Here, using weights from a PCA per age cohort would shift the support for every age cohort marginally, thus introducing noise in the measure when aggregating the indices rather than precision. Therefore, we compute z-Scores for every item and add them.

[32] Ridge regression (e.g., Hoerl and Kennard, 1970) is another way of handling multicollinearity, see Table B-27 in the Appendix for corresponding results and further details on the approach applied. Results are very similar, but as Ridge regression yields biased coefficients (Gruber, 2017) and for ease of interpretation of coefficients, we present results from orthogonalized measures in the main text.

measure that matters according to theory for the respective index (see the predictions in the previous subsections).[33] In the regressions, we include the untouched measure and the residuals of the others resulting from predictions using the remaining measures. Results from regressions on correlated measures instead of on orthogonalized measures are printed in the Appendix, see Table B-26. Note that due to multicollinearity both coefficients and standard errors are imprecise in that table. Results are, however, very similar to those presented in the main text.

Before turning to the relationship between our risk preferences and field behavior, we would like to note that our experimental measures of (higher order) risk preferences are estimates and thus involve some degree of error. A way to deal with this is multiple imputation (e.g., Rubin, 1996; Horton and Lipsitz, 2001).[34] Originally, this procedure was developed for dealing with missing values, where – roughly speaking – the missing values are repeatedly replaced by any means of imputation using the remaining data in different combinations. For every imputation, the regression is run once. Then, from all these regression results on partly imputed data, accurate computation of standard errors is possible, accounting for the degree of uncertainty in the data. In our case, we account for the uncertainty in the data using multiple imputation by first deleting one elicited utility point before estimating the utility curve with the remaining utility points, and then using the resulting estimate as predictor for our regressions of field behavior. As our results are robust to using the multiple imputation approach described here, we report results from least squares regressions in the main text. For results obtained using multiple imputation, see Table B-25 in the Appendix.

5.1 General Risk Taking and Patience Behavior

As a kind of validation of our experimental measures with adolescents, we start by analyzing how our experimental measures relate to standard survey questions about risk attitudes and patience. Results are summarized in Table 4. Our experimentally elicited Arrow-Pratt measure of risk aversion significantly predicts the willingness to take risk as elicited via the survey question at the 0.1% significance level. Notably, also our experimental Crainich-Eeckhoudt prudence measure and the experimental Denuit-Eeckhoudt temperance measure both significantly predict willingness to take risk; the former even at the same significance level as risk aversion. Our measures of prudence and risk aversion also significantly predict risk taking behavior as measured by our adapted DOSPERT scale.

[33] If theory does not suggest one measure as the most important one, we take prudence, as it has the lowest correlation with the other two measures on average.

[34] We thank Glenn Harrison for suggesting this.

Table 4: (Higher Order) Risk Preferences and General Survey Questions/Questionnaires on General Risk Taking and Patience

	Risk tolerance (Survey, SOEP)		DOSPERT (Adapted)		Patience (Survey, SOEP)		General Patience	
				OLS regression results				
Risk aversion (AP)	-0.998****	(0.208)	-0.283****	(0.066)	0.074	(0.203)	0.087	(0.084)
Prudence	-0.485****	(0.087)	-0.098*	(0.047)	-0.034	(0.073)	0.115**	(0.045)
Temperance	-0.253*	(0.120)	-0.047	(0.045)	0.097	(0.118)	0.096	(0.055)
Impatience	0.088	(0.098)	0.165***	(0.046)	-0.522****	(0.087)	-0.145***	(0.044)
R^2	0.092		0.058		0.059		0.041	
Observations	653		658		653		658	

	Risk tolerance (Survey, SOEP)	DOSPERT (Adapted)	Patience (Survey, SOEP)	General Patience
		Raw Pearson correlation coefficients		
Risk aversion (AP)	-0.270****	-0.150****	0.022	0.135****
Prudence	-0.202****	-0.099**	-0.017	0.116***
Temperance	-0.192****	-0.092**	0.015	0.131****
Impatience	0.075*	0.184****	-0.240****	-0.161****
Risk tolerance (Survey)		0.270****		
Patience (Survey)				0.148****

Notes: Positive coefficients imply increasing risk tolerance (as measured by the standard survey question on willingness to take risk in general, see Dohmen et al., 2011), increasing general risk taking behavior, and increasing patience (where 'survey' refers to the standard survey question on patience, see Vischer et al., 2013) in the upper panel ("OLS regression results") and positive correlations in the lower panel ("Raw Pearson correlation coefficients"). Experimental risk and time measures are expressed in standard deviations in the upper panel. Outcome indices are formed using PCA weights and are standard normalized (single item survey questions are used without transformation). Questions included in these indices are listed in Section D.1 in the questionnaire in Online Appendix D. See Tables B-8 and B-9 for additional regression results. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Interestingly, while the coefficient of risk aversion indicates that a one standard deviation lower risk aversion is associated with a one degree higher willingness to take risk on a scale from 0 to 10, the coefficient of prudence is still about half as large and the coefficient of temperance about a quarter as large. This points to the fact that general risk taking behavior, as we understand it in everyday language, might only be insufficiently captured by risk aversion alone.

The results regarding patience show the hypothesized relations between a single item survey question, a general patience scale and our experimental measure of impatience, all at a significance level of at least 1%. Interestingly, also prudence is positively related with our general patience scale.

Via the use of Pearson correlation coefficients and the meta study METARET (Crosetto, 2019), we can compare our method with alternative experimental measures of risk aversion and their correlation with the SOEP survey question. Our results with respect to this question are printed in the column "Risk tolerance (Survey)" (partial correlations in the upper panel, and pair-wise Pearson correlation coefficients in the lower panel of Table 4). In METARET, Pearson coefficients of experimental measures with the SOEP question range, on average, from .12 (N = 3,463) for the Bomb Risk Elicitation Task (BRET) to −.04 (N = 983) for the Certainty Equivalent price list, when using raw choices. Interestingly, the probably most widely used Holt and Laury method performs worse in this aspect than the BRET, with a correlation of .1 (N = 7,552). When estimating Arrow-Pratt risk aversion coefficients, no correlation coefficient exceeds .1. Our method has a close to thrice as large coefficient – namely .27 – as the pooled Pearson correlation of the best method surveyed by the METARET study.

5.2 Financial Decision Making

Results on financial decision making are reported in Table 5. Already for adolescents and as predicted by theory, prudence matters for (net) saving and temperance is negatively related to risky investment, even when controlling for our, as it appears, important measure of time preferences (a control variable that is missing in the study by Noussair et al., 2014). Financial insurance demand is unrelated with risk aversion, and negatively related with prudence, which is predicted by theory for the case when the insured object is of uncertain value.[35] Moreover, temperance is significantly related to saving, as is impatience in a negative way, and also risk aversion and prudence are negatively related with risky investment.

[35]This assumption seems realistic given that we asked for smartphone and bike insurance, i.e., insurance for two items that are heavily used by adolescents and decline in value relatively fast, where the decline additionally depends on the treatment of the item.

Table 5: (Higher Order) Risk Preferences and Financial Decision Making

	Saving (w./ Debt)		Risky Investment		Fin. Insurance	
Risk aversion (AP)	0.093	(0.115)	-0.161*	(0.078)	-0.064	(0.073)
Prudence	0.060*	(0.032)	-0.103*	(0.049)	-0.062**	(0.025)
Temperance	0.110**	(0.049)	-0.064**	(0.024)	-0.010	(0.069)
Impatience	-0.222***	(0.036)	0.013	(0.027)	0.021	(0.041)
R^2	0.061		0.017		0.0054	
Observations	658		658		658	

Notes: Positive coefficients imply increasing likelihood to save, invest in risky assets or possess an insurance. Risk and time measures are expressed in standard deviations. Outcome indices are formed using PCA weights and are standard normalized. Questions included in these indices are listed in Section D.2 in the questionnaire in Online Appendix D. See Tables B-10, B-11 and B-13 for additional regression results, and Table B-12 for results when additionally using questions from Section D.1 for the index on risky investment (see the indications in Section D.1 for details). Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Although these results are in line with theory (Leland, 1968; Kimball, 1992; Eeckhoudt and Kimball, 1992; Fei and Schlesinger, 2008) and previous empirical findings (e.g., Noussair et al., 2014), they should be interpreted with care, since in particular younger adolescents may only have limited exposure to and experience in certain domains of financial decision making – among them probably insurance and investment.[36] In this light, it might not be surprising that, e.g., temperance seems to be more important for saving than prudence, although theory posits an unambiguously positive relationship only for the latter (which we also find), or that the results regarding investment and insurance depend on the inclusion or exclusion of gender, age and financial control variables (see Tables B-11 and B-13 in the Appendix). Actually, the fact that we find the predicted relations already among adolescents despite those limitations suggests that higher order risk preferences are robustly related to financial behavior.

5.3 Health-Related Behavior

Results with respect to health-related behavior are summarized in Table 6. Patience is positively correlated with healthy behavior, and so is prudence (in line with the predictions derived in Section 4 and similar in spirit to empirical results by Attema et al., 2019, who find subjects behave prudent when (hypothetically) deciding on remaining years to live). The results with respect to prudence are mainly driven by addictive behavior (as the magnitude of coefficients increases while significance

[36]For example, our questions on insurance demand asking about possession of a bike or mobile phone insurance, or our questions on possession or plans to acquire stocks might not be particularly meaningful to some, in particular younger, participants in our sample.

Table 6: (Higher Order) Risk Preferences and Health-Related Behavior

	Unhealthy Behavior		Addictive Behavior		Smartphone Addiction	
Risk aversion (AP)	0.030	(0.086)	0.015	(0.086)	0.001	(0.088)
Prudence	-0.137***	(0.035)	-0.144***	(0.034)	-0.154****	(0.033)
Temperance	-0.023	(0.064)	-0.016	(0.062)	0.001	(0.054)
Impatience	0.161***	(0.039)	0.163***	(0.040)	0.154***	(0.038)
R^2	0.039		0.041		0.040	
Observations	561		561		561	

Notes: Positive coefficients imply increasing engagement in unhealthy or addictive behavior. Risk and time measures are expressed in standard deviations. Outcome indices are formed using PCA weights and are standard normalized. Questions included in these indices are listed in Section D.3 in the questionnaire in Online Appendix D. See Tables B-14, B-18 and B-19 for additional regression results, and Tables B-15 to B-17 for results when additionally using questions from Sections D.1 and D.4 for the index on health-related behavior (see the indications in Sections D.1 and D.4 for details). Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table 7: (Higher Order) Risk Preferences and Prevention and Environmentally-Friendly Behavior

	General Prevention (Short Term)		General Prevention (Long Term)		Eco-friendly behavior	
Risk aversion (AP)	0.178**	(0.079)	0.233**	(0.080)	0.188*	(0.099)
Prudence	-0.110**	(0.039)	0.040	(0.054)	0.031	(0.034)
Temperance	0.032	(0.039)	0.121**	(0.048)	0.048	(0.062)
Impatience	0.073**	(0.026)	-0.081**	(0.036)	-0.140****	(0.028)
R^2	0.026		0.033		0.034	
Observations	658		658		658	

Notes: Positive coefficients imply increasing prevention effort or increasing eco-friendly behavior. Risk and time measures are expressed in standard deviations. Outcome indices are formed using PCA weights and are standard normalized. Questions included in these indices are listed in Section D.4 in the questionnaire in Online Appendix D. See Tables B-20, B-21 and B-22 for additional regressions results. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

increases; see column two in Table 6), which in turn mainly captures questions addressing addictive usage of social media and smartphones (last column, Table 6). This finding is robust to controlling for age and gender, amongst others, and inclusion of questions from the DOSPERT catalogue and other indices that might be health related (see Tables B-14 to B-19 for details). Notably, neither risk nor temperance are predictive for this kind of behavior, meaning that having a measure of prudence may be important for identifying subjects at risk of smartphone addiction that has been shown to lead to bad health outcomes, such as depression.

Table 8: (Higher Order) Risk Preferences, Preference for Competitive Income and Planning Behavior

	Pref. for Comp. Income		Cautious Planning	
Risk aversion (AP)	-0.093***	(0.023)	-0.033	(0.048)
Prudence	0.052*	(0.026)	0.040	(0.046)
Temperance	0.053	(0.049)	0.166***	(0.052)
Impatience	-0.017	(0.028)	-0.009	(0.039)
R^2	0.036		0.018	
Observations	649		658	

Notes: Positive coefficients imply increasing preference for competitive income or more cautious planning behavior. Risk and time measures are expressed in standard deviations. Outcome indices are formed by adding z-Scores (preference for competetive income) or using PCA weights (planning behavior) and are standard normalized. Questions included in these indices are listed in Sections D.5 and D.6 in the questionnaire in Online Appendix D. See Tables B-23 and B-24 for additional regression results. Robust standard errors clustered at the session level in parentheses. ****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

5.4 General Prevention and Environmentally-Friendly Behavior

General prevention and environmentally-friendly behavior are summarized in Table 7. Risk aversion is positively correlated with pro-environmental behavior (as predicted by Bramoullé and Treich, 2009) and prevention effort, irrespectively of the period in which the possible adverse event might happen. The relation with prudence, however, depends on the timing, as predicted by theory. We can confirm the results by Krieger and Mayrhofer (2016) and find support for the prediction of the one-period model (Eeckhoudt and Gollier, 2005): For an adverse event that might happen in the same period, prudence is negatively correlated with prevention effort. For an adverse event that is separated from the preventative effort by some time delay (as in the model of Menegatti, 2009), the coefficient of prudence is positive, but not significant in our sample. This is also the case for eco-friendly behavior, which might be seen as just a special case of a two-period prevention setting. Interestingly, temperance predicts long-term preventative effort, i.e., when effort precedes its effect. This is in line with our measure of temperance being interpreted as a measure for kurtosis aversion (Denuit and Eeckhoudt, 2010), i.e., aversion against adverse outcomes. Another interesting observation is that patience seems to have a similar relation with prevention as prudence: Patience is positively related with long-term prevention efforts including environmentally friendly behavior, but negatively with short-term prevention efforts.

5.5 Preference for Competitive Income

Results on a preference for competitive income are reported in column 1 of Table 8. In line with earlier findings by Dohmen and Falk (2011), risk aversion is negatively correlated with a preference for a competitive income. The coefficient on prudence, however, has the opposite sign and is half as large as the coefficient on risk aversion. Assuming that adolescents and adults have similar preferences, this result empirically supports the identification strategy by Fuchs-Schündeln and Schündeln (2005) – on average. On the individual level, however, the mechanisms at play seem to be somewhat more nuanced, as prudence is not equal to risk aversion (see Section 3), and as the opposing signs of prudence and risk aversion indicate.

Our results are robust to controlling for age and gender, among others. Being female is associated with a lower preference for competitive income, independent of risk preferences, and the size of this association is comparable to an increase of more than three standard deviations in risk aversion (see Table B-23).

5.6 Planning Behavior

The relation between higher order risk preferences and cautious planning behavior, i.e., the intensity with which individuals react and change their plans if risk enters a particular decision situation, is reported in column 2 in Table 8. This intensity is measured by the additional time individuals plan to invest in certain situations, in which risk in the decision situation increases (such as for how long to prepare for an exam the scope of which is uncertain). As predicted by theory (Kimball, 1990), prudence is positively (but insignificantly) correlated with a more cautious planning behavior. Instead, the coefficient of temperance is positive and significant, even when controlling for age and gender (see Table B-24). As the coefficient of temperance that we use is a measure of kurtosis aversion (Denuit and Eeckhoudt, 2010), this result might be in line with participants deciding rather based on the perceived distribution of the given risk than on proper optimization: The more they dislike adverse outcomes, the more they prepare to avoid these situations. It is, moreover, in line with such an interpretation of our finding regarding prevention effort, where the effort precedes the possible adverse event (see Table 7).

5.7 Are Prudence and Temperance Important to Assess the Role of Risk Aversion Properly?

In this section, we have examined how experimental measures of risk aversion, prudence and temperance are related to many different domains of field behavior. Our

inclusion of prudence and temperance has been motivated by theoretical predictions about their potential relationship with field behavior. Using variable selection with the Lasso approach also confirms their importance for predicting field behavior in addition to significant estimates presented in the previous subsections (see Table B-28 in the Appendix). Yet, in the introduction we have argued that, up to date, the large majority of papers that relate experimental risk measures to field behavior do not consider the higher order risk preferences prudence and temperance, but are confined to measures of risk aversion. In this final subsection before concluding, we would like to illustrate – and stress – that ignoring prudence and temperance might lead to wrong conclusions about the relationship of risk aversion to field behavior.

We start by observing that in some regressions the coefficients of prudence and/or temperance have a different sign than the coefficient of risk aversion (e.g., with respect to the preference for a competitive income, short term prevention, health behavior). This already suggests that for some field behavior, controlling for both, risk aversion and higher order risk preferences is crucial, as they might work in different directions. Fuchs-Schündeln and Schündeln (2005), for instance, highlight the need to account for prudence when studying precautionary saving in Germany after reunification due to possible self-selection into jobs with more secure income. Yet, operating with aggregate data, they use prudence and risk aversion as synonyms. Here we provide systematic evidence on this topic on the individual level by presenting in Table 9 all 15 regressions from Tables 4 to 8, but this time *without* including prudence and temperance. The purpose of Table 9 is to demonstrate how the estimated coefficients and their significance level for risk aversion react to the inclusion or exclusion of higher order risk preferences. If we first look at Table 9 from a mere descriptive point of view, we note that in 12 out of 15 cases, risk aversion is significant in these regressions without prudence and temperance, while in 3 cases it is insignificant. However, indicated by a crossed out letter 'R' for risk aversion in the respective rows of Table 9, we have highlighted six cases – out of the 12 significant ones – where the corresponding regressions in Tables 4 to 8 show that risk aversion becomes insignificant as soon as prudence and temperance are taken into account. Moreover, in four of those cases the coefficient even changes its sign. In line with this observation, in all those four cases, risk averison is not among the variables selected as independent variables by the lasso approach for regressions of the corresponding field behavior (see Table B-28 in the Appendix for all results). In the three cases where risk aversion is insignificant in Table 9, we notice one case where the addition of prudence and temperance turns risk aversion also significant (this is the case of the short term general prevention index).

Table 9: Estimation Models Without Higher Order Risk Preferences

(a) General Survey Questions/Questionnaires on General Risk Taking and Patience (see Table 4)

	Risk tolerance (Survey, SOEP)		DOSPERT (Adapted)		Patience (Survey, SOEP)		General Patience	
				OLS regression results				
Risk aversion (AP)	-0.647****	(0.063)	-0.149***	(0.039)	0.048	(0.106)	0.134**	(0.048)
Impatience	0.088	(0.100)	0.165***	(0.046)	-0.522****	(0.087)	-0.145***	(0.044)
C.f. with HORP	R−, P−, T−		R−, P−				~~R+~~ P+	
R^2	0.074		0.049		0.058		0.039	
Observations	653		658		653		658	

(b) Financial Decision Making (see Table 5)

	Saving (w./ Debt)		Risky Investment		Fin. Insurance	
Risk aversion (AP)	0.112**	(0.039)	-0.095***	(0.030)	-0.056	(0.033)
Impatience	-0.222***	(0.036)	0.013	(0.027)	0.021	(0.041)
C.f. with HORP	~~R+~~ P+, T+		R−, P−, T−		P−	
R^2	0.061		0.0091		0.0035	
Observations	658		658		658	

(c) Health-Related Behavior (see Table 6)

	Unhealthy Behavior		Addictive Behavior		Smartphone Addiction	
Risk aversion (AP)	-0.082*	(0.043)	-0.086*	(0.044)	-0.086*	(0.047)
Impatience	0.160***	(0.042)	0.162***	(0.042)	0.153***	(0.041)
C.f. with HORP	~~R~~ $\overset{+}{\nearrow}$ P−		~~R~~ $\overset{+}{\nearrow}$ P−		~~R~~ $\overset{+}{\nearrow}$ P−	
R^2	0.028		0.029		0.026	
Observations	561		561		561	

(d) Prevention and Environmentally-Friendly Behavior (see Table 7)

	General Prevention (Short Term)		General Prevention (Long Term)		Eco-friendly behavior	
Risk aversion (AP)	-0.011	(0.044)	0.152***	(0.046)	0.107**	(0.048)
Impatience	0.073**	(0.026)	-0.081**	(0.035)	-0.140****	(0.028)
C.f. with HORP	R$\overset{+}{\nearrow}$, P−		R+, T+		R+	
R^2	0.0053		0.030		0.031	
Observations	658		658		658	

(e) Preference for Competitive Income and Sensitivity to Optimal Choice (see Table 8)

	Pref. for Comp. Income		Cautious Planning	
Risk aversion (AP)	-0.094***	(0.024)	0.098**	(0.038)
Impatience	-0.017	(0.028)	-0.009	(0.039)
C.f. with HORP	R−, P+		~~R+~~ T+	
R^2	0.028		0.0097	
Observations	649		658	

Notes: Positive coefficients imply increasing preference for the respective behavior. Risk and time measures are expressed in standard deviations. Row 'C.f. with HORP' summarizes significant risk preferences and their sign in models where prudence and temperance are accounted for. See Tables 4 to 8 for these results and additional notes on the respective models. R: Risk Aversion, P: Prudence, T: Temperance. Crossed out signs with an arrow pointing at a different sign indicate sign reversal for risk aversion when controlling for prudence and temperance. A crossed out 'R' indicate regressions in which risk aversion is no longer significant once prudence and temperance are accounted for. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Overall, this descriptive analysis reveals that it matters substantially whether one relates only risk aversion to field behavior or whether higher order risk preferences are additionally taken into account. In particular the inclusion of prudence makes a difference. Once prudence is taken account of, risk aversion turns insignificant with respect to savings, but in particular also in relation to unhealthy behavior, addictive behavior, smartphone addiction, general prevention (short term) and general patience. We think this is particularly important with respect to health-related behavior. Obviously, the relation of health-related behavior to risk aversion and higher order risk preferences depends a lot on controlling for higher order risk preferences, even more so because these are the four cases where the coefficient of risk aversion changes its sign when higher order risk preferences are included. Whereas it looks from Table 9 as if more risk aversion is less often related to unhealthy behavior, addictive behavior and smartphone addiction, the estimations accounting for higher order risk preferences in Table 6 show that prudence matters all the time (the higher the intensity of prudence, the less unhealthy behavior, addiction and smartphone usage), and risk aversion even becomes positive (albeit it remains insignificant). Thus, when failing to control for prudence (and to a lesser extent temperance), the true relation between risk aversion and unhealthy behavior is blurred by the level of prudence that is captured with a risk aversion measure (see, e.g., the correlation of prudence and the standard one-item survey question on general willingness to take risk). Therefore, if the relevant control variables are incomplete, for example because they lack higher order risk preferences, one might prematurely conclude that risk preferences are unrelated with (un)healthy behavior (as, e.g., in Galizzi and Miraldo, 2017).[37] Instead, the picture is more complex, and it is a different risk preference than risk aversion that is relevant in this context, namely prudence.

6 Conclusion

In this paper, we have analyzed how experimentally elicited measures of the (higher order) risk attitudes risk aversion, prudence and temperance as well as of time preferences relate to field behavior concerning decisions with uncertain outcomes such as health-related behavior, eco-friendly behavior, or financial decision making.

We have used a novel method to measure risk aversion and the higher order risk preferences prudence and temperance and quantify their intensities. In our sample of 658 students from sixth to twelfth grade in German schools, we have found clear evidence for risk aversion, prudence and temperance in the aggregate. These findings are in line with studies on adult populations (e.g., Noussair et al., 2014; Ebert and Wiesen, 2014; Deck and Schlesinger, 2014). We have found no significant age effects for any of our preferences. We find females exhibiting more risk averse, more prudent and more temperant behavior. Cognitive abilities and prudence are unrelated , while cognitive abilities and temperance are negatively related in our study with adolescents.

[37] This could also result in finding a relation only in a sub-sample that is more prudent, such as females.

The most important findings of our paper concern the relationship of experimental measures and field behavior and, in particular, the importance of prudence and temperance in relation to risk aversion with respect to understanding risk taking behavior in the field. In general, the correlation coefficients between our measures and the single-item willingness-to-take-risk question (Dohmen et al., 2011) exceed common values in the literature by an order of magnitude. Prudence seems to have a half as large (and temperance a quarter as large) influence on general risk taking compared to risk aversion, suggesting that risky behavior is only insufficiently captured by risk aversion alone. This finding is corroborated in a regression exercise where we show that the significance (and even the sign) of our risk aversion parameter depends in several cases on whether or not we include the higher order risk preferences prudence and temperance. The most striking case refers to behavior in the health domain: Unhealthy and addictive behavior, in particular our smartphone addiction scale, is strongly related to imprudence, and not to risk aversion, even though using only risk aversion (and excluding prudence and temperance) seems to suggest that risk aversion and this health-related behavior are linked to each other. This is not to say that risk aversion never matters when prudence and temperance are also considered, but our findings advocate caution when drawing inferences from studies that ignore prudence and temperance.

Our results demonstrate that some behavior is only predicted by prudence, such as health-related behavior, whereas other behavior seems to depend on a combination of risk aversion, prudence, and, to a lesser extent, temperance. Thus, whether or not a certain behavior is related to risk attitudes depends on the nature of the risk. The absence of a correlation with the attitude towards a symmetric gamble, which would be captured by classical risk aversion, does not necessarily rule out that individuals perceive a certain behavior as risky. It might just also be the case that prudence is the better (and sometimes only) predictor for that kind of behavior.

In fact, we have been able to provide support for theoretical predictions related to risk preferences of several models. The model by Bramoullé and Treich (2009), for example, suggesting that uncertainty might alleviate the commons problem, posits that risk aversion decreases pollution due to uncertainty. In fact, we find support for the claim that risk averters behave more eco-friendly. Moreover, we provide additional support for the theoretical predictions related with risky investment and intemperance (Kimball, 1992; Gollier and Pratt, 1996) as well as with saving and prudence (Leland, 1968; Kimball, 1990). Lastly, our results with respect to prevention effort of a possibly contemporaneous unwanted event (negative relation) are in line with theory (Eeckhoudt and Gollier, 2005), while we find indication (but not significantly) for the prediction that the relation flips when the possible unwanted event follows the effort only with some time delay (Menegatti, 2009).

To conclude with a potential policy implication of our study, our results suggest, that higher order risk preferences could be used for an efficient identification of adolescents that might be prone to problematic health-related, and in particular, addictive behavior. This makes our results particularly timely, given the age of our sample and the growing evidence that adolescence is crucial in developing addictive behavior. For example, smoking experimentation of any level in childhood and adolescence, including only a few puffs, is associated with an at least 26% increased risk of being a smoker 20 years later compared to those who never smoked (Paul

et al., 2008). The age of smoking the first cigarette during childhood and adolescence is a highly significant predictor of smoking status, nicotine dependence, and monthly cigarette consumption at age 22; around 80% of smokers at the age of 22 smoked their first cigarette with at most 14 years (Buchmann et al., 2011). Similar patterns have been documented for alcohol (e.g., Grant and Dawson, 1997; DeWit, 2000), hard drugs (e.g., Lynskey, 2003; Chen et al., 2009) and gambling addiction (e.g., Black et al., 2015; Jiménez-Murcia et al., 2010), which perturbs sound financial behavior. The conclusion from this literature is always the same: Early prevention is key! So, given that we find no age effects, but rather stable relationships of prudence and temperance to field behavior across the whole age range studied in this paper, our experimental measures of higher order risk preferences might become helpful in identifying youths at risk of developing harmful habits and field behavior.

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A Appendix: Details on Methods and Design

		Lottery Outcomes		
Iteration	Sure Amount	Low	High	Choice
1	$S_1 = L_1 + (H_1 - L_1)/2 = 210.00$	$L_1 : 140$	$H_1 : 280$	Lottery
2	$S_2 = S_1 + (H_1 - L_1)/4 = 245.00$	$L_1 : 140$	$H_1 : 280$	Sure Amount
3	$S_3 = S_2 - (H_1 - L_1)/8 = 227.50$	$L_1 : 140$	$H_1 : 280$	Sure Amount
Result	$CE = S_3 - (H_1 - L_1)/16 = 218.75$			

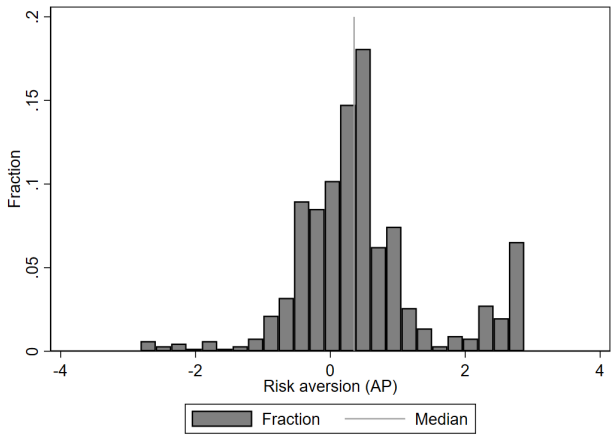
B Appendix: Tables and Figures

Table B-1: Influence Factors of Risk Aversion (Arrow-Pratt Measure, Raw Cognitive Ability Measures)

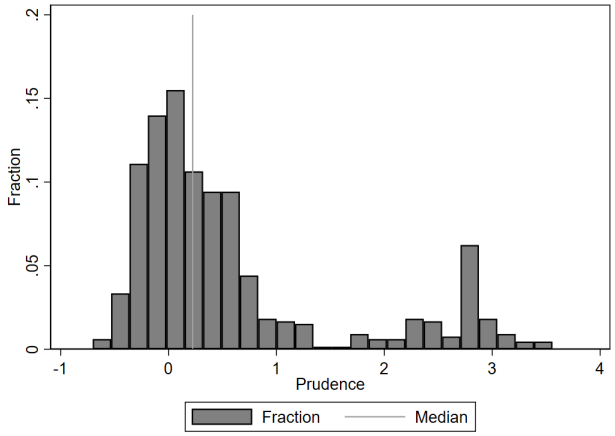
	Risk Aversion		Risk Aversion		Risk Aversion		Risk Aversion	
Age (in years)	−0.031***	(0.010)	−0.014	(0.012)			−0.011	(0.017)
Cognitive ability			−0.126***	(0.041)	−0.126***	(0.038)	−0.145***	(0.041)
Female (=1)							0.270***	(0.087)
Impatience							−0.855***	(0.283)
Pocket money per week							−0.004	(0.002)
Math grade							−0.024	(0.051)
German grade							−0.036	(0.069)
Number of siblings							0.004	(0.034)
Migration background (=1)							−0.059	(0.100)
Education mother: A-Levels (=1)							−0.119	(0.097)
Education father: A-Levels (=1)							−0.013	(0.105)
BMI							−0.014	(0.013)
Parents Occupation								
Full-time and part-time							0.051	(0.074)
One full-time							0.133	(0.143)
Don't work/other regularity							0.090	(0.098)
Religion								
Protestant							0.093	(0.133)
Other or no religion							−0.099	(0.112)
School controls	no		no		no		yes	
R^2	0.01		0.02		0.02		0.08	
Observations	656		656		658		634	

Notes: Positive coefficients imply increasing risk aversion. Robust standard errors clustered at the session level in parentheses. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Reference categories for parents' occupation is 'Both fulltime', and 'Catholic' for religion. For 24 participants, some demographic information is missing (mostly, children were unaware of their parents' education or occupation), which explains the lower number of observations in some columns. See Table B-5 for regression results excluding participants that reported problems with handling their tablets during our study. P-values for factors added only in the last column of this table except for gender are corrected for multiple testing using the Romano-Wolf procedure with 1,000 iterations (Romano and Wolf, 2005a,b, 2016).

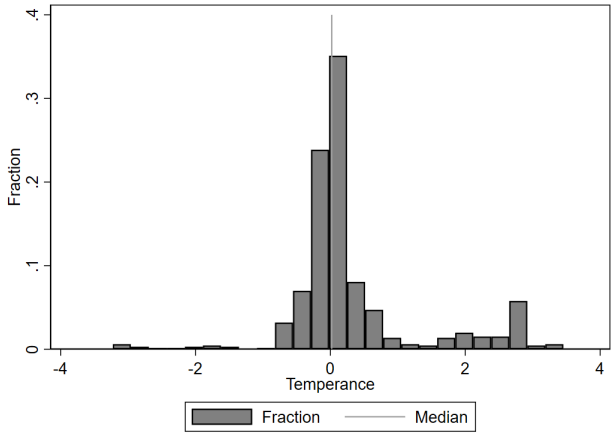
*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.



(a) Histogram of the Arrow-Pratt risk aversion measure



(b) Histogram of the Crainich and Eeckhoudt prudence measure



(c) Histogram of the Denuit and Eeckhoudt temperance measure

Figure B-1: Prevalences of (higher order) risk preferences

Table B-2: Influence Factors of Prudence (Raw Cognitive Ability Measures)

	Prudence		Prudence		Prudence		Prudence	
Age (in years)	−0.018	(0.013)	−0.010	(0.016)			−0.012	(0.017)
Cognitive ability			−0.059	(0.055)	−0.063	(0.048)	−0.058	(0.055)
Female (=1)							0.240**	(0.108)
Impatience							−0.597**	(0.254)
Pocket money per week							−0.008**	(0.003)
Math grade							−0.034	(0.045)
German grade							−0.048	(0.067)
Number of siblings							0.029	(0.035)
Migration background (=1)							0.040	(0.081)
Education mother: A-Levels (=1)							−0.097	(0.094)
Education father: A-Levels (=1)							−0.007	(0.102)
BMI							−0.011	(0.013)
Parents Occupation								
Full-time and part-time							0.087	(0.070)
One full-time							0.247	(0.141)
Don't work/other regularity							0.019	(0.133)
Religion								
Protestant							−0.005	(0.098)
Other or no religion							−0.138	(0.126)
School controls	no		no		no		yes	
R^2	0.00		0.00		0.00		0.06	
Observations	656		656		658		634	

Notes: Positive coefficients imply increasing prudence. Robust standard errors clustered at the session level in parentheses. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Reference categories for parents' occupation is 'Both fulltime', and 'Catholic' for religion. For 24 participants, some demographic information is missing (mostly, children were unaware of their parents' education or occupation), which explains the lower number of observations in some columns. See Table B-6 for regression results excluding participants that reported problems with handling their tablets during our study. P-values for factors added only in the last column of this table except for gender are corrected for multiple testing using the Romano-Wolf procedure with 1,000 iterations (Romano and Wolf, 2005a,b, 2016).

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table B-3: Influence Factors of Temperance (Raw Cognitive Ability Measures)

	Temperance		Temperance		Temperance		Temperance	
Age (in years)	−0.015	(0.011)	−0.001	(0.013)			−0.002	(0.016)
Cognitive ability			−0.104**	(0.039)	−0.099**	(0.035)	−0.121**	(0.042)
Female (=1)							0.182**	(0.084)
Impatience							−0.673**	(0.290)
Pocket money per week							−0.004	(0.003)
Math grade							−0.031	(0.059)
German grade							−0.000	(0.069)
Number of siblings							0.010	(0.035)
Migration background (=1)							−0.103	(0.094)
Education mother: A-Levels (=1)							−0.129	(0.091)
Education father: A-Levels (=1)							0.019	(0.098)
BMI							−0.006	(0.011)
Parents Occupation								
Full-time and part-time							0.119	(0.071)
One full-time							0.195	(0.129)
Don't work/other regularity							0.151	(0.126)
Religion								
Protestant							−0.048	(0.125)
Other or no religion							−0.158	(0.135)
School controls	no		no		no		yes	
R^2	0.00		0.01		0.01		0.05	
Observations	656		656		658		634	

Notes: Positive coefficients imply increasing temperance. Robust standard errors clustered at the session level in parentheses. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Reference categories for parents' occupation is 'Both fulltime', and 'Catholic' for religion. For 24 participants, some demographic information is missing (mostly, children were unaware of their parents' education or occupation), which explains the lower number of observations in some columns. See Table B-7 for regression results excluding participants that reported problems with handling their tablets during our study. P-values for factors added only in the last column of this table except for gender are corrected for multiple testing using the Romano-Wolf procedure with 1,000 iterations (Romano and Wolf, 2005a,b, 2016).

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table B-4: Influence Factors of (Higher Order) Risk Preferences (Sub-Sample With Most Precise Measurement of Cognitive Abilities)

	[1] Risk aversion		[2] Prudence		[3] Temperance	
Age (in years)	−0.004	(0.018)	−0.014	(0.017)	−0.000	(0.017)
Cognitive ability	−0.150***	(0.049)	−0.056	(0.063)	−0.121**	(0.048)
Female (=1)	0.222**	(0.075)	0.207**	(0.094)	0.142**	(0.064)
Impatience	−0.714**	(0.261)	−0.544	(0.246)	−0.535	(0.266)
Other Factors	10		10		10	
School controls	yes		yes		yes	
R^2	0.07		0.06		0.05	
Observations	582		582		582	

Notes: Positive coefficients imply increasing risk aversion, prudence and temperance. Robust standard errors clustered at the session level in parentheses. Cognitive ability scores are standardized, such that above average scores are positive. Other possible influence factors controlled for are relative math grade, relative German grade (where positive variables imply above average performance relative to the grade), the amount of pocket money per week, relative BMI, the number of siblings, the religion, migration background, parents' education (indicating separately whether mother and father have a university entrance diploma each) as well as parents' occupation as well; see Tables B-5, B-6 and B-7 for detailed regressions results. P-values for factors omitted in this table and for impatience are corrected for multiple testing using the Romano-Wolf procedure with 1,000 iterations (Romano and Wolf, 2005a,b, 2016).

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table B-5: Influence Factors of Risk Aversion (Sub-Sample With Most Precise Measurement of Cognitive Abilities)

	Risk Aversion		Risk Aversion		Risk Aversion		Risk Aversion	
Age (in years)	−0.031***	(0.010)	−0.014	(0.011)			−0.004	(0.018)
Cognitive ability			−0.125**	(0.047)	−0.134***	(0.043)	−0.150***	(0.049)
Female (=1)							0.222**	(0.075)
Impatience							−0.714**	(0.261)
Pocket money per week							−0.004	(0.002)
Math grade							−0.013	(0.055)
German grade							−0.038	(0.069)
Number of siblings							0.007	(0.036)
Migration background (=1)							−0.068	(0.099)
Education mother: A-Levels (=1)							−0.132	(0.108)
Education father: A-Levels (=1)							−0.025	(0.097)
BMI							−0.017	(0.013)
Parents Occupation								
Full-time and part-time							0.020	(0.081)
One full-time							0.082	(0.145)
Don't work/other regularity							0.073	(0.104)
Religion								
Protestant							0.092	(0.118)
Other or no religion							−0.042	(0.106)
School controls	no		no		no		yes	
R^2	0.01		0.02		0.02		0.07	
Observations	656		603		604		582	

Notes: Positive coefficients imply increasing risk aversion. Robust standard errors clustered at the session level in parentheses. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Reference categories for parents' occupation is 'Both fulltime', and 'Catholic' for religion. For 24 participants, some demographic information is missing (mostly, children were unaware of their parents' education or occupation), which explains the lower number of observations in some columns. See Table **??** for regression results excluding participants that reported problems with handling their tablets during our study. P-values for factors added only in the last column of this table except for gender are corrected for multiple testing using the Romano-Wolf procedure with 1,000 iterations (Romano and Wolf, 2005a,b, 2016).

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table B-6: Influence Factors of Prudence (Sub-Sample With Most Precise Measurement of Cognitive Abilities)

	Prudence		Prudence		Prudence		Prudence	
Age (in years)	−0.018	(0.013)	−0.015	(0.017)			−0.014	(0.017)
Cognitive ability			−0.054	(0.063)	−0.065	(0.055)	−0.056	(0.063)
Female (=1)							0.207**	(0.094)
Impatience							−0.544	(0.246)
Pocket money per week							−0.008**	(0.003)
Math grade							−0.022	(0.051)
German grade							−0.047	(0.067)
Number of siblings							0.021	(0.037)
Migration background (=1)							0.038	(0.073)
Education mother: A-Levels (=1)							−0.154*	(0.086)
Education father: A-Levels (=1)							0.013	(0.092)
BMI							−0.012	(0.013)
Parents Occupation								
Full-time and part-time							0.101	(0.078)
One full-time							0.272	(0.146)
Don't work/other regularity							0.018	(0.157)
Religion								
Protestant							0.018	(0.083)
Other or no religion							−0.099	(0.121)
School controls	no		no		no		yes	
R^2	0.00		0.01		0.00		0.06	
Observations	656		603		604		582	

Notes: Positive coefficients imply increasing prudence. Robust standard errors clustered at the session level in parentheses. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Reference categories for parents' occupation is 'Both fulltime', and 'Catholic' for religion. For 24 participants, some demographic information is missing (mostly, children were unaware of their parents' education or occupation), which explains the lower number of observations in some columns. See Table **??** for regression results excluding participants that reported problems with handling their tablets during our study. P-values for factors added only in the last column of this table except for gender are corrected for multiple testing using the Romano-Wolf procedure with 1,000 iterations (Romano and Wolf, 2005a,b, 2016).

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table B-7: Influence Factors of Temperance (Sub-Sample With Most Precise Measurement of Cognitive Abilities)

	Temperance		Temperance		Temperance		Temperance	
Age (in years)	−0.015	(0.011)	−0.004	(0.013)			−0.000	(0.017)
Cognitive ability			−0.098**	(0.044)	−0.101**	(0.040)	−0.121**	(0.048)
Female (=1)							0.142**	(0.064)
Impatience							−0.535	(0.266)
Pocket money per week							−0.005	(0.002)
Math grade							−0.020	(0.063)
German grade							−0.000	(0.069)
Number of siblings							0.008	(0.039)
Migration background (=1)							−0.108	(0.093)
Education mother: A-Levels (=1)							−0.172*	(0.092)
Education father: A-Levels (=1)							0.015	(0.093)
BMI							−0.011	(0.011)
Parents Occupation								
Full-time and part-time							0.098	(0.088)
One full-time							0.171	(0.126)
Don't work/other regularity							0.120	(0.135)
Religion								
Protestant							−0.036	(0.114)
Other or no religion							−0.097	(0.124)
School controls	no		no		no		yes	
R^2	0.00		0.01		0.01		0.05	
Observations	656		603		604		582	

Notes: Positive coefficients imply increasing temperance. Robust standard errors clustered at the session level in parentheses. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Reference categories for parents' occupation is 'Both fulltime', and 'Catholic' for religion. For 24 participants, some demographic information is missing (mostly, children were unaware of their parents' education or occupation), which explains the lower number of observations in some columns. See Table **??** for regression results excluding participants that reported problems with handling their tablets during our study. P-values for factors added only in the last column of this table except for gender are corrected for multiple testing using the Romano-Wolf procedure with 1,000 iterations (Romano and Wolf, 2005a,b, 2016).

*** Significant at the 1 percent level.
** Significant at the 5 percent level.
* Significant at the 10 percent level.

Table B-8: DOSPERT (Adapted)

	DOSPERT (Adapted)		DOSPERT (Adapted)		DOSPERT (Adapted)		DOSPERT (Adapted)	
Prudence	-0.098*	(0.052)	-0.098*	(0.049)	-0.098*	(0.047)	-0.102**	(0.045)
Risk aversion (AP)			-0.283****	(0.065)	-0.283****	(0.066)	-0.297****	(0.063)
Temperance			-0.047	(0.046)	-0.047	(0.045)	-0.043	(0.045)
Impatience					0.165***	(0.046)	0.139**	(0.050)
Age (in years)							0.006	(0.019)
Female							-0.072	(0.065)
Math grade							-0.167***	(0.047)
German grade							-0.147**	(0.058)
R^2	0.0097		0.031		0.058		0.11	
Observations	658		658		658		653	

Notes: Positive coefficients imply increasing general risk taking behavior. Experimental risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Section D.1 of the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-9: General Patience Scale

	General Patience		General Patience		General Patience	
Impatience	-0.145***	(0.045)	-0.145***	(0.044)	-0.131***	(0.042)
Risk aversion (AP)			0.087	(0.084)	0.080	(0.090)
Prudence			0.115**	(0.045)	0.112**	(0.048)
Temperance			0.096	(0.055)	0.091	(0.056)
Age (in years)					-0.001	(0.037)
Female					0.178*	(0.089)
Math grade					0.101**	(0.035)
German grade					0.040	(0.039)
R^2	0.021		0.041		0.062	
Observations	658		658		653	

Notes: Positive coefficients imply increasing patience. Experimental risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Section D.1 of the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses. ****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-10: Saving (w./ Debt)

	Saving (w./ Debt)		Saving (w./ Debt)		Saving (w./ Debt)		Saving (w./ Debt)	
Prudence	0.060*	(0.033)	0.060*	(0.032)	0.060*	(0.032)	0.077*	(0.041)
Risk aversion (AP)			0.093	(0.120)	0.093	(0.115)	0.134	(0.129)
Temperance			0.110**	(0.049)	0.110**	(0.049)	0.114**	(0.041)
Impatience					-0.222***	(0.036)	-0.211***	(0.038)
Age (in years)							0.003	(0.021)
Female							-0.317***	(0.068)
Math grade							0.125**	(0.057)
German grade							0.116*	(0.055)
Pocket money per week							-0.009***	(0.002)
Earnings side job per week							0.001	(0.002)
Pocket money gets cut occasionally							-0.030	(0.162)
Additional money when needed							0.037	(0.046)
R^2	0.0037		0.013		0.061		0.13	
Observations	658		658		658		646	

Notes: Positive coefficients imply increasing likelihood to save. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Section D.2 of the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses. ****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-11: Risky Investment

	Risky Investment		Risky Investment		Risky Investment		Risky Investment	
Temperance	-0.064**	(0.024)	-0.064**	(0.024)	-0.064**	(0.024)	-0.033	(0.021)
Risk aversion (AP)			-0.161*	(0.078)	-0.161*	(0.078)	-0.072	(0.077)
Prudence			-0.103*	(0.049)	-0.103*	(0.049)	-0.059	(0.047)
Impatience					0.013	(0.027)	-0.009	(0.026)
Age (in years)							-0.025	(0.017)
Female							-0.535***	(0.067)
Math grade							0.071*	(0.037)
German grade							0.011	(0.037)
Pocket money per week							0.008	(0.004)
Earnings side job per week							0.003	(0.002)
Pocket money gets cut occasionally							0.002	(0.118)
Additional money when needed							-0.092	(0.064)
R^2	0.0041		0.017		0.017		0.11	
Observations	658		658		658		646	

Notes: Positive coefficients imply increasing likelihood to invest in risky assets. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Section D.2 of the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-12: Risky Investment (Extended Index)

	Risky Investment (Ext.)		Risky Investment (Ext.)		Risky Investment (Ext.)		Risky Investment (Ext.)	
Temperance	-0.053**	(0.022)	-0.053**	(0.022)	-0.053**	(0.022)	-0.021	(0.021)
Risk aversion (AP)			-0.172**	(0.069)	-0.172**	(0.068)	-0.081	(0.069)
Prudence			-0.100*	(0.049)	-0.100*	(0.049)	-0.054	(0.046)
Impatience					0.026	(0.029)	0.003	(0.029)
Age (in years)							-0.024	(0.019)
Female							-0.582***	(0.070)
Math grade							0.045	(0.042)
German grade							0.030	(0.040)
Pocket money per week							0.007	(0.004)
Earnings side job per week							0.003	(0.002)
Pocket money gets cut occasionally							-0.038	(0.118)
Additional money when needed							-0.101	(0.069)
R^2	0.0028		0.016		0.017		0.12	
Observations	658		658		658		646	

Notes: Positive coefficients imply increasing likelihood to invest in risky assets. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Sections D.1 and D.2 of the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-13: Financial Insurance Demand

	Fin. Insurance		Fin. Insurance		Fin. Insurance		Fin. Insurance	
Prudence	-0.062**	(0.025)	-0.062**	(0.025)	-0.062**	(0.025)	-0.044	(0.032)
Risk aversion (AP)			-0.064	(0.074)	-0.064	(0.073)	-0.039	(0.072)
Temperance			-0.010	(0.069)	-0.010	(0.069)	-0.010	(0.070)
Impatience					0.021	(0.041)	0.010	(0.043)
Age (in years)							-0.007	(0.018)
Female							-0.109	(0.074)
Math grade							-0.032	(0.050)
German grade							0.024	(0.064)
Pocket money per week							0.008**	(0.003)
Earnings side job per week							0.001	(0.002)
Pocket money gets cut occasionally							-0.026	(0.157)
Additional money when needed							-0.015	(0.047)
R^2	0.0039		0.0050		0.0054		0.020	
Observations	658		658		658		646	

Notes: Positive coefficients imply increasing likelihood to possess an insurance. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Section D.2 of the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-14: Unhealthy Behavior

	Unhealthy Behavior		Unhealthy Behavior		Unhealthy Behavior		Unhealthy Behavior	
Prudence	-0.136***	(0.036)	-0.135***	(0.035)	-0.137***	(0.035)	-0.170****	(0.033)
Risk aversion (AP)			0.031	(0.089)	0.030	(0.086)	-0.020	(0.081)
Temperance			-0.023	(0.064)	-0.023	(0.064)	-0.035	(0.062)
Impatience					0.161***	(0.039)	0.146***	(0.046)
Age (in years)							0.013	(0.022)
Female							0.284**	(0.105)
Math grade							-0.149***	(0.046)
German grade							-0.185****	(0.031)
R^2	0.016		0.016		0.039		0.11	
Observations	561		561		561		560	

Notes: Positive coefficients imply increasing engagement in unhealthy or addictive behavior. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Section D.3 of the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-15: Unhealthy Behavior (Extended Index: Prevention and Eco-Friendly Behavior)

	Unhealthy Behavior (ext: P&E)		Unhealthy Behavior (ext: P&E)		Unhealthy Behavior (ext: P&E)		Unhealthy Behavior (ext: P&E)	
Prudence	-0.105**	(0.044)	-0.105**	(0.043)	-0.108**	(0.045)	-0.138***	(0.043)
Risk aversion (AP)			-0.026	(0.102)	-0.026	(0.099)	-0.071	(0.091)
Temperance			-0.012	(0.069)	-0.012	(0.070)	-0.022	(0.070)
Impatience					0.182****	(0.040)	0.164***	(0.048)
Age (in years)							0.016	(0.026)
Female							0.241*	(0.114)
Math grade							-0.150***	(0.045)
German grade							-0.207****	(0.033)
R^2	0.0096		0.0098		0.039		0.11	
Observations	561		561		561		560	

Notes: Positive coefficients imply increasing engagement in unhealthy or addictive behavior. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Sectiona D.3 and D.4 of the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-16: Unhealthy Behavior (Extended Index: DOSPERT)

	Unhealthy Behavior (ext: DOS)		Unhealthy Behavior (ext: DOS)		Unhealthy Behavior (ext: DOS)		Unhealthy Behavior (ext: DOS)	
Prudence	-0.087*	(0.045)	-0.087*	(0.044)	-0.089*	(0.043)	-0.114***	(0.035)
Risk aversion (AP)			-0.063	(0.083)	-0.064	(0.082)	-0.088	(0.072)
Temperance			-0.055	(0.071)	-0.055	(0.071)	-0.063	(0.070)
Impatience					0.186***	(0.043)	0.157***	(0.049)
Age (in years)							0.017	(0.022)
Female							0.077	(0.091)
Math grade							-0.214****	(0.043)
German grade							-0.202***	(0.050)
R^2	0.0067		0.0091		0.040		0.13	
Observations	561		561		561		560	

Notes: Positive coefficients imply increasing engagement in unhealthy or addictive behavior. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Sections D.3 and D.1 of the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-17: Unhealthy Behavior (Extended Index: All)

	Unhealthy Behavior (all)		Unhealthy Behavior (all)		Unhealthy Behavior (all)		Unhealthy Behavior (all)	
Prudence	-0.088*	(0.045)	-0.088*	(0.044)	-0.090*	(0.043)	-0.115***	(0.035)
Risk aversion (AP)			-0.079	(0.085)	-0.079	(0.083)	-0.104	(0.074)
Temperance			-0.056	(0.072)	-0.056	(0.072)	-0.064	(0.072)
Impatience					0.192***	(0.044)	0.163***	(0.052)
Age (in years)							0.018	(0.022)
Female							0.081	(0.095)
Math grade							-0.210****	(0.044)
German grade							-0.207***	(0.050)
R^2	0.0069		0.0098		0.043		0.13	
Observations	561		561		561		560	

Notes: Positive coefficients imply increasing engagement in unhealthy or addictive behavior. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Sections D.3, D.4 and D.1 of the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-18: Addictive behavior

	Addictive Behavior		Addictive Behavior		Addictive Behavior		Addictive Behavior	
Prudence	-0.142***	(0.035)	-0.142***	(0.034)	-0.144***	(0.034)	-0.175****	(0.033)
Risk aversion (AP)			0.016	(0.089)	0.015	(0.086)	-0.033	(0.081)
Temperance			-0.016	(0.061)	-0.016	(0.062)	-0.028	(0.061)
Impatience					0.163***	(0.040)	0.149***	(0.047)
Age (in years)							0.013	(0.022)
Female							0.280**	(0.103)
Math grade							-0.144***	(0.043)
German grade							-0.169****	(0.031)
R^2	0.017		0.018		0.041		0.10	
Observations	561		561		561		560	

Notes: Positive coefficients imply increasing engagement in addictive behavior. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Section D.3 of the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-19: Addictive Usage of Smarthpone and Social Media

	Smartphone Addiction		Smartphone Addiction		Smartphone Addiction		Smartphone Addiction	
Prudence	-0.152****	(0.034)	-0.152****	(0.034)	-0.154****	(0.033)	-0.186****	(0.035)
Risk aversion (AP)			0.002	(0.091)	0.001	(0.088)	-0.053	(0.082)
Temperance			0.001	(0.053)	0.001	(0.054)	-0.011	(0.055)
Impatience					0.154***	(0.038)	0.145***	(0.046)
Age (in years)							0.009	(0.022)
Female							0.331***	(0.106)
Math grade							-0.120**	(0.041)
German grade							-0.153***	(0.041)
R^2	0.020		0.020		0.040		0.095	
Observations	561		561		561		560	

Notes: Positive coefficients imply increasing engagement in addictive behavior. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in these indices are listed in Section D.3 of the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-20: Prevention (Short-Term)

	General Prevention (Short Term)		General Prevention (Short Term)		General Prevention (Short Term)		General Prevention (Short Term)	
Prudence	-0.117***	(0.038)	-0.117***	(0.038)	-0.110**	(0.039)	-0.130***	(0.041)
Risk aversion (AP)			0.168*	(0.081)	0.178**	(0.079)	0.131	(0.075)
Temperance			0.025	(0.039)	0.032	(0.039)	0.023	(0.041)
Impatience					0.073**	(0.026)	0.069**	(0.030)
Age (in years)							-0.003	(0.027)
Number of siblings							-0.058*	(0.029)
Female							0.254***	(0.057)
Math grade							-0.108**	(0.049)
German grade							-0.056	(0.061)
R^2	0.014		0.021		0.026		0.063	
Observations	658		658		658		653	

Notes: Positive coefficients imply increasing prevention effort. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Section D.4 in the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-21: Prevention (Long-Term)

	General Prevention (Long Term)		General Prevention (Long Term)		General Prevention (Long Term)		General Prevention (Long Term)	
Prudence	0.047	(0.057)	0.047	(0.055)	0.040	(0.054)	0.015	(0.052)
Risk aversion (AP)			0.245***	(0.080)	0.233**	(0.080)	0.194**	(0.072)
Temperance			0.129**	(0.047)	0.121**	(0.048)	0.109**	(0.039)
Impatience					-0.081**	(0.036)	-0.081**	(0.034)
Age (in years)							-0.008	(0.021)
Female							0.377***	(0.116)
Math grade							-0.111*	(0.053)
German grade							0.066	(0.053)
R^2	0.0022		0.027		0.033		0.084	
Observations	658		658		658		653	

Notes: Positive coefficients imply increasing prevention effort. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Section D.4 in the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses. ****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-22: Eco-friendly behavior

	Eco-friendly behavior		Eco-friendly behavior		Eco-friendly behavior		Eco-friendly behavior	
Prudence	0.044	(0.036)	0.044	(0.036)	0.031	(0.034)	0.036	(0.031)
Risk aversion (AP)			0.208*	(0.105)	0.188*	(0.099)	0.193*	(0.093)
Temperance			0.061	(0.064)	0.048	(0.062)	0.041	(0.060)
Impatience					-0.140****	(0.028)	-0.118***	(0.033)
Age (in years)							-0.007	(0.025)
Female							0.106	(0.100)
Math grade							0.064**	(0.024)
German grade							0.200***	(0.058)
R^2	0.0020		0.015		0.034		0.077	
Observations	658		658		658		653	

Notes: Positive coefficients imply increasing eco-friendly behavior. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Section D.4 in the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses. ****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-23: Preference for Competitive Income

	Pref. for Comp. Income		Pref. for Comp. Income		Pref. for Comp. Income		Pref. for Comp. Income	
Risk aversion (AP)	-0.094***	(0.024)	-0.093***	(0.023)	-0.093***	(0.023)	-0.070**	(0.025)
Prudence			0.052*	(0.026)	0.052*	(0.026)	0.057**	(0.025)
Temperance			0.053	(0.049)	0.053	(0.049)	0.025	(0.047)
Impatience					-0.017	(0.028)	-0.016	(0.029)
Age (in years)							0.025***	(0.008)
Female							-0.266****	(0.050)
Math grade							0.004	(0.022)
German grade							0.021	(0.026)
R^2	0.027		0.035		0.036		0.096	
Observations	649		649		649		645	

Notes: Positive coefficients imply increasing preference for competitive income. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed by adding z-Scores and are standard normalized. Questions included in this index are listed in Section D.5 in the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-24: Planning Behavior

	Cautious Planning		Cautious Planning		Cautious Planning		Cautious Planning	
Prudence	0.040	(0.048)	0.040	(0.046)	0.040	(0.046)	0.030	(0.053)
Risk aversion (AP)			-0.033	(0.048)	-0.033	(0.048)	-0.052	(0.051)
Temperance			0.166***	(0.052)	0.166***	(0.052)	0.164***	(0.052)
Impatience					-0.009	(0.039)	-0.002	(0.040)
Age (in years)							-0.005	(0.028)
Female							0.140	(0.095)
Math grade							-0.028	(0.050)
German grade							0.020	(0.059)
R^2	0.0016		0.018		0.018		0.024	
Observations	658		658		658		653	

Notes: Positive coefficients imply increasing sensitivity of optimal choice to risk. Risk and time measures are expressed in standard deviations. Cognitive ability scores, relative German grade and relative math grade are standardized, such that above average scores are positive. Outcome indices are formed using PCA weights and are standard normalized. Questions included in this index are listed in Section D.6 in the questionnaire in Online Appendix D. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-25: Regression Results Using Multiple Imputation

(a) General Survey Questions/Questionnaires on General Risk Taking and Patience (see Table 4)

	Risk tolerance (Survey)		DOSPERT (adapted)		Patience (Survey)		General Patience (all)	
Risk Aversion (AP)	-0.497****	(0.104)	-0.132***	(0.035)	0.037	(0.101)	0.043	(0.042)
Prudence	-0.485****	(0.087)	-0.087*	(0.047)	-0.034	(0.073)	0.115**	(0.045)
Temperance	-0.192*	(0.091)	-0.043	(0.035)	0.074	(0.089)	0.073	(0.042)
Impatience	0.087	(0.097)	0.167***	(0.045)	-0.516****	(0.086)	-0.143***	(0.044)
R^2	0.092		0.055		0.059		0.041	
Observations	653		658		653		658	

(b) Financial Decision Making (see Table 5)

	Saving (w./ Debt)		Risky Investment		Fin. Insurance	
Risk Aversion (AP)	0.046	(0.058)	-0.080*	(0.039)	-0.032	(0.037)
Prudence	0.060*	(0.032)	-0.078*	(0.037)	-0.062**	(0.025)
Temperance	0.083**	(0.037)	-0.064**	(0.024)	-0.007	(0.052)
Impatience	-0.220***	(0.035)	0.012	(0.026)	0.020	(0.040)
R^2	0.061		0.017		0.0054	
Observations	658		658		658	

(c) Health-Related Behavior (see Table 6)

	Unhealthy Behavior		Addictive Behavior		Smartphone Addiction	
Risk Aversion (AP)	0.015	(0.043)	0.008	(0.043)	0.000	(0.044)
Prudence	-0.137***	(0.035)	-0.144***	(0.034)	-0.154****	(0.033)
Temperance	-0.017	(0.049)	-0.012	(0.047)	0.001	(0.041)
Impatience	0.159***	(0.039)	0.161***	(0.039)	0.153***	(0.038)
R^2	0.039		0.041		0.040	
Observations	561		561		561	

(d) Prevention and Environmentally-Friendly Behavior (see Table 7)

	General Prevention (Short Term)		General Prevention (Long Term)		Eco-friendly behavior	
Risk Aversion (AP)	0.084*	(0.040)	0.120**	(0.043)	0.104*	(0.050)
Prudence	-0.116***	(0.039)	0.039	(0.053)	0.044	(0.036)
Temperance	0.019	(0.029)	0.102**	(0.041)	0.046	(0.047)
Impatience	0.072**	(0.026)	-0.071*	(0.037)	-0.139****	(0.027)
R^2	0.026		0.031		0.034	
Observations	658		658		658	

(e) Preference for Competitive Income and Planning Behavior (see Table 8)

	Pref. for Comp. Income		Cautious Planning	
Risk Aversion (AP)	-0.093***	(0.023)	-0.016	(0.024)
Prudence	0.043*	(0.021)	0.040	(0.046)
Temperance	0.024	(0.022)	0.126***	(0.039)
Impatience	-0.017	(0.028)	-0.009	(0.039)
R^2	0.036		0.018	
Observations	649		658	

Notes: Positive coefficients imply increasing preference for the respective behavior. Risk and time measures are expressed in standard deviations. Results obtained using a multiple imputation approach (e.g., Rubin, 1996; Horton and Lipsitz, 2001). See the main text for details on the implementation and Tables 4 to 8 for results from usual OLS regressions and additional notes on the respective models. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-26: Regression Results Using Correlated Risk Measures

(a) General Survey Questions/Questionnaires on General Risk Taking and Patience (see Table 4)

	Risk tolerance (Survey)		DOSPERT (adapted)		Patience (Survey)		General Patience (all)	
Risk aversion (AP)	-0.983****	(0.217)	-0.240***	(0.071)	-0.002	(0.205)	0.065	(0.083)
Prudence	-0.329**	(0.137)	-0.047	(0.056)	-0.116	(0.082)	0.049	(0.048)
Temperance	0.618**	(0.241)	0.170*	(0.084)	0.053	(0.178)	0.026	(0.095)
Impatience	0.088	(0.098)	0.168***	(0.046)	-0.521****	(0.087)	-0.144***	(0.044)
R^2	0.092		0.055		0.059		0.041	
Observations	653		658		653		658	

(b) Financial Decision Making (see Table 5)

	Saving (w./ Debt)		Risky Investment		Fin. Insurance	
Risk aversion (AP)	0.060	(0.117)	-0.159*	(0.079)	-0.061	(0.075)
Prudence	-0.018	(0.043)	-0.104*	(0.050)	-0.056	(0.057)
Temperance	0.037	(0.126)	0.144	(0.085)	0.046	(0.108)
Impatience	-0.222***	(0.036)	0.013	(0.027)	0.021	(0.041)
R^2	0.061		0.017		0.0054	
Observations	658		658		658	

(c) Health-Related Behavior (see Table 6)

	Unhealthy Behavior		Addictive Behavior		Smartphone Addiction	
Risk aversion (AP)	0.053	(0.088)	0.039	(0.088)	0.024	(0.088)
Prudence	-0.117*	(0.053)	-0.128**	(0.050)	-0.150***	(0.039)
Temperance	-0.056	(0.121)	-0.036	(0.118)	-0.006	(0.106)
Impatience	0.161***	(0.039)	0.163***	(0.040)	0.154***	(0.038)
R^2	0.039		0.041		0.040	
Observations	561		561		561	

(d) Prevention and Environmentally-Friendly Behavior (see Table 7)

	General Prevention (Short Term)		General Prevention (Long Term)		Eco-friendly behavior	
Risk aversion (AP)	0.178**	(0.079)	0.229**	(0.088)	0.188*	(0.099)
Prudence	-0.129***	(0.039)	-0.049	(0.070)	0.001	(0.058)
Temperance	-0.125*	(0.065)	-0.073	(0.079)	-0.116	(0.099)
Impatience	0.073**	(0.026)	-0.072*	(0.037)	-0.140****	(0.028)
R^2	0.026		0.031		0.034	
Observations	658		658		658	

(e) Preference for Competitive Income and Planning Behavior (see Table 8)

	Pref. for Comp. Income		Cautious Planning	
Risk aversion (AP)	-0.163***	(0.047)	-0.034	(0.048)
Prudence	0.039	(0.029)	-0.069	(0.059)
Temperance	0.054	(0.049)	0.197***	(0.065)
Impatience	-0.017	(0.028)	-0.009	(0.039)
R^2	0.036		0.018	
Observations	649		658	

Notes: Positive coefficients imply increasing preference for the respective behavior. Risk and time measures are expressed in standard deviations. Results obtained from OLS regressions with correlated risk and time measures. Consequently, coefficient estimates might be biased and standard errors incorrect. See Tables 4 to 8 for results from orthogonalized risk measures and additional notes on the respective models. Robust standard errors clustered at the session level in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-27: Regression Results Using Ridge Regression

(a) General Survey Questions/Questionnaires on General Risk Taking and Patience (see Table 4)

	Risk tolerance (Survey)		DOSPERT (adapted)		Patience (Survey)		General Patience (all)	
Risk aversion (AP)	-0.927****	(0.179)	-0.226***	(0.076)	0.000	(0.165)	0.064	(0.077)
Prudence	-0.317***	(0.119)	-0.044	(0.050)	-0.113	(0.109)	0.048	(0.051)
Temperance	0.556***	(0.197)	0.154*	(0.084)	0.049	(0.181)	0.028	(0.084)
Impatience	0.089	(0.090)	0.167****	(0.038)	-0.516****	(0.083)	-0.143****	(0.039)
Observations	653		658		653		658	

(b) Financial Decision Making (see Table 5)

	Saving (w./ Debt)		Risky Investment		Fin. Insurance	
Risk aversion (AP)	0.060	(0.076)	-0.148*	(0.078)	-0.057	(0.078)
Prudence	-0.017	(0.050)	-0.101**	(0.051)	-0.055	(0.052)
Temperance	0.037	(0.083)	0.131	(0.085)	0.041	(0.086)
Impatience	-0.220***	(0.038)	0.013	(0.039)	0.021	(0.039)
Observations	658		658		658	

(c) Health-Related Behavior (see Table 6)

	Unhealthy Behavior		Addictive Behavior		Smartphone Addiction	
Risk aversion (AP)	0.050	(0.090)	0.036	(0.090)	0.022	(0.090)
Prudence	-0.116*	(0.060)	-0.127**	(0.060)	-0.148**	(0.060)
Temperance	-0.053	(0.098)	-0.034	(0.098)	-0.006	(0.098)
Impatience	0.159****	(0.045)	0.161****	(0.045)	0.153****	(0.045)
Observations	561		561		561	

(d) Prevention and Environmentally-Friendly Behavior (see Table 7)

	General Prevention (Short Term)		General Prevention (Long Term)		Eco-friendly behavior	
Risk aversion (AP)	0.167**	(0.077)	0.218***	(0.077)	0.177**	(0.077)
Prudence	-0.129**	(0.051)	-0.049	(0.051)	0.000	(0.051)
Temperance	-0.115	(0.085)	-0.063	(0.085)	-0.105	(0.085)
Impatience	0.072*	(0.039)	-0.072*	(0.039)	-0.139****	(0.039)
Observations	658		658		658	

(e) Preference for Competitive Income and Planning Behavior (see Table 8)

	Pref. for Comp. Income		Cautious Planning	
Risk aversion (AP)	-0.156****	(0.044)	-0.027	(0.078)
Prudence	0.039	(0.029)	-0.066	(0.051)
Temperance	0.047	(0.048)	0.186**	(0.085)
Impatience	-0.017	(0.022)	-0.008	(0.039)
Observations	649		658	

Notes: Positive coefficients imply increasing preference for the respective behavior. Risk and time measures are expressed in standard deviations. Results obtained from a ridge regressions using the `ridgereg` Stata module (Shehata, 2012) and, for each outcome, a penalty parameter optimized by Generalized Cross Validation as suggested by Golub et al. (1979). Without penalty (i.e., for a penalty paramter of 0), ridge regression corresponds to OLS regression (a case that we have excluded here by setting the lowest possible penalty parameter to 0.01). For a non-zero penalty paramter, a trade-off is introduced between a low sum of the absolute size of coefficients and a high fidelity to the data. This trade-off results in a bias, but efficiency is increased; most importantly, however, ridge regression alleviates the problem of multicollinearity (Gruber, 2017). See Tables 4 to 8 for results from orthogonalized risk measures and additional notes on the respective models. Standard errors in parentheses.
****/***/**/* denotes significance at the 0.1 / 1 / 5 / 10 percent level.

Table B-28: Selected Variables Using Lasso (Tibshirani, 1996)

	Risk Aversion	Prudence	Temperance	Impatience
Risk tolerance (Survey)	x	x	x	x
DOSPERT (adapted)	x	x	x	x
Patience (Survey)		x		x
General Patience (all)	x	x	x	x
Saving (w./ Debt)	x		x	x
Risky Investment	x	x		
Fin. Insurance				
Unhealthy Behavior		x		x
Addictive Behavior		x		x
Smartphone Addiction		x		x
General Prevention (Short Term)	x	x	x	x
General Prevention (Long Term)	x	x	x	x
Eco-friendly behavior	x			x
Pref. for Comp. Income	x	x		x
Cautious Planning			x	

Notes: An "x" in the row of an outcome indicates that the respective risk/time measure (see table head) is selected as independent variable for a linear regression of the outcome according to the Lasso approach. The method was performed for a linear model using the build-in Stata command with default parameters. See Tables 4 to 8 for results from regressions with all risk and time measures (orthogonalized) and additional notes on the respective models. Note that inclusion in the model is not equivalent to significance. It rather suggests that inclusion of the variable increases the model's predictive quality.

C Appendix: Instructions (for Online Publication)

C.1 Translated Instructions

Hello and welcome to our study. Glad, that you are here and willing to participate. Within the next 45 minutes, we are going to play some 'decision games' with you, you will work on some riddles and then, you are will be asked to complete a questionnaire. This you will do almost exclusively on a tablet computer and we will explain everything explicitly step by step. First we will explain, then you can take action, and then we will explain the next step. We start with the games.

(In the session with the older students): Just a quick comment on the explanations. Since we are doing a scientific study, it is important that we always give the same explanations. As we also conduct the study with younger students, the explanations are at times more detailled than it would be necessary for you. Thus, in case it seems a little elongated to you, rest assured, this has nothing to do with you, but we just have to do it this way and it also ensures that you really understand everything very well.

From now on, please do not talk to each other anymore, leave your cell phone where it is resp. put it away in case you are holding it in your hands and please listen carefully. You can earn money in the games. We will pay you out in cash at the end of the experiment or you will receive the money in an envelope – more on this later. The amount of money you can earn depends on your answers and decisions. That is why it is important for you to understand the rules. So please listen carefully! We will stop our instructions repeatedly, so that you can ask questions. Just raise your hand, then one of us will come to you to answer your question.

Everything OK so far? *(Leave some time for questions; answer questions individually and in private)*

In the first game, you are to decide four times whether you would prefer a specific amount of money today, or a slightly larger amount of money in 3 weeks time. Here you can see such a decision situation. *(Show the slide of the presentation that displays the time preference decision situation.)* This is how the decision screen will look like. On the left, you can see the amount of money you would get immediately, in this example 100 thalers. On the right, you can see the amount you would get in three weeks, in this example 120 thalers.

So if you say, given the 'basic amount' of 100 thalers, I would wait three more weeks in order to get 20 additional thalers – which option do you have to choose? *(Assuming that the answer is 'right')* Exactly, then you have to choose the right option. If you prefer to have 100 thalers today, you have to choose the left option, accordingly.

We convert thalers to euros and 100 thalers are approximately (*mention the relevant amount only*)

- grade 6: 2 euros.
- grade 8: 2.50 euros.
- grade 10: 3.50 euros.
- grade 12: 5.50 euros.

So think carefully about your preferred option.

You can simply enter your decesion by tapping the 'L' or 'R' button.

Everything ok so far? *(Leave some time for questions; answer questions individually and in private)*

Concerning the payout: In addition to the decision games, there are a few riddles. For each riddle you have solved correctly you will get some additional money.

Besides this game, we are going to play another two types of games with you. Overall, you will make about 25 decisions, and one of those decisions will be paid out for real.

Your tablet randomly chooses one of the three types of decision games and it also randomly picks the number of the decision. It is important that you take every decision seriously, because until the end, you will not know which decision will be payed out.

If this game is randomly chosen for payout by the tablet, you will receive the money either today or in three weeks – depending on your decisions.

If you decided for a payout in three weeks and this decision was randomly chosen for payout, you could collect the money in the secretary's office in three weeks *(adapt to procedure in the corresponding school).*

Everything ok so far? *(Leave some time for questions; answer questions individually and in private)*

If anyone of you does not want to participate, please let us know now. You will also be able to stop later at any time. Just raise your hand – then one of us will come to you and discuss the next steps.

Does anyone like to stop now or do you have any questions? *(Leave some time for the students to raise their hands resp. for questions; answer questions individually and in private; if someone drops out, write down the tablet's ID-number and the session number in order to be able to delete the observation.)*

Everything ok so far? *(Leave some time for questions; answer questions individually and in private)*

(Black out slide show by pressing the 'B' key)

Okay, then we will play the decision games now.

(Start session)

(As soon as everyone has made their decisions) Now you will decide 18 times whether you would rather have a specific certain amount or you would like to throw a coin with us and end up having either a higher or a lower amount than the certain amount. We will change the amounts from decision situation to decision situation.

Such a decision situation looks like this, for example. *(Show the slide of the presentation that displays the coin tossing decision situation).* On the left, we have a coin and you will get 70 thalers, regardless of whether the coin lands with the white or the black side at the top. So you will get this amount with certainty; we show that by the fact that both for the white side *(point at the upper arrow)* and the black side *(point at the lower arrow)* there are 70 thalers in the end. On the right *(point at the right option)* this is different. Here you will get 140 thalers, if the coin lands with the white side at the top *(point at the upper arrow)*, thus laying on the black side. If the coin lands with the black side at the top *(point at the lower arrow)*, you will get 0 thalers — that is: nothing.

Thus, you have to decide, whether you would rather take home 70 thalers with certainty or whether you would like to have the chance to get 140 thalers, where you can also end up empty-handed. So if you say: "I would rather like to have the chance to get 140 thalers and take the risk of ending up empty-handed with this coin toss", which option do you have to choose? *Assuming that the answer is 'right')* Exactly, you have to choose the right option. Otherwise, if you say you would prefer to play it safe, you have to chose the left option.

To enter your decision, simply tap on the button below the option you prefer. Since the decision situations look rather similar at first sight, you also have to press 'Next' *(point at the 'next' button)*, to make sure you do not accidentally choose the same answer again for a different situation.

Everything ok so far? *(Leave some time for questions; answer questions individually and in private)*

Now turning to the payout: Let's assume, the computer selected decision number one of the coin toss.

Let us additionally assume that you had chosen the left option. Then you would simply get 70 thalers. However, if you had chosen the right option, your tablet would toss a coin. If the coin showed white, you would get 140 thalers in this example.

As I said, we will convert thalers to euros later. 140 thalers are the highest payout you can earn in this game. That is about (*mention the relevant amount only*)

- grade 6: 2,75 euros.
- grade 8: 3,50 euros.
- grade 10: 5,00 euros.
- grade 12: 7,75 euros.

So think carefully about how you decide.

Everything ok so far? *(Leave some time for questions; answer questions individually and in private)*

(Black out slide show by pressing the 'B' key)

(Start subsession 'Certainty Equivalents')

(As soon as everyone has made their decisions) In the last of the three games, in different situations, you can choose whether you prefer to draw a ball from a bag, we call it bag L for left, or a ball from another bag, we call it bag R for right. Of course, this will happen without you being able to look into the bag, so you will not be able to pick out the ball you want. You will draw a ball randomly. Here you can see how such a bag looks like *(Show the slide of the presentation that displays the urn decision situation)*. As you can see, there are four balls in each bag. The number written on a balls indicates how many thalers you will get if you randomly draw the corresponding ball. For example *(point at the ball with a 50 written on it, marked with R)*, on the red ball – R means red, G means green, B means blue — you can read 50. So, if you happen to draw this ball, you get 50 thalers. As I said, you will not be able to look into the bag, so you could draw each of the four balls, and the chances of drawing each of these balls are the same. That is, if you draw out of the right bag, the chances that you will draw a ball with a 50 and get 50 thalers are twice as big as the chance to draw a ball with an 80 or 120, simply because there are two balls with a 50 on it.

You may only draw one ball and only choose once per decision situation from which bag you want to draw. In the next decision situation you will be allowed to draw from another bag. In total, there are three such decision situations.

Everything ok so far? *(Leave some time for questions; answer questions individually and in private)*

Okay. If in this situation you think: "I would prefer to have a higher chance of a rather high payment, even if I could end up going home with the smallest amount"; from which bag would you like to draw here, which option do you prefer? Drawing out of the left or the right bag? *(Assuming*

that the answer is 'left') Exactly, then you have to choose the left option. But if you think: "Even if the chances to draw the small amount are higher — it is not that small in comparison – and, besides, I could also draw the highest amount." – then you have to choose the option on the right.

To enter your decision, simply tap on the button below the bag from which you prefer to draw.

Everything clear so far? *(Leave some time for questions; answer questions individually and in private)*

(Black out slide show by pressing the 'B' key)

(Start subsession 'Urn')

(As soon as everyone has made their decisions) In the next part of our study we would like to ask you a few riddles. There are two types of riddles: The first type of riddle is to assign a number to a symbol. As fast as possible. The goal is to assign the correct number to as many symbols as possible in one and a half minutes. *(Show the slide of the presentation that displays the Symbol-Digit-Test)* Up here *(point at the allocation table)* you can see which number belongs to which symbol. You will always see this table. Here on the middle, *(point at the symbol in the center panel)* a symbol is randomly selected. Your task is to press *(point at the buttons)* the correct number as fast as possible. What is the correct number in this case? *(Assuming that the answer is 'eight')* Exactly, eight is the correct answer, and you have to choose eight here *(point at the button labelled with eight)*. Take good care of what you are pressing because there is no going back. If you pressed a number, the next task with the next symbol will come and you shall choose the corresponding number again. It takes a total of one and a half minutes and up here *(point at the time)* you can see how much time you have left.

For the riddles that you will play now and for those that you will play afterwards, those of you who solved the most riddles correctly get approximately (*mention the relevant amount only*)

- grade 6: 1,40 euros in total.
- grade 8: 1,75 euros in total.
- grade 10: 2,50 euros in total.
- grade 12: 3,90 euros in total.

If you solved fewer riddles correctly, you will get proportionally less; so make an effort!

Everything ok so far? *(Leave some time for questions; answer questions individually and in private)*

Okay, then you can play these riddles for a minute and a half now. As soon as you are ready, you can press 'next', but after 15 seconds at most you will be forwarded automatically, and then the time will run. A minute and a half, as many and as correct as possible.

Everything ok so far? *(Leave some time for questions; answer questions individually and in private)*

(Black out slide show by pressing the 'B' key)

(Start subsession 'Cognitive Ability 1')

(As soon as the time for the Symbol-Digit-Test is up) Now we turn to the second kind of riddles. Here, you will be shown some different patterns, and one pattern is always missing. There are several possibilities to fill in the gap, and the possibilities will be shown to you. You have to choose the number of the fitting possibility. We will show you a total of 10 such patterns and you will have 5 minutes to solve the riddles. *(Show the slide of the presentation that displays the matrix test.)* For example, such a riddle could like this: Up here *(point at the time)* you can see how much time you have left. Here *(point at pattern)* you can see the pattern. Here *(point at gap)*

something is missing. Down here *(point at possible options)* you can see different possibilities to fill in the gap. In this example, which option is the correct one? *(Assuming that the answer is 'five')* Exactly, number five is the correct solution. So we choose five down here. Take good care of what you are pressing, because there is no going back. When you have pressed a number, the next riddle starts.

Everything ok so far? *(Leave some time for questions; answer questions individually and in private)*

Okay, then you can play these riddles for five minutes now. Again, you can press 'next' as soon as you are ready, just like before. After 15 seconds at most, however, you will be forwarded automatically. Then, your time will run.

Everything ok so far? *(Leave some time for questions; answer questions individually and in private)*

Alright, you may now start solving the riddles.

(Black out slide show by pressing the 'B' key)

(Start subsession 'Cognitive Ability 2')

(As soon as the time for the pattern riddles is up) Now, you can complete a questionnaire. If you have any questions, just raise your hand and one of us will come and help you. Most questions to tick can be answered relatively quickly. Just read the question and tick what you think. To give you a feeling of how long this should take: That is less than 2 minutes per page.

In the questionnaire, we will not ask for your name. That means we have no way of finding out who completed which questionnaire. So, it is completely anonymous. We only know that a questionnaire belongs to a person in this room, but we have no way of finding out to which person, once you have left the room.

There will be a number of questions where you can enter single letters from your name and your parents' names; e.g., the last letter of your fist name. We did so to be able to match your data, in case we will come cack in two years. You have this information and so you will be able to enter the same data again in two years. For us, however, it is impossible to do anything with it, because we do not know your parents' names. As I said, we do not even save your name, so we cannot figure out whose questionnaire it was. Therefore, this remains anonymous.

Everything ok so far? *(Leave some time for questions; answer questions individually and in private)*

After you have completed the questionnaire, we will go through the rows and pay you. So please just remain seated.

Then, we will give you a stack of sheets with some more questions; I will tell you more about that later.

(Start subsession 'Questionnaire')

(As soon as all have completed the questionnaires)

In the stack of sheets we have just handed out, we are asking for some of your classmates' names who come to your mind when you think about the corresponding question. We will replace the names with codes as soon as you are done, and the columns with the names will stay here and will be shredded. So we will not take them with us and again, we have no possibility of finding out who has named which person in which question. All we know later is thas student A has named students B, C and D in question 1. But we cannot find out who students A, B, C and D are.

To answer the questions, please name only students who are in your class. Students who are not present today can still be named. Please do not mention friends that are not in your class,

e.g. friends from your soccer club or something similar. Please do not name them here. Only your classmates' names. When you write some names on the answer sheet, please only use full names, that is first and last names. Please do not use nicknames or names only you use. If you do not know the full name, please raise your hand and we will help you. Answering the questions, please name the classmates who come to your mind. You are welcome to name more than one person; just do not name all of your classmates. There is no right or wrong here — just write what you think. Please write in block letters and try to write clearly. Do not use more than one minute per page.

Everything ok so far? *(Leave some time for questions; answer questions individually and in private)*

C.2 Original Instructions (German)

Hallo und herzlich willkommen zu unserer Studie. Schön, dass ihr hier seid und mitmachen wollt. In den nächsten 45 Minuten werden wir ein paar "Entscheidungsspiele" mit euch spielen, ihr dürft ein paar Rätsel bearbeiten und anschließend einen Fragebogen ausfüllen. Ihr dürft fast alles auf einem Tablet machen und wir erklären alles ausführlich der Reihe nach. Wir erklären, dann dürft ihr aktiv werden, und danach erklären wir den nächsten Schritt. Wir fangen mit den Spielen an.

(In der Session mit den älteren Schülern): Noch ein Kommentar zu den Erklärungen. Da wir eine wissenschaftliche Studie machen, ist es wichtig, dass wir immer die gleichen Erklärungen machen. Da wir die Studie auch mit jüngeren Schülern durchführen, sind die Erklärungen teilweise ausführlicher, als das sonst nötig wäre. Das hat also nichts mit euch zu tun, wenn euch das etwas länglich erscheint, aber wir müssen das so machen und es stellt auch sicher, dass ihr wirklich alles ganz genau versteht.

Redet ab jetzt bitte nicht mehr miteinander, lasst euer Handy wo es ist bzw. legt es weg, wenn ihr es gerade in der Hand haltet und hört gut zu. Ihr könnt in den Spielen Geld verdienen. Das Geld werden wir euch in bar am Ende des Experiments auszahlen oder aber ihr bekommt es in einem Briefumschlag – mehr dazu später. Wieviel Geld ihr verdienen könnt, hängt von euren Antworten und Entscheidungen ab. Daher ist es wichtig, dass ihr die Regeln versteht. Hört also bitte gut zu! Wir werden öfter eine Pause machen, sodass ihr Fragen stellen könnt. Hebt dazu einfach die Hand, einer von uns wird dann zu euch kommen um eure Frage zu beantworten.

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

Im ersten Spiel sollt ihr viermal entscheiden, ob ihr einen bestimmten Geldbetrag lieber heute haben wollt, oder einen etwas größeren Geldbetrag in 3 Wochen. Hier seht ihr so eine Entscheidungssituation. *(Slide der Präsentation, die die Zeitpräferenz-Entscheidungssituation abbildet, zeigen.)* So sieht das dann aus. Hier links seht ihr den Geldbetrag, den ihr sofort bekommen würdet, in diesem Beispiel sind das 100 Taler. Rechts steht der Betrag, den ihr in drei Wochen bekommen würdet, im Beispiel 120 Taler.

Wenn ihr also sagt, für 20 Taler mehr, da würde ich bei einer Höhe von 100 Taler schon auch drei Wochen warten – welche Option müsst ihr dann wählen? *(Angenommen, die Antwort ist rechts)* Genau, dann müsst ihr die rechte Option wählen. Wenn ihr die 100 Taler allerdings lieber heute hättet, müsst ihr entsprechend die linke Option wählen.

Wir rechnen die Taler in Euro um, und 100 Taler sind ungefähr *(nur den relevanten Betrag nennen)*

- Klasse 6: 2 Euro.

- Klasse 8: 2,50 Euro.
- Klasse 10: 3,50 Euro.
- Klasse 12: 5,50 Euro.

Überlegt also gut, was euch lieber ist.

Eure Entscheidung könnt ihr einfach durch Tippen auf den "L" oder "R" Button eingeben.

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

Zur Auszahlung: Zusätzlich zu den Entscheidungsspielen haben wir noch ein paar Rätselfragen. Pro richtig gelöstem Rätsel bekommt ihr zusätzlich Geld.

Wir werden außer diesem Spiel noch weitere zwei Arten von Spielen mit euch spielen. Ihr werdet dabei insgesamt rund 25 Entscheidungen treffen, und eine dieser Entscheidungen wird in echt ausgezahlt.

Aus den drei Arten von Entscheidungsspielen wählt euer Tablet zufällig eines aus und wählt außerdem zufällig die Nummer der Entscheidung aus. Da ihr bis zum Schluss nicht wissen werdet, welche Entscheidung ausbezahlt wird, ist es wichtig, dass ihr jede Entscheidung ernst nehmt.

Wenn dieses Spiel vom Tablet zufällig zur Auszahlung ausgewählt wird, dann bekommt ihr euer Geld entweder heute oder in drei Wochen – je nachdem, wie ihr entschieden habt.

Solltet ihr euch für eine Zahlung in drei Wochen entschieden haben und diese Entscheidung zufällig zur Auszahlung ausgewählt werden, könnt ihr das Geld in drei Wochen im Sekretariat abholen. *(Entsprechend der Abmachung mit der Schule anpassen.)*

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

Falls eine oder einer von euch nicht teilnehmen möchte, lasst es uns bitte jetzt wissen. Ihr werdet auch später zu jedem Zeitpunkt aufhören können. Hebt dafür einfach die Hand – einer von uns kommt dann zu euch und bespricht das weitere Vorgehen.

Möchte jemand jetzt aufhören oder habt ihr Fragen? *(Zeit lassen für Meldungen bzw. Fragen; Fragen persönlich und vertraulich beantworten; bei Abbruch ID-Nummer des Tablets zusammen mit der jeweiligen Session notieren, um Datensatz löschen zu können.)*

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

(Bildschirmpräsentation mit Druck auf Taste "B" auf schwarz stellen) Okay, dann werden wir jetzt die Entscheidungsspiele spielen.

(Session starten)

(Wenn alle soweit ihre Entscheidungen getätigt haben) Jetzt dürft ihr 18 mal entscheiden, ob ihr lieber einen bestimmten Betrag sicher haben oder aber mit uns eine Münze werfen wollt, und am Ende entweder einen höheren oder aber einen niedrigeren Betrag als den sicheren Betragt haben wollt. Wir werden die Beträge in den 18 Entscheidungssituationen verändern.

Eine solche Situation sieht zum Beispiel so aus *(Slide der Präsentation, die die Münzwurf-Entscheidungssituation abbildet, zeigen)*. Wir haben hier links eine Münze, und egal, ob die Münze auf der weißen oder auf der schwarzen Seite zum Liegen kommt, bekommt ihr 70 Taler. Diesen Betrag bekommt ihr also sicher; das zeigen wir damit, dass sowohl für weiß *(auf oberen Pfeil zeigen)* als auch für schwarz *(auf unteren Pfeil zeigen)* am Ende 70 Taler stehen. Hier rechts *(auf rechte Option zeigen)* sieht das anders aus. Hier bekommt ihr 140 Taler, wenn die Münze weiß zeigt *(auf oberen Pfeil zeigen)*, also auf der schwarzen Seite liegt. Wenn die Münze nun aber schwarz zeigt *(auf unteren Pfeil zeigen)*, bekommt ihr 0 Taler – also nichts.

Ihr müsst also entscheiden, ob ihr lieber 70 Taler sicher nach Hause nehmen oder lieber die Chance haben wollt, 140 Taler zu bekommen, wobei ihr eben auch leer ausgehen könnt. Wenn ihr also sagt: "Ich möchte lieber die Chance haben, 140 Taler zu bekommen, und nehme das Risiko

in Kauf, bei diesem Münzwurf auch leer auszugehen", welche Option müsst ihr dann wählen? *(Angenommen, die Antwort ist "rechts")* Genau, ihr müsst die rechte Option wählen. Andererseits, wenn ihr sagt, ihr wollt lieber auf Nummer Sicher gehen, dann müsst ihr die linke Option wählen.

Um eure Entscheidung einzugeben, tippt bitte einfach auf den Button unter der Option, die ihr lieber hättet. Weil die Entscheidungssituationen auf den ersten Blick sehr ähnlich aussehen, müsst ihr zusätzlich auf "Weiter" drücken *(auf "Weiter"-Button zeigen)*, um sicherzustellen, dass ihr nicht versehentlich noch einmal die gleiche Antwort für eine andere Situation wählt.

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

Zur Auszahlung hier: Nehmen wir jetzt mal an, der Computer hätte die Entscheidung 1 des Münzwurfs ausgewählt.

Nehmen wir jetzt zusätzlich an, dass ihr euch für die linke Option entschieden hättet. Dann bekommt ihr einfach 70 Taler. Hättet ihr euch hingegen für die rechte Option entschieden, wirft euer Tablet eine Münze. Zeigt die Münze weiß, hättet ihr in diesem Beispiel also 140 Taler bekommen. Wie gesagt rechnen wir die Taler später in Euro um. 140 Taler sind das meiste, was ihr hier mit diesem Spiel verdienen könnt. Das sind ungefähr *(nur den relevanten Betrag nennen)*

- Klasse 6: 2,75 Euro.
- Klasse 8: 3,50 Euro.
- Klasse 10: 5,00 Euro.
- Klasse 12: 7,75 Euro.

Überlegt euch also gut, wie ihr entscheidet.

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

(Bildschirmpräsentation mit Druck auf Taste „B" auf schwarz stellen)

(Subsession Certainty Equivalents starten)

(Wenn alle soweit ihre Entscheidungen getätigt haben) Im letzten der drei Spiele müsst ihr in verschiedenen Situationen wählen, ob ihr lieber einen Ball aus einem Beutel, nennen wir ihn Beutel L für links, oder einen Ball aus einem anderen Beutel, den nennen wir Beutel R für rechts, ziehen wollt. Das passiert natürlich, ohne dass ihr in den Beutel schauen könnt, also ihr könnt euch nicht den Ball raussuchen, den ihr gerne hättet. Ihr zieht einen Ball zufällig. Die Beutel sehen jeweils so aus wie auf diesem Bild hier *(Slide der Präsentation, die die Urnen-Entscheidungssituation abbildet, zeigen)*. Ihr seht, in jedem Beutel sind vier Bälle. Die Zahl auf den Bällen gibt an, wieviel Taler ihr bekommt, wenn ihr den entsprechenden Ball zufällig zieht. Zum Beispiel hier *(auf Ball mit der 50, markiert mit R, zeigen)*, auf dem roten Ball – R steht für rot, G steht für grün, B steht für blau – da steht 50 drauf. Wenn ihr also diesen Ball zufällig zieht, bekommt ihr 50 Taler. Wie gesagt, ihr dürft nicht in den Beutel schauen, ihr könntet also jeden der vier Bälle ziehen, und die Chancen, jeden dieser Bälle zu ziehen, sind gleich. Das heißt wenn ihr hier aus dem rechten Beutel zieht, sind die Chancen, dass ihr einen Ball mit einer 50 zieht und 50 Taler bekommt, doppelt so groß, wie die Chance einen Ball mit einer 80 oder 120 zu ziehen, ganz einfach, weil hier zwei Bälle mit einer 50 drin sind.

Ihr dürft nur einen Ball ziehen und nur einmal pro Entscheidungssituation wählen, aus welchem Beutel ihr ziehen wollt. In der nächsten Entscheidungssituation dürft ihr dann wieder aus einem anderen Beutel ziehen. Insgesamt gibt es drei solcher Entscheidungssituationen.

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

Okay. Wenn ihr in dieser Situation jetzt denkt: "Ich möchte lieber größere Chancen auf eine recht hohe Zahlung, auch wenn ich dabei am Ende mit dem kleinsten Betrag heim gehen könnte"

aus welchem Beutel möchtet ihr dann hier ziehen, welche Option bevorzugt ihr? Ziehen aus dem Beutel links oder aus dem Beutel rechts? *(Angenommen, die Antwort ist links)* Genau, dann müsst ihr links wählen. Wenn ihr aber denkt: "Auch wenn die Chancen, den kleinen Betrag zu ziehen höher sind – so klein ist er im Vergleich auch nicht – und außerdem könnte ich ja auch den höchsten Betrag ziehen" — dann müsst ihr die rechte Option wählen.

Um eure Entscheidung einzugeben, tippt bitte einfach auf den Button unter dem Beutel, aus dem ihr lieber ziehen wollt.

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

(Bildschirmpräsentation mit Druck auf Taste "B" auf schwarz stellen)

(Subsession Urn starten)

(Wenn alle soweit ihre Entscheidungen getätigt haben) Im nächsten Teil unserer Studie wollen wir euch ein paar Rätselfragen stellen. Wir haben zwei Arten von Rätselfragen mitgebracht: Die erste Art von Rätsel besteht darin, einem Symbol eine Zahl zuzuordnen. Und zwar möglichst schnell. Das Ziel ist, in eineinhalb Minuten so vielen Symbolen wie möglich die korrekte Zahl zuzuordnen. *(Slide der Präsentation, die den Symbol-Digit-Test abbildet, zeigen.)* Hier oben *(auf Zuordnungstabelle zeigen)* seht ihr, welche Zahl zu welchem Symbol gehört. Diese Tabelle werdet ihr immer sehen. Hier in der Mitte *(auf Symbol in der Mitte zeigen)* wird dann zufällig ein Symbol ausgewählt. Eure Aufgabe ist es nun, so schnell wie möglich hier unten *(auf die Buttons zeigen)* die richtige Zahl zu drücken. Was ist jetzt hier die richtige Zahl? *(Angenommen, die Antwort ist Acht)* Genau, hier ist Acht richtig, und ihr müsst die Acht hier wählen *(auf Acht zeigen)*. Passt gut auf, was ihr drückt, weil es hier kein Zurück gibt. Wenn ihr eine Zahl gedrückt habt, kommt die nächste Aufgabe mit dem nächsten Symbol und ihr sollt wieder die zugehörige Zahl wählen. Insgesamt dauert das eineinhalb Minuten und hier oben *(auf Zeit zeigen)* seht ihr, wie viel Zeit ihr insgesamt noch habt.

Zusammen für die Rätselspiele, die ihr gleich spielt, und die, die danach kommen, bekommen diejenigen, die am meisten richtig haben, ungefähr *(nur den relevanten Betrag nennen)*

- Klasse 6: 1,40 Euro.
- Klasse 8: 1,75 Euro.
- Klasse 10: 2,50 Euro.
- Klasse 12: 3,90 Euro.

Wer weniger Rätsel richtig gelöst hat, bekommt entsprechend weniger; gebt euch also Mühe!

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

Okay, dann dürft ihr diese Rätsel jetzt für eineinhalb Minuten spielen. Wenn ihr bereit seid, könnt ihr "Weiter" drücken, aber spätestens nach 15 Sekunden geht es auch automatisch weiter, und ab dann läuft die Zeit. Eineinhalb Minuten, so viel und so richtig wie möglich.

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

(Bildschirmpräsentation mit Druck auf Taste "B" auf schwarz stellen)

(Subsession "Cognitive Ability 1" starten)

(Wenn die Zeit zur Beantwortung des Symbol-Digit-Tests abgelaufen ist) Nun kommen wir zur zweiten Art von Rätselfragen. Hier bekommt ihr verschiedene Muster gezeigt, und jeweils ein Muster fehlt. Es gibt verschiedene Möglichkeiten, die fehlende Stelle auszufüllen, und diese Möglichkeiten werden euch angezeigt. Ihr sollt dann die Nummer der Möglichkeit wählen, die passt. Wir zeigen euch insgesamt 10 solcher Muster und ihr habt 5 Minuten Zeit. *(Slide der Präsentation, die den Matrizentest abbildet, zeigen.)* Das sieht zum Beispiel so aus: Hier oben *(auf Zeit zeigen)*

seht ihr, wieviel Zeit ihr noch habt. Hier *(auf Muster zeigen)* seht ihr das Muster. Hier *(auf Lücke zeigen)* fehlt etwas. Hier unten *(auf mögliche Optionen zeigen)* seht ihr verschiedene Möglichkeiten, um die fehlende Stelle auszufüllen. Welche ist in diesem Beispiel die richtige Möglichkeit? *(Angenommen, die Antwort ist "fünf")* Genau, die fünfte ist die richtige Lösung. Wir wählen hier unten also Fünf aus. Passt gut auf, was ihr drückt, weil es hier kein Zurück gibt. Wenn ihr eine Zahl gedrückt habt, kommt das nächste Musterrätsel für euch.

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

Okay, dann dürft ihr diese Rätsel jetzt für fünf Minuten spielen. Wenn ihr bereit seid, könnt ihr wieder "Weiter" drücken, wie vorhin auch schon. Nach spätestens 15 Sekunden geht es aber auch automatisch weiter. Dann läuft eure Zeit.

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

Dann könnt ihr gleich mit den letzten Rätselfragen starten.

(Bildschirmpräsentation mit Druck auf Taste "B" auf schwarz stellen)

(Subsession „Cognitive Ability 2" starten)

(Wenn die Zeit zur Beantwortung der Muster-Rätsel abgelaufen ist) Nun dürft ihr noch einen Fragebogen beantworten. Wenn ihr dabei Fragen habt, hebt bitte einfach die Hand, einer von uns kommt dann zu euch und hilft euch. Die meisten Fragen zum Ankreuzen sind recht schnell zu beantworten. Lest einfach die Frage, und kreuzt an, was ihr denkt. Um euch ein Gefühl zu geben, wie lange das dauern sollte: Das sind pro Seite, die gezeigt wird, unter 2 Minuten.

Wir fragen auf dem Fragebogen nicht nach eurem Namen. Das heißt, wir haben keine Möglichkeit, herauszufinden, wer welchen Fragebogen ausgefüllt hat. Das ist also komplett anonym. Wir wissen lediglich, dass ein Fragebogen zu einer Person hier im Raum gehört, haben aber keine Möglichkeit herauszufinden, zu welcher Person, sobald ihr den Raum verlassen habt.

Es wird eine Reihe von Fragen geben, bei denen ihr einzelne Buchstaben aus euren Namen und den Namen eurer Eltern angeben dürft; z.B. den letzten Buchstaben eures Vornamens. Das haben wir gemacht, falls wir in zwei Jahren wieder kommen, um eure Daten zusammen bringen zu können. Diese Informationen habt ihr und könnt damit in zwei Jahren dieselben Daten wieder angeben. Für uns ist es allerdings unmöglich, damit etwas anzufangen, weil wir ja nicht wissen, wie eure Eltern heißen. Wir speichern ja wie gesagt nicht einmal euren Namen, können also nicht darauf kommen, wessen Fragebogen das war. Das bleibt also dadurch anonym.

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

Im Anschluss daran werden wir durch die Reihen gehen und euch bezahlen. Bleibt bitte also einfach sitzen.

Dann geben wir euch noch einen Stapel von Blättern mit einigen weiteren Fragen; dazu sage ich später mehr.

(Subsession "Questionnaire" starten)

(Wenn alle Fragebögen ausgefüllt wurden)

In dem Stapel von Blättern, den wir gerade ausgeteilt haben, fragen wir nach Namen von einigen Mitschülern von euch, die euch bei den entsprechenden Fragen einfallen. Wir werden die Namen, sobald ihr fertig seid, durch Codes ersetzen, und die Spalten mit den Namen bleiben hier und werden geshreddert. Die nehmen wir also nicht mit, und wir haben wieder keine Möglichkeit, herauszufinden, wer was angegeben hat. Alles, was wir später wissen, ist, dass Schüler A bei Frage 1 Schüler B, C und D angegeben hat. Wer aber Schüler A, B, C und D sind, können wir nicht mehr herausbekommen.

Bitte nennt zur Beantwortung der Fragen nur Namen von Schülern, die in eurer Klasse sind. Schülerinnen oder Schüler, die heute nicht anwesend sind, können trotzdem genannt werden. Bitte nennt keine Namen von Freunden, die nicht in dieser Klasse sind, z.B. aus eurem Fußballverein oder Ähnlichem. Die bitte nicht nennen. Nur Namen von Mitschülerinnen und Mitschüler. Wenn ihr Namen auf den Antwortbogen schreibt, verwendet bitte nur ganze Namen, also Vor- und Nachnamen. Bitte verwendet keine Namen, die nur ihr verwendet oder andere Spitznamen. Wenn ihr den vollständigen Namen nicht kennt, meldet euch bitte und wir werden euch helfen. Nennt als Antwort auf die Fragen die Namen eurer Mitschüler, die euch bei der jeweiligen Frage einfallen. Ihr könnt gern mehrere Namen nennen; nennt nur nicht alle eure Mitschüler. Es gibt hier kein richtig oder falsch – schreibt einfach, was ihr denkt. Bitte schreibt in Druckbuchstaben und gebt euch Mühe, deutlich zu schreiben. Verwendet pro Seite nicht mehr als eine Minute.

Alles klar soweit? *(Zeit lassen für Fragen; Fragen persönlich und vertraulich beantworten)*

D Appendix: Translated Questionnaire (for Online Publication)

D.1 General Risk Taking and Patience Behavior

One-Item Survey Questions

Compared to others, are you generally willing to renounce something to benefit from that in the future? Or are you, compared to others, not willing to do so? Please tick one of the boxes on the scale, whereby the value 0 means: "not at all willing to do so", and the value 10 means: "very willing to do so". With the values in between you can graduate your assessment. [0-10]	all grades	
How do you assess yourself: Are you generally a person who is ready to take risks or do you try to avoid risks? Please tick one of the boxes on the scale, whereby the value 0 means: "not at all ready to take risks" and the value 10 means: "very ready to take risks". With the values in between you can graduate your assessment. [0-10]	all grades	
In general, are you also ready to take risks even when something really bad can happen or do you try to avoid risks like that? Please tick one of the boxes on the scale, whereby the value 0 means: "not at all ready to take risks" and the value 10 means: "very ready to take risks". With the values in between you can graduate your assessment. [0-10]	all grades	

(Adapted) Domain-Specific Risk-Taking Scale (DOSPERT)

How many times did you drink five or more alcoholic beverages on a single evening in 2018?	8, 10, 12	H*
How often did you copy parts of somebody else's work in 2018 (e.g., copied a longer text from Wikipedia for a presentation or copied some homework)?	10, 12	
Have you ever skied on a slope that has exceeded your abilities or have you skied off-piste? [yes, no, I do not ski]	all grades	
Have you ever gotten involved in unprotected sex? [yes, no]	10, 12	H*
How many times did you tell a friend's secret to someone else in 2018?	all grades	
How many times did you not fasten your seat belt while driving in 2018?	all grades	H*
How often did you not wear a helmet when riding a scooter or a motorbike (or similar) in 2018?	all grades	
How often did you not use sun protection even though you were in the sun for a long time in 2018?	all grades	H*
How often did you copy (from your neighbour, a cheat sheet, ...) in a class test/exam in 2018?	all grades	
How often did you fake the signature of another person (e.g., your parents) in 2018?	all grades	
Have you ever stolen a small item in a shop (e.g., a pencil or a lipstick)? [yes, no]	all grades	
How often did you wear clothes (including private occasions) that your parents or someone else disapproved of in 2018?	all grades	
How many times did you steal a small amount of money from someone you know in 2018?	all grades	
How many times were you involved in a brawl in 2018?	all grades	H*
How many times did you cross a red light in 2018?	all grades	
Instead of using illegal streaming sites, I prefer using Netflix, Amazon Prime Video or similar services that I pay for. [yes, no]	all grades	
Have you ever gambled away an entire week's pocket money (or more) in a bet? [yes, no]	all grades	I*
How often did you not wear a helmet when you rode a bike in 2018?	all grades	H*
Have you ever met a person you got to know online/on social networks/apps? [yes, no]	all grades	
If I have forgotten my homework, I will not announce it and simply hope that it will not be my turn during the discussion. [yes, a bit of both – it depends, no]	all grades	
Do you use your mobile phone in traffic other than for navigation (e.g., when you are driving a car, scooter or bicycle, when you are crossing the road, ...)? [yes, no]	all grades	

Note: Questions indicated with H* and I* are arguably related to (un-)healthy behavior and to risky investment. Results with respect to health related behavior and risky investment are robust to inclusion of these question in addition to those in Section D.2 and Section D.3, respectively, see Table B-12 and Table B-16.

General Impatience Scale

I tend to procrastinate activities. [levelOfApproval]	all grades
I always do my homework as early as possible. [levelOfApproval]	all grades
Playing an instrument (e.g., in music school, band, at home...) [spareTimeFrequency]	all grades

D.2 Financial Decision Making

Saving w./ Debt

How do you handle your pocket money/income? ["I spend everything quickly", "I save less than the half", "I save approximately the half", "I save more than the half", "I save everything"]	all grades
Assuming that you get 50 euros for christmas or for your birthday. What will you do with the money? ["I spend everything quickly", "I save less than the half", "I save approximately the half", "I save more than the half", "I save everything"]	all grades
Do you have a bank account? [yes, no]	all grades
Do you borrow money from your parents? ["Yes, actually every month", "Yes, several times per year (more than 4 times per year; but not every month)", "Yes, rarely (less than 4 times per year)", "No, never"]	all grades
Do you have a credit card? [yes, no]	all grades

Risky Investment

Do you know what a stock is? [yes, no]	all grades
Do you have any stocks? [yes, no]	all grades
Do you think you will buy some stocks in the future? [yes, no]	all grades
Have you ever used money, that was originally intended for something else at a subsequent date (e.g. for holidays or a present), for a bet or invested it in stocks? [yes, no]	all grades

Notes: See also Section D.1 for a question from the adapted DOSPRT with relation to risky investment. Results with respect to risky investment are robust to inclusion of this question in addition to the questions in this subsection, see Table B-12.

Financial Insurance

Do you have a cell phone insurance? [yes, no, I do not know]	all grades
Did you take it out yourself? [yes, no, I do not have a cell phone insurance resp. I do not know if I have one]	all grades
Do you have a bike insurance? [yes, no, I do not know]	all grades
Did you take it out yourself? [yes, no, I do not have a bike insurance resp. I do not know if I have one]	all grades

D.3 Health Related Behavior

Body height (in cm)	all grades
Body weight (in kilograms (kg))	all grades
Sports (soccer, volleyball, dancing, running, ...) [spareTimeFrequency]	all grades

Sub-index of Health Related Behavior: Questions Targeting Addictive Behavior

Do you smoke cigarettes? ["I do not smoke", "I do not smoke, but I have tried it", "I smoke approx. 1-2 cigarette(s) per day", "I smoke approx. one pack of cigarettes per week", "I smoke more than one pack of cigarettes per week"]	8, 10, 12
Do you drink any alcohol? ["no, never", "yes, rarely (up to 1-2x per month)", "yes, occasionally, one to two drinks (up to 1-2x per week)", "yes, occasionally, more than two drinks (up to 1-2x per week)", "yes, regulary (more often than 2x per week)"]	8, 10, 12

Sub-index of Addictive Behavior: Questions Targeting Excessive Smartphone Usage

When I take a photo with my cell phone or experience a special situation, I immediately think about posting it on Facebook, Instagram, Snapchat or the like. [0-5]	all grades	
I get into trouble with my parents or friends or with my girlfriend resp. my boyfriend, because I use my smartphone that much. [0-5]	all grades	
I feel uncomfortable (e.g. nervous or fretful or disquiet or a bit sad) when I cannot use my smartphone for a considerable time, because of an empty battery, no signal, or because my smartphone was taken away. [0-5]		
When I feel bad or when I face a difficult task, I distract myself with my smartphone. [0-5]	all grades	
My smartphone disturbs me while doing my homework or studying. [0-5]		
I often check my phone while eating with my family to see if there are any news. [yes, no]	all grades	

Notes: See also Sections D.1 and D.4 for questions from the adapted DOSPRT and questions on prevention and eco-friendly behavior with relation to (un-)healthy behavior. Results with respect to (un-)healthy behavior are robust to inclusion of these questions (in any combination) in addition to the questions in this subsection, see Tables B-15 to B-17.

D.4 General Prevention and Environmentally Friendly Behavior

General Prevention (Short Term)

I mutually interchange secrets with my friends to make sure they do not disclose mine. [0-5]	all grades	
To make sure that I can always use my mobile phone and can be reached, I have a powerbank with me. [0-5]	all grades	
Because the others do the same, I prefer to go to the bakery or to the kiosk instead of taking food from home. [0-5]	all grades	
Because I think of packing something to eat and drink during longer journeys by bus, train or car I am not hungry or thirsty in such situations. [0-5]	all grades	
When the class is divided up into groups, I make sure that I have at least one student in my group who is good at the subject in question. [0-5]	all grades	
Because (romantic) relationships sometimes go better and sometimes worse, I invest time in relationships with good friends and my family - they are always there for me. [0-5]	8, 10, 12	

General Prevention (Long Term)

When packing, do you use a packing list to make sure you do not forget anything important? [yes, no]	all grades	
I brush my teeth as often and as long as I should. [0-5]	all grades	H*
I pay attention to my diet: that it is healthy and balanced, not too much and not too little. [0-5]	all grades	H*
For some subjects, I study more in order to compensate for a worse grade in another subject, for example because I do not like the other subject, or because the tests/exams are often very difficult. [0-5]	all grades	
Because the risk of being caught copying, for example from a cheat sheet, is much too high for me, I prefer to learn more and refrain from copying. [0-5]	all grades	
On average: How long do you prepare for a test or an exam? [“more than one week”, “approximately one week”, “a few days”, “one day”]	all grades	
Because I do not know yet what I would like to become later, I try to get good grades to keep all possibilities open to me. [yes, no]	all grades	
If I have to give a presentation at school using PowerPoint, I will always have two options to access the file (e.g. via my e-mail address and an USB stick) or I have the presentation as a PDF file with me. [0-5]	10, 12	
When looking for a (side) job, an internship or even a university place, it makes sense to send further applications until you have received a written confirmation of the desired option, even if it has already been confirmed orally. [yes, no]	8, 10, 12	
Every now and then, I check whether the vaccinations according to my vaccination card are up-to-date. [yes, no]	8, 10, 12	H*

Eco-friendly Behavior

I buy second-hand products, for example second-hand clothes, mobile phones, laptops, or the like. [0-5]	all grades	
If I leave my room for several hours, I will turn down the heating. [0-5]	all grades	
If I am the last to leave the room, I will turn off the light. [0-5]	all grades	
If I do not need the water while showering, I will turn it off. [0-5]	all grades	
If currently noone is watching, the TV will be turned off. [0-5]	all grades	
If I do not use the computer/laptop for a considerable time, I will turn it off resp. put it into the power-saving mode. [0-5]	all grades	
When I do the shopping, I use my own bag or backpack. [0-5]	all grades	
At school or on the way, I use my own beverage bottle (made of glass or metal). [0-5]	all grades	
I use my own cup for coffee or hot chocolate. [0-5]	all grades	
I try using the bike, wherever it is possible. [0-5]	all grades	H*
I seperate my waste to the best of my knowledge and belief. [0-5]	all grades	
If you go to the bathroom, wash your hands and there are only paper towels to dry your hands: How many paper towels do you take? [0-10]	all grades	
When you are in the canteen, how many napkins do you take on your tray? [0-10]	all grades	
If you smoke (otherwise leave the question unanswered): I throw the cigarettes on the ground after smoking. [0-5]	8, 10, 12	

Note: Questions indicated with H* are arguably related to (un-)healthy behavior. Results with respect to health related behavior are robust to inclusion of these question in addition to those in Section D.3, see Table B-15.

D.5 Preference for Competitive Income

Later, I would like to be self-employed, e.g. as a craftsman, an architect, a cafe owner, etc. [yes, no]	all grades	
Later, I would like to be a civil servant, e.g. as a teacher, a policeman, in a city's administration or at the tax office, etc. [yes, no]	all grades	
For the riddles, we will pay a few thalers for each correct solution. Although we will not change that: Would you prefer a fixed amount of thalers for your payment, regardless of the number of riddles that you have solved correctly? [yes, no]	all grades	
Or alternatively, would you like to make a small competition out of it? We would allot you a classmate from the room, and the one of you who would have solved more riddles correctly, would get the partner's fixed payment and additionally his own fixed payment. However, the other one would get nothing. [yes, no]	all grades	

D.6 Planning Behavior

Imagine in the next vocabulary test 10 words from the last lesson of the last school year are asked in addition to the current lesson. How much longer are you going to study? ["0 minutes", "10 minutes", "20 minutes", "30 minutes", "45 minutes", "1 hour", "1 hours, 30 minutes", "2 hours", "2 hours, 30 minutes", "3 hours", "4 hours", "5 hours", "6 hours", "7 hours"]	all grades
Imagine you would like to visit us at the Max-Planck-Institute and have an appointment with us. According to Google Maps you need 20 minutes by bike from the main station in Bonn, where you start either with your own bike or with a borrowed one. However, there are three traffic lights on the route, all of which can be either red or green - or any combination of the two. How many minutes/hours before the meeting should you start at the main station? ["1 hour", "55 minutes", "50 minutes", "45 minutes", "40 minutes", "35 minutes", "30 minutes", "25 minutes", "20 minutes", "15 minutes"]	all grades
Imagine you have to hand in an important document of several pages printed and bound at a certain time (e.g. 12 noon), e.g. a seminar paper or a longer presentation with classmates. You decide to have this done in a copy shop right next to the place where you have to hand in the document. Also, imagine you could go there from home and that would take 10 minutes. It is always possible that the USB stick is not readable, the format is wrong, the file is not readable or there are five customers ahead of you. The printing itself and the binding do not last longer than 15 minutes. How many minutes/hours before handing in do you start going to the copy shop from home? ["20 minutes", "25 minutes", "30 minutes", "35 minutes", "40 minutes", "45 minutes", "50 minutes", "55 minutes", "1 hour", "1 hours, 15 minutes", "1 hour, 30 minutes", "1 hours, 45 minutes", "2 hours", "2 hours, 30 minutes", "3 hours"]	10, 12

D.7 Demographic Information

I am [female, male]	all grades
Your postcode/I am from [Choice list with possible living areas]	all grades
What grade are you in? [6,8,10,12]	all grades
Your month of birth [1 - 12]	all grades
Your year of birth [Choice list with birth years]	all grades
Last year, I got the following grades in my report:	all grades
In mathematics [1, 2, 3, 4, 5, 6]	all grades
In german [1, 2, 3, 4, 5, 6]	all grades
I am [Choice list with the most frequent religions]	all grades
How often do you attend religious festivities (e.g. mass, mosque attendance, ...) [spareTimeFrequency]	all grades
Please mark the appropriate statement: ["My parents and I were born in Germany", "I was born in Germany. One parent was not", "I was born in Germany. My mother and my father were not", "I was not born in Germany"]	all grades
My mother has A levels [yes, no]	all grades
My father has A levels [yes, no]	all grades
My parents ["both work full-time (e.g. both father and mother work from monday to friday the whole day)", "one works full-time, one works part-time", "both work part-time (e.g. both father and mother only work in the midmorning or only on 2-3 days per week)", "one works full-time", "one works part-time", "work in another regularity", "currently, both do not work."]	all grades
Number of younger sisters	all grades
Number of older sisters	all grades
Number of younger brothers all grades	
Number of older brothers	all grades
Approximate amount of pocket money (from my parents, my grandparents, ... altogether) per week [0-50; 0.5]	all grades
I have a side job, through which I earn the following amount per week (on average; 0 if no side job) [0-150; 1]	all grades
Is your pocket money cut sometimes? [yes, no]	
Do you get additional pocket money for larger purchases and expenses? [yes, sometimes/it depends, no]	all grades
Do you regulary get the same amount of money in your side job? [yes, no, I do not have a side job]	10, 12
Do you have any influence on it (e.g. because you can decide yourself how often you work)? [yes, no, I do not have a side job]	10, 12