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Time (in)consistent food choice of children and teenagers

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Abstract

We document an increasing capacity to resist temptation in a time consistent manner from children to teenagers. Competencies develop in two steps: From age 8 on many pupils naively plan and after age 12 successfully implement strategies to resist temptation. Our evidence comes from a food choice experiment that we conducted with comparable participant pools of elementary and high school pupils in 5 different school years. We offer tangible choices in terms of apples and chocolate. On the first day pupils state their preference regarding tomorrows consumption and on the second day they pick one food item for immediate consumption. We find that most of the 6 to 7 year olds consistently choose chocolate for future and immediate consumption. With pupils age 8 to 12 we observe an increase of time inconsistent behavior - pupils naively planning to consume an apple tomorrow and then choosing chocolate for immediate consumption. From age 14 on a larger share of pupils is sophisticated in the sense that they plan to and actually do consume an apple.

1 Introduction

There are many ways to make putting off unpleasant tasks—like signing an old age savings contract or starting a diet—appear to be quite rational: We hope to face less temptation after the holiday season or are waiting for free advice from a relative. However, in most cases when putting the task off one already knows that it will most likely not be more pleasant later. Nevertheless, many people postpone things up to the point where it becomes harmful, and many economists as well as psychologists have wondered how this can happen. One popular example is the study on 401(k) pension plans by Choi et al. (2002). The authors find that 68% of the individuals in their study realize that they save too little for their retirement. 24% plan to increase savings in the future but nevertheless fail to put the plan into action. Only 3% out of the 24% actually increased their savings rate four months later. Another example is the examination of gym payment plans by Della Vigna and Malmendier (2006). They discover that individuals with a monthly membership in a gym pay almost twice as much for their training compared to pay as you go rates (19$ instead of 10$). The explanation proposed for this "irrational" behavior is that individuals know that their plan to go to the gym tomorrow will fail and thus try to bind their future self by buying a monthly membership. However, they are unable to consider that the cost of the monthly membership will be irrelevant when deciding about going to the gym tomorrow. In another study on credit card borrowing Laibson et al. (2000) find that individuals pay high interest on credit card debt while at the same time holding large amounts of relatively illiquid assets.

With increasing evidence that economic behavior and decision making in general are not necessarily constant over the life-cycle[1], behavioral experiments in which children participate have become increasingly popular for studying the evolution of economic behavior. Webley and Lea (1993) and Harbaugh et al. (2001) argue that to understand adult decision making it is necessary to examine how economic socialization takes place and how choice behavior develops over age.[2] Thus, to shed light onto time consistent

[1]Neurological studies by Brown et al. (2005), Fair et al. (2007) and Fair et al. (2008) analyzing the development of brain activity of children of different ages find that neuronal control networks change substantially over age, which, in turn, may result in changes in behavior.

[2]Webley (2005) provides a review of the development of children's understanding of economic concepts and their economic behavior. Most of the experimental economic studies analyze the behavior of children in interactive contexts, popular examples are the studies on ultimatum bargaining by Murnighan and Saxon (1998) as well as Harbaugh et al. (2007), on trust and trustworthiness by Sutter and Kocher (2007), on fairness and pro-social behavior byHouser and Schunk (2009) and Sutter (2007).

and inconsistent human behavior, it is crucial to know how children develop a time perspective and the ability to delay gratification. In particular, we are interested in the following questions: How does the ability to delay gratification vary over age and cognitive abilities? How does this affect time consistent and inconsistent decision making?

Time preferences have been linked to many important fields of human decision making, among them nutrition choices, health behavior (e.g. vaccination, smoking, exercising) and financial decisions. Chabris et al. (2008) provide an extensive overview of the relationship between time discounting in the laboratory and real-world behavior of individuals. Even though they find low correlations between measured discount rates and behavior in one particular situation like exercising or smoking, they provide evidence that discount rates predict aggregate behavior reasonably well. By examining the development of time preferences over age and cognitive abilities we hope to further the understanding of time consistent and inconsistent behavior and ultimately contribute to the design of policies and educational programs for children and adults. Moreover, economic models of household decision making increasingly take into account children's influence on household outcomes. Therefore, while thinking about bargaining power and preference formation within the household it is vital to improve the understanding of preferences of young household members and how their behavior might influence aggregate outcomes.

We contribute to the literature by examining children's decision making at two different points in time in a simple food choice experiment. In particular we apply a slightly modified version of the food choice experiment of Read and van Leeuwen (1998) to individuals aged between 6 and 18. We approach individuals on two consecutive days. On the first day we ask whether children prefer a healthy apple or unhealthy Smarties (small sugar-coated chocolate sweets) for consumption tomorrow. On the second day individuals have the opportunity to reconsider their choice for immediate consumption. Thereby, we can detect age effects in decision making as well as the effect of cognitive abilities within the age groups and how they influence time consistent and inconsistent behavior. In contrast to existing literature dealing with changing discount rates over the life-cycle (e.g. Green et al. (1994, 1996, 1999), Read and Read (2004)) we do not ask for

Few studies analyze individual decision making of children. Harbaugh et al. (2001) for example examine the rationality of individual choices of children between 7 and 11 and find that older children violate the generalized axiom of revealed preference less frequently than younger children. Bettinger and Slonim (2007) arrive at similar conclusions and additionally find that older children are more patient.

preferences between (hypothetical) monetary pay-offs but offer real pay-offs in terms of Smarties and apples. Our experiment is closely related to the study by Bettinger and Slonim (2007). Contrary to their design of offering Toys'R'Us gift certificates as payout, our design allows for the observation of choice in a situation that is very familiar to the children (food-choice) and there is only a marginal lag between the payout of the reward and its consumption in our experiment. Our study can on the one hand be seen as a robustness check of their result and on the other hand as an extension to a different area of decision making.

The remainder of this paper is organized as follows. In section 2 we develop our hypotheses based on the existing literature on self-control and discounting. Section 3 describes the participants and the experimental design. In section 4 we report our results before discussing them in section 5. We conclude in section 6.

2 Literature and Hypotheses

The most widely used economic model to describe decision making over time is the discounted utility (DU) model by Samuelson (1937). It assumes that a discount rate can be used to substitute between future utility and today's utility. Many of the axioms that form the basis of the DU model have been questioned with regard to their empirical validity, but still most attempts to describe human behavior over time are modifications of Samuelson's basic framework. Frederick et al. (2002) provide a comprehensive overview of the theoretical and empirical economic literature on time preferences. Some of the biggest empirical puzzles and challenges to the DU model of human behavior over time are raised by preference reversal or time inconsistency as in the examples mentioned above. A potential alternative to the DU framework which resolves many of these issues is hyperbolic discounting, first formulated in Strotz (1955-56). Unlike in Samuelson's model, individuals do not use the same discount rate for all future periods. Instead, more distant future periods are discounted at a lower rate (weaker discounting) than the more immediate future, which is discounted more strongly. Within this framework Strotz as well as Pollack (1968) distinguish between two kinds of individuals, the naïves and the sophisticated. Naïve individuals postpone unpleasant activities, while being convinced that they will carry them out later (i.e. they are ignorant about the changes in the discount rates over time). Sophisticated individuals anticipate the changes in

discounting, thus they are aware of their weakness and tendency to postpone. They may therefore try to find mechanisms to bindingly commit their future self to carry out decisions perceived to be beneficial at the earlier point in time. Based on these contributions, Laibson (1997, 1998) develops a simple model of present-biased preferences, also known as quasi-hyperbolic discounting or $\beta\delta$-framework, to explain inconsistencies arising in the context of inter-temporal choice. This specification of the utility function has provided good fit to experimental and empirical data[3] and has also been examined neuro-economically.[4]

Preference reversals occur when individuals plan to do one thing tomorrow but, when faced with the decision for immediate consumption, change their mind and choose the opposite. Such reversals are at odds with forward-looking agents in standard economic theory. Read and van Leeuwen (1998) find that these reversals occur on the one hand due to intrapersonal empathy gaps, i.e. the inability of individuals to make a decision considering future preferences without heavily weighting their current preferences (also referred to as state of arousal). On the other hand, they may be due to quasi-hyperbolic discounting. In this experiment we are particularly interested in preference reversal due to quasi-hyperbolic discounting while holding states of arousal constant. Therefore, we examine individuals at roughly the same point in time on each day (if possible after the first school break) and additionally control for food intake of that day and the self-reported intensity of hunger in order to be able to control for changes in individuals' states.

In order to analyze dynamic inconsistency, Read and van Leeuwen (1998) define goods relative to each other as "virtues" and "vices". Virtues compared to vices yield higher utility in the long run and lower utility in the short term. This means that the opportunity cost of choosing a virtue is relatively low and comes into effect immediately while the opportunity cost of a vice is relatively high and occurs late in time. Based on the model of quasi-hyperbolic discounting Read and van Leeuwen (1998) state that if individuals put higher weight on immediate than on future utility, the food choice of

[3]See for example Angeletos et al. (2001), Laibson et al. (2000), O'Donoghue and Rabin (1999).

[4]For a review of neuroeconomical studies see Camerer et al. (2005), Loewenstein et al. (2008). McClure et al. (2004) and McClure et al. (2007) find that two separate neural systems may be involved when people make decisions regarding immediate versus future monetary payoffs (or real payoffs in terms of water or juice, as well as gift certificates). In contrast to this, Kable and Glimcher (2007) and Glimcher et al. (2007) find no neurological evidence for distinct β- and δ-discounting. Instead they argue for a single system in charge of these processes. Hare et al. (2009) find evidence that self-control is related to activities in two different brain regions.

individuals should reflect this. Mirroring these considerations, in our choice experiment a healthy snack (apple) is a virtue relative to the unhealthy snack (smarties). Therefore, we expect a higher choice of healthy snacks for delayed than for immediate consumption:

$$\text{H1: } Prob_F(apple) > Prob_I(apple),$$

where $Prob_F(apple)$ is the probability to choose an apple for future consumption and $Prob_I(apple)$ is the probability to choose an apple for immediate consumption.

Becker and Mulligan (1997) argue that individuals can exert effort to evaluate the payoffs in future time periods. As younger individuals have higher incentives to invest into improved imagination, a u-shaped pattern of time discounting over age emerges. The older people are, the more investments they have accumulated, but at some point the limited remaining life-span dominates this effect as it induces individuals to prefer instant gratification. Empirical economic studies examining the development of discount rates for individuals of different ages indicate that the valuation of payoffs in future time periods is indeed not constant but changes over the life cycle (for example Green et al. (1994, 1996, 1999), Read and Read (2004)). Most of the authors that estimate discount factors for individuals of different ages using data from experiments find that discounting does decrease with increasing age at least until adulthood.[5] Furthermore, Mischel and Metzner (1962) and Mischel et al. (1989) find that self-control and patience develop with age. The ability to resist temptation increases when children's cognitive abilities improve and a "time feeling" develops. Thus according to these studies, preference for delayed rewards is a function of age, intelligence and the length of the delay interval. They find a strong relationship between the preference for delayed reward (larger chocolate bar) and age as well as a less strong but significant relationship with intelligence. Furthermore, the authors find evidence that individuals who are better at delaying gratification tend to have more realistic estimates of future events. In a second experiment Mischel et al. (1989) examine the strategies applied by children to resist temptation and find that older children are better at finding successful delaying strategies. Additionally, they discover that better delayers have better scholastic aptitude test (SAT) scores ten years later and are evaluated as having higher social and cognitive abilities. Similar relations between patience and cognitive abilities were found by Mischel et al. (1988, 1990) and Kirby et al. (2005). Bettinger and Slonim (2007) identify that rationality (defined as time consistent

[5]Discount rates might increase again at old age due to declines in life-expectancy.

behavior) as well as patience in an intertemporal choice experiment increases with age and achievement in a test of mathematical ability. Webley et al. (1991), Furnham (1999) and Otto et al. (2006) examine children's savings behavior (partly in play economies, i.e. games within an economic setting). The overall result is that older children apply successful saving/waiting strategies, avoid temptation and reach targets more frequently than younger children.

In line with the existing literature young children are expected to discount strongly and therefore have higher preferences for instant gratification. With increasing age and cognition the valuation of future time periods increases, i.e. individuals discount less. Therefore, we expect that with increasing age and cognitive abilities the proportion of individuals that choose chocolate when deciding for tomorrow should decrease, i.e. the probability to choose the apple for tomorrow should increase as individuals learn to take future time periods into account.[6]

$$\text{H2: } Prob_F(apple|cohort1) < Prob_F(apple|cohort2) < \text{etc.},$$

where *cohort 1* is younger (H2a) or has lower cognitive abilities (H2b) than *cohort 2*.

Moreover, Becker and Mulligan (1997) point out that time discounting of children could change with parental wealth as richer households have more resources to invest into future-oriented capital, i.e. "wealth causes patience" and not vice versa. Thus, we propose H2c as above, where *cohort 2* has richer parents than *cohort 1*. As parents could spend their own time instead of wealth on the education of their offspring, children's patience can also increase with the parental level of education (H2d).

The argument above holds equally for immediate choice. Thus, with increasing age (H3a), cognitive abilities (H3b) and parental wealth and education (H3c and H3d) the proportion of individuals choosing instant gratification when deciding immediately should decrease and therefore the probability to choose the apple for current consumption should increase.

$$\text{H3: } Prob_I(apple|cohort1) < Prob_I(apple|cohort2) < \text{etc.},$$

In the (quasi-) hyperbolic discounting framework it is relatively easy to make good decisions for future selves (I can always plan to eat healthy food or go to the gym

[6] We are aware of the fact that the same pattern of preferences will be observed if the taste for sweets changes over age. We will discuss this point in the conclusion.

tomorrow). The hard part is to stick with the choice. If the first step of individuals is to realize that it would be better to eat healthy tomorrow and the harder second step is to actually do so, we expect differences in the choice structures over age and cognitive abilities. In other words, we expect that the speeds with which the ability to be far-sighted (choose the apple for tomorrow) and the ability to stick with the choice (choose the apple also for immediate consumption) develop are different. The pattern of choice that should emerge is that the majority of young children will be time consistent and myopic. These kids will always select highest instant gratification ("chocolate-choosers"). With increasing age and cognition the ability to delay rewards as well as the valuation of future time periods increases. Therefore, time inconsistent behavior emerges because it is more difficult to exert self-control in immediate than in future choices. Children will choose the apple for future consumption, however when it comes to picking for now they will prefer chocolate, i.e. there is a high amount of "switchers". Furthermore, the amount of time consistent "apple-choosers" rises with age and cognitive abilities. Expressed more formally this means that:

$$\text{H4: } Prob_I(switching|cohort1) > Prob_I(switching|cohort2) > \text{etc.},$$

where *switching* is the decision to take chocolate for immediate consumption *given that* the individual has chosen the apple on the day before. Again *cohort 1* can be younger (H4a), have lower cognitive abilities (H4b) or have less wealthy and less educated parents (H4c and H4d) compared to *cohort 2*.

In addition to this Read and van Leeuwen (1998) find that women and men significantly differ in their choice pattern. Women choose fewer (or at least not more) unhealthy snacks for future consumption than men. However, they choose significantly more unhealthy snacks when deciding for current consumption. In contrast to this, Bettinger and Slonim (2007) find that boys are less patient than girls, but in their experiment there was a substantial time lag between receiving and consuming the pay-off. Accordingly, we expect our pattern of future choices for boys and girls to be similar to the results of Read and van Leeuwen (1998); i.e. choices for future consumption of boys and girls should be similar but we expect a higher preference for the unhealthy snack by girls when choosing for current consumption.

$$\text{H5: } Prob_F(apple|female) = Prob_F(apple|male) \text{ and}$$
$$Prob_I(switching|female) > Prob_I(switching|male)$$

3 Methodology

3.1 Participants

We conducted the experiment with pupils in four schools in Germany between May and July 2008. Two of the schools were located in the state Baden-Württemberg (one primary school and one high-school ("Gymnasium")) and two in Rhineland-Palatinate (one primary and upper secondary school and one high-school ("Gymnasium")). We obtained the permission to conduct the experiment from the headmasters of the schools as well as the parents of pupils in advance. Data of 244 pupils from age 6 to 18 was collected, 133 of them were female and 111 male. In total we visited 12 classes and collected data from two 1st (age 6-7), 3rd (age 8-9) and three 6th (age 11-12) and 9th (age 14-15) as well as two 12th (age 17-18) grade classes. Table 1 contains the population statistics.

Table 1 about here

3.2 Experimental Design

3.2.1 Procedure

The choice experiments are designed in a one-to-one, face-to-face procedure[7] on two consecutive days at approximately the same time of day. On day one we ask the pupils for their future choice, i.e. what they prefer for the following day. On day two when the payoff period for the future choice comes into effect we ask pupils for their immediate choice. Thus, they are given the opportunity to change their mind and decide on their immediate consumption without being reminded of and restricted by their previous choice. The experimental protocol can be found in appendix A.

On the first day the pupils are introduced to the experiment, they fill in a questionnaire concerning their age, sex, and the food intake of the day as well as several background variables like parental wealth and grades in the last report card and a personal code.[8] We will explain the variables in greater detail in section 3.3. The ques-

[7]For exemplary designs of experiments in which children participate as subjects see Houser and Schunk (2009) and Häger et al. (2010). The exact wording of our experiment is contained in the appendix.

[8]The personal code allows us to match the questionnaires and decisions on the two days without being able to connect them to an individual pupil. There is a slightly modified procedure for the first

tionnaire is placed in an envelope and sealed. After that the teacher continues with the regular class and pupils leave the classroom one by one to meet the experimenter. The experimenter is seated behind a table where one of each of the food items is displayed. The experimenter asks the pupil individually whether she prefers an apple or Smarties on the following day.[9] The decision is written on the sealed envelope. After that, the pupil goes back into the classroom. Pupils are requested not to communicate with their classmates when they go back. A second experimenter staying in the classroom during the experiment enforces this when necessary.

On the second day, pupils fill in a questionnaire asking for the food intake of the second day and the same personal code. The questionnaire is placed in an envelope and sealed. Again the pupils meet the experimenter one by one, while class continues. The experimenter on day two is always a different person than the day before in order to credibly assure that the experimenter does not know the pupil's prior decision. Again, the groceries are displayed on a table and the experimenter asks the pupil whether she wants an apple or Smarties now. The experimenter points out that pupils are not bound to stick to the decision they took the previous day. In addition to that, a basket containing many apples and Smarties packages is displayed in the background on day two to show that there is no shortage of snacks if pupils change their mind. As soon as the individuals make their choice the snack is given to them. In order to not disturb teaching the pay-off is placed in a paper bag, such that other participants cannot observe it when the pupil goes back into the classroom.[10] Pupils are asked to wait with the consumption until all pupils finished the experiment. The consumption delay is no longer than 15 to 20 minutes at most.

3.2.2 Choice

Smarties count as vices compared to apples: they give high immediate pleasure due to high calories, high sugar, the chocolate taste and an appealing appearance. However, they are associated with long-term cost like weight problems, coronal heart disease, bad

graders as they cannot answer the written questionnaire in any reasonable time. We ask them about their hunger and food items in their lunch bags etc. face to face. We do not obtain information on their parental background and grades because they are not graded yet.

[9]The order of the food items in the question asked by the experimenter is randomly switched and noted for each individual. We add this as a control in our regressions.

[10]In fact, many of the pupils held the bag behind their back when they entered the class in addition to this.

teeth, etc. Their image as being unhealthy is in line with our pretest results (see table 2).[11] Compared to Smarties, apples are reckoned as virtues. They give less immediate pleasure due to their lower calorie level and are less sweet, but they are associated with low long-term cost. The healthiness of apples is a common perception as shown by our pretest results. Details on the "objective" and "subjective" characteristics of the alternatives are displayed in table 2. Apples and smarties are selected as most healthy and most unhealthy, respectively, by our pretest group of 39 individuals (see figure B6 in the appendix).

Table 2 about here

3.3 Additional Variables

Before the contact with the experimenter on each day, individuals are asked to fill in a short paper and pencil questionnaire in class. It is handed to the experimenter when pupils meet him/her individually.[12] In this questionnaire we ask for variables like age and sex. In addition to that several questions related to hunger and the food intake of the day as well as the food in the lunch box are asked. A list of the questions and variables constructed is contained in the appendix. Hunger is measured on a scale form 'very hungry' to 'not hungry at all' on both days. To estimate the difference in hunger between the two days we construct two dummy variables. The first one (less hungry) takes the value one if pupils indicate a lower value compared to the first day. Similarly the second dummy (more hungry) takes the value one if pupils indicate a higher value on the second day compared to the first.

Moreover, we collect data on pupils' skill levels by asking for their grades in math and German in the last report card. Grades have been used in previous experiments to measure differences in cognitive abilities among students. Houser and Schunk (2009) find a correlation between performance in math (math grade) and the amount of M&Ms sent in a dictator game. They relate this to the fact that cognitive abilities are relevant in many economic decision making contexts (e.g. Frederick (2005), Rydval and Ortmann

[11] See appendix B for details on the pretest. Houser and Schunk (2009) as well as Murnighan and Saxon (1998) use yellow M&Ms as pay off in experiments with children. However, our pretest reveals that people perceive yellow M&Ms, which contain peanuts, not as unhealthy as Smarties (see figure B5). In order to avoid subject confusion about the type of M&Ms we use Smarties, which are similar to the brown M&Ms.

[12] The questions asked on both days are contained in appendix C.

(2004)). In Germany school grades are measured on a scale from 1–very good to 6–insufficient. From this information we constructed two dummies: 'math good' takes the value one if a pupil has a better grade than the average of the pupils of the same age and 'language good' indicates if the pupil was better than average in German.

To control for a variation in family background that might influence students' preferences and their cognitive development we include two items from the OECD's Program for International Student Assessment (PISA) 2000 questionnaire. The first item is related to the educational background and asks for an estimate of the number of books at home. Students were given some help in doing this estimation. After some calculation they had to indicate on a scale how many books their parents approximately have at home. We constructed a variable equal to 1 if parents own more than 250 books.[13] The second item focuses on parental wealth by asking for the number of mobile phones, televisions, calculators, computers, music instruments, cars and bathrooms of the students' families.[14] Pupils could answer on a scale from 0–none to 3–three or more. We calculated a mean level of wealth by averaging over all seven items. In addition, we collect data on school type, class subject, time and date of the experiment as well as outside temperature.

4 Empirical Results

4.1 Revealed Preferences for Future and Immediate Consumption

The respective choices on the first and on the second day are displayed in table 3. About 57% of the pupils prefer an apple and 43% prefer Smarties for tomorrow's consumption (rows). However, for immediate consumption pupils choose apples and Smarties with equal probability (columns). Thus, as proposed by *hypothesis 1* and in line with the results of Read and van Leeuwen (1998), we find that pupils are more likely to choose the healthy snack for future consumption compared to the unhealthy snack. Moreover, they are more likely to switch from healthy to unhealthy when selecting a snack for immediate consumption than vice versa. Symmetry of the choice reversal is rejected at

[13] We played around with different cutoff values and our results do not change.

[14] For a discussion of these items in the context of PISA see Kunter et al. (2002): Item 1 "Besitz an Büchern" (p.244), Item 2 "Vorhandene Menge bestimmter Wohlstands- und Kulturgüter" (p.243).

the 5% significance level (p=0.022).

Table 3 about here

4.2 Who Chooses Healthy for the Future?

The analysis of choice for future consumption over age reveals that among the first graders about 28% choose the apple for tomorrow, whereas 77% of the 12th graders choose healthy for tomorrow (see figure 1). This difference persists in the multivariate analysis of future choice. We conduct probit regressions, where the dependent variable equals one if the individuals select an apple for tomorrow (see Table 4).

Figure 1 about here

In line with *hypothesis 2a* we find an overall positive and significant effect of belonging to an older age group on choosing an apple for tomorrow (model 0). Including individual dummies for all age groups reveals no significant differences in the choices between first and third graders (model 1). However, compared to the third graders, sixth, ninth and twelfth graders are all significantly more likely to choose the apple. We conducted one-sided χ^2–tests to compare the marginal effects of the other age-groups. We find that there are no significant differences in the probability to choose the apple between the sixth and the twelfth as well as the ninth and the twelfth graders, respectively. Surprisingly, compared to the ninth graders the sixth graders are more likely to choose the apple. In these regressions we also control for the self-reported state of arousal ("hungry"), gender, and whether the apple was mentioned first. Mentioning the apple first has a weakly significant negative effect (at 10% significance) on choosing the apple for tomorrow in the first specification (model 0), but the effect is not robust to including dummies for the age groups. Moreover, when choosing for tomorrow no significant difference between male and female individuals can be detected (*hypothesis 5*).[15]

Table 4 about here

[15]We also run separate regressions for girls and boys. The age effects we detect are very similar across gender. Additionally, we ran all regressions excluding the 12th graders, because there is some selection into 12th grade on the basis of cognitive abilities. Overall, our results persist when excluding this age-group.

In models 2 and 3 controls for cognitive abilities (math grade in the last report card) and parental background (education and wealth) are added. As we do not have information on cognitive abilities and parental background for first graders the number of observations is lower in these regressions. The first remarkable result is that including additional variables does not substantially change the age effect. Secondly, in contrast to our *hypothesis 2b* cognitive abilities turn out to have no overall significant effect on children's choices for the future (model 2). And finally, we can not detect any influence of parental wealth or education (*hypothesis 2c* and *2d*) on children's food selection.

To investigate the effects of age and cognitive abilities in more detail we include interaction terms between math grade and the cohort dummies (model 3). The interaction effects should reveal whether cognitive abilities play a role for future choices within certain age groups. When interaction terms are included, the age-dummies hardly change. Moreover, we do not find any effect of cognitive abilities in the youngest and the oldest age group. Among the sixth graders pupils with above average math abilities are more likely to pick the apple, however among the ninth graders the opposite is the case. Thus, with respect to our *hypothesis 2b* we find that there is no clear positive effect of cognitive abilities for children of a particular age on the probability of choosing the apple for tomorrow.[16]

4.3 Who Chooses Healthy for Now?

In *hypothesis 3* we propose that the effects of age and cognitive abilities on the choice of an apple largely apply in the same manner for immediate and future consumption. Figure 2 indicates that the propensity to choose the apple for immediate consumption increases with age. Regression results are displayed in table E9 in the appendix. We find that older individuals are significantly more likely to choose the apple for immediate consumption. Compared to our previous analysis cognitive abilities in terms of math or German grade grade show a positive effect on choosing the apple here (at 5% significance). Moreover, parental wealth increases the probability to pick an apple for immediate consumption (at 10% significance). Apart from that we find that girls are significantly less likely to choose the apple for immediate consumption which is in line with *hypothesis 5*. We

[16] We conduct the same regressions using the German grade instead of the math grade. Overall, the results remain similar. For girls we find that better language abilities have a positive and significant effect on selecting an apple for tomorrow's consumption.

omit a detailed discussion of these results as the more interesting question concerns the immediate choice conditional on the choice on the previous day.

Figure 2 about here

Figure 3 displays the frequency of all choice combinations on day 1 and day 2. The top panels show that the frequency of consistently choosing chocolate decreases over age whereas the likelihood to select an apple on the first day and stick with it increases with age. The two bottom panels show the inconsistent choices. The frequencies of switching from apple to chocolate and vice versa are hump-shaped over the age groups. However, there are more individuals changing their choice from apple to chocolate than the other way round at all ages.

Figure 3 about here

We are particularly interested in the determinants of selecting chocolate for immediate consumption when the apple was chosen on the day before. Therefore, we condition the following analysis on the individuals that choose an apple on the first day (see figure 4). In the first and the third grade there is the largest share of pupils who change their mind. Specifically, among the 6 and 7 year old 38% of the kids that choose an apple for the future change their mind and prefer chocolate when selecting for immediate consumption. Among the 8 and 9 year old 45% change their mind. In contrast to this, only 15% of the older individuals (14/15 and 17/18 year old) switch from apple to chocolate on the second day.

Figure 4 about here

We conduct probit regressions to single out the determinants of the second day choice in more detail. The dependent variable here is a dummy which is equal to one if individuals choose chocolate on the second day conditional on the choice of an apple on the previous day (table 5). As proposed in *hypothesis 4a*, there is a significant negative effect of age on switching, i.e. younger individuals are less likely to stick with their choice of an apple on the second day, even when controlling for changes in the self-reported state of hunger between the first and the second day (model 0).[17] Using dummies for

[17]For a more detailed discussion of preference reversals due to hot-cold-empathy gaps see Read and van Leeuwen (1998).

all age groups (model 1) shows that the probability of switching is highest among the third graders. The first graders as well as the older pupils are more likely to stick with their choice compared to individuals at age 8/9. The negative effect for the first graders compared to the third graders is a little surprising. However, this effect might be due to the fact that few pupils in the first grade choose an apple for tomorrow. And the ones that do so might have strong preferences for the apple and thus are less likely to switch compared to the third graders. Again we conducted one-sided χ^2-tests to determine if the differences between the older age-groups are significant. Pupils aged 14 to 15 and 17 to 18 are significantly less likely to switch from apple to chocolate compared to all younger age groups. Between the two oldest cohorts there is no significant difference in the probability of switching. In line with the findings of Read and van Leeuwen (1998) and our *hypothesis 5*, girls tend to change their mind more often (24 of the 37 individuals switching from apple to smarties are female, 13 are male). They have a higher probability of choosing chocolate on the second day conditional on selecting the apple before.

Table 5 about here

In models 2 and 3 we add controls for cognitive abilities and parental background. Again first graders are omitted. As proposed in *hypothesis 4b* the math grade turns out to have a weakly significant (at 10%) negative effect on switching (model 2).[18] The results regarding parental background are mixed. Consistent with *hypothesis 4c*, there is a negative effect of parental wealth on selecting chocolate on the second day when the first choice is an apple (significant at 5%). However, we find no significant effect of parental education on the likelihood to change one's mind (*hypothesis 4d*).

As in the previous analysis we add interaction effects between age and cognitive abilities (model 3). The analysis reveals a surprising effect of cognitive abilities on the probability of switching. Among the oldest participants all pupils with good math sticked with the apple (therefore this variable is dropped from the estimation because it predicts failure perfectly.) which is in line with *hypothesis 4b*. However, among the 11 to 12 and 14 to 15 year old being good in math increases the probability of switching. This result is in contrast to *hypothesis 4b*.[19]

[18] German grade turns out to have no significant effect on the children's conditional food choice on the second day.

[19] When using German grade effects are the same.

What determines the switching from Smarties to apples? Similarly to our previous analysis we estimate probit models where the selection of an apple on the second day is the dependent variable. We condition on a choice of Smarties on the previous day. Our results reveal no overall age effect (model 0 in table E10 in the appendix). When adding cohort dummies (model 1) we find that individuals in the sixth grade are significantly more likely to switch from chocolate to apple than the third graders. First graders are significantly less likely to change their mind in this direction compared to third graders. However, there are no effects for the older individuals. Interestingly, parental education measured by the number of books at home is significantly negatively related to switching from Smarties to apple.

5 Discussion

Our experimental design allows for the simultaneous observation of long-term oriented behavior and instant gratification by giving the same individuals the opportunity to choose between healthy and unhealthy snacks on two consecutive days. Thus, we contribute to the economic as well as the psychological literature on instant gratification, and intertemporal decision making.

Overall, a large share of individuals in our experiment behaves in a manner that can be considered time consistent. The pattern of choices we observe is substantially more stable than the choice pattern detected by Read and van Leeuwen (1998). This is probably due to our slightly modified design: First of all we tried to keep states of arousal constant, i.e. we approached kids approximately at the same point in time on each day. Secondly, we restricted our choice to two food items only (one healthy and one unhealthy) in order to simplify the choice. Nevertheless, we confirm previous results of time inconsistent behavior. More individuals choose the healthy alternative for the future, however when it comes to selecting food for immediate consumption, individuals are prone to changing their mind and prefer the unhealthy alternative *(hypothesis 1)*.

With regard to age we find that older individuals are more likely to choose the healthy snack for the future and at the same time they are more likely to stick with their original decision *(hypothesis 2a and 4a)*. Thus, older individuals are both better at planning for the future and at resisting temptation. We find the largest differences in the probability to select the apple for the future between the third and the sixth graders, i.e. at the

onset of puberty pupils seem to become better at planning for the future. However, when it comes to sticking with their choice, we find that the third and the sixth graders both are more likely to change their mind and select Smarties for immediate consumption compared to the older individuals.

Thus, the following stylized pattern of revealed preferences emerges: The choices of younger individuals are time consistent but myopic in the sense that long-term effects of the choice are disregarded. They discount strongly and choose chocolate for future and immediate consumption. With increasing age, individuals become more long-term oriented, which introduces time inconsistent behavior in some. They choose the apple for the future but fail to stick with it when selecting for immediate consumption. According to Strotz (1955-56) and Pollack (1968) they would be classified as naïve. They know that they should care about the future; however, they are not able to bind their future self successfully to reach the long-term rational goal. With further increasing age and cognition individuals are more likely to stick with their healthy choices. These individuals choose an apple for the future and for immediate consumption. They are long-term oriented and time consistent – if this results from successful strategies to deal with temptation, they would classify as sophisticated. Frederick et al. (2002) point out that the degree of naïvety and sophistication of individuals might have important policy implications: if individuals are sophisticated, the provision of commitment devices might be optimal, however, if individuals are naïve, more effort is needed in terms of education to increase awareness of time inconsistent behavior.

A potential point of criticism of our results is that not only time preference but also taste changes with age, i.e. we observe the declining preference for Smarties, because there is a shift in preferences away from sweets. Cooke and Wardle (2005), for example, find that the preference for sweet and fatty food items decreases between age 8 and 16. However, at the same time they find that the preference for fruits decreases with age as well. Overall they find that sweet and fatty food is preferred over fruit at all ages. Thus, according to their finding, we should not see a systematic shift from unhealthy to healthy food over age. Moreover, if our results are driven by changes in the taste for sweets and fruits, we should not observe the time inconsistencies. In the case of changing tastes one would expect that there is no difference between preferences for future and preferences for immediate consumption.

Cognitive abilities are not revealed to have an overall effect on choosing an apple

for the future or resisting temptation *(hypothesis 2b and 4b)*. Moreover, the results regarding the role of cognition at certain ages are mixed. This is somewhat contradictory to results by Mischel and Metzner (1962) and Mischel et al. (1989) who find that patience is associated with higher cognitive capacity. Our results might be influenced by the fact that we use self-reported grades and do not check with teachers if the information given by students is correct. Another explanation might be that we ask for the grade in the last report card which was given to pupils approximately four months before the experiment. Thus, some students might not remember their grade and thus the measurement error might be high.

We are not able to detect any systematic influence of parental background (wealth and education) on the choice of apples for the future *(hypothesis 2c and d)*. However, we find a significant and negative effect of parental wealth on switching behavior *(hypothesis 4c)*. There is no significant effect of parental education on switching from apple to Smarties *(hypothesis 4d)*. We might not find effects for parental education because of a high measurement error in the estimate of the number of books at home. On the one hand it might not be a perfect proxy for parental education and on the other hand students might have had difficulties in estimating the number of books despite the support we gave in doing the estimation.

A further issue is that there might be communication among students and among students with their parents between the first and the second day. Therefore, food choices as well as lunch boxes might be adjusted to the additional food item offered by the experimenter. Firstly, regarding the communication among students: The concern is that pupils want the same item as their peer. However, we do not think that this effect influences our result because students did not know anything about the choice before making their decision on the first day and until the last moment on the second day they did not know about the opportunity to change their mind. Secondly, with regard to the communication with parents the concern is raised that parents might adapt the lunch boxes of their children on the second day according to the choice of the child, i.e. those who picked chocolate do not get chocolate in their box and those who pick apples do not get additional fruit. We checked the dynamic adjustment of consumption and do not find any evidence that pupils eat differently on the first and on the second day.

6 Conclusions

We are the first study to clearly demonstrate changing patterns of time preferences over age in the context of a typical situation that children are faced with on a daily basis: choosing between two food items. We do not need to rely on children's ability to actually discount as in experiments using monetary incentives, or abstract from the given situation (e.g. experiments using delayed rewards such as gift certificates, Bettinger and Slonim (2007)). In this regard, our results can be seen to apply more directly and may be considered as a robustness check to previous results.

Apart from that, we believe that the patterns in choice behavior that we detect point to certain policy recommendations. A lesson that parents have understood from the dawn of time is that it clearly makes sense to restrict the choices of children as long as they are not able to consider the future impact of their decisions. But, more importantly, children act in a way that is to some degree predictable and regular – therefore it may not only be promising to balance their disregard for long-term effects of their behavior by providing them with "high-powered" short-term incentives but also to teach them about long-term consequences of their behavior.

Children actually do learn to consider the long-term effects of their decisions. With our experimental setup, we were clearly not equipped to establish whether this is a conscious or a subconscious effort. More research is required to determine whether and how to teach young individuals about the long-term impact of their choices, perhaps by helping them to avoid forming self-damaging preferences and to increase their ability to appreciate future consequences of today's actions. It would be very interesting to conduct a long-term study of human behavior and relate time preferences at young ages not just to cognitive abilities but also to real-world decisions they make later in life. In this vein, additional design options for public policies aimed to improve long-term rational behavior of individuals may be found, which could influence such different but equally important realms as individual health, private retirement planning and addiction.

Moreover, we believe that this realm should not be limited to sociological research, but that neurological and neuro-economic studies may have an important role to play in this context: Perhaps as a first step, a neurological examination of children's decision making may solve the conflicting results of McClure et al. (2004, 2007), Glimcher et al. (2007) and Hare et al. (2009).

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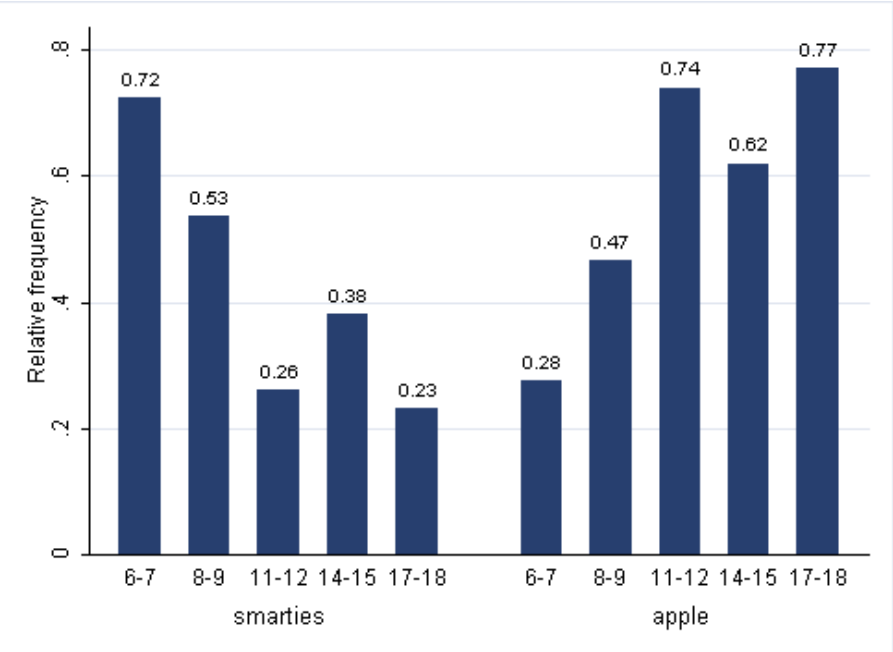
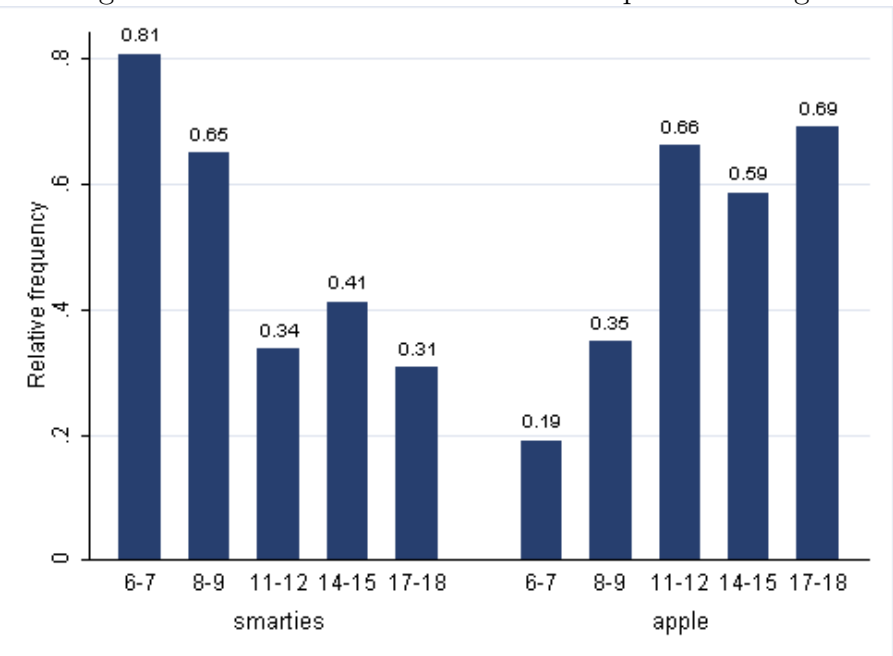
Figure 1: Choice for Future Consumption over Age



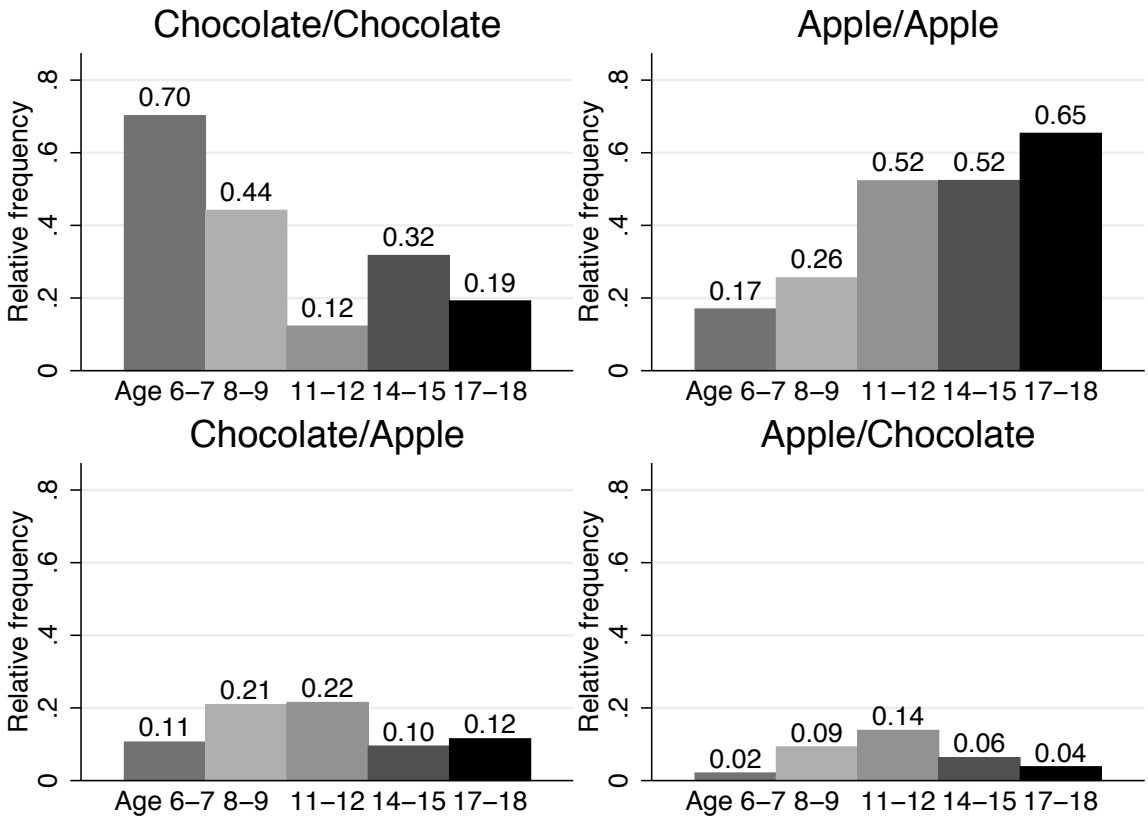
This figure displays the relative frequencies of choosing Smarties and apples for consumption tomorrow, i.e. choice on day 1, over age for all participants (n=244).

Figure 2: Choice for Immediate Consumption over Age



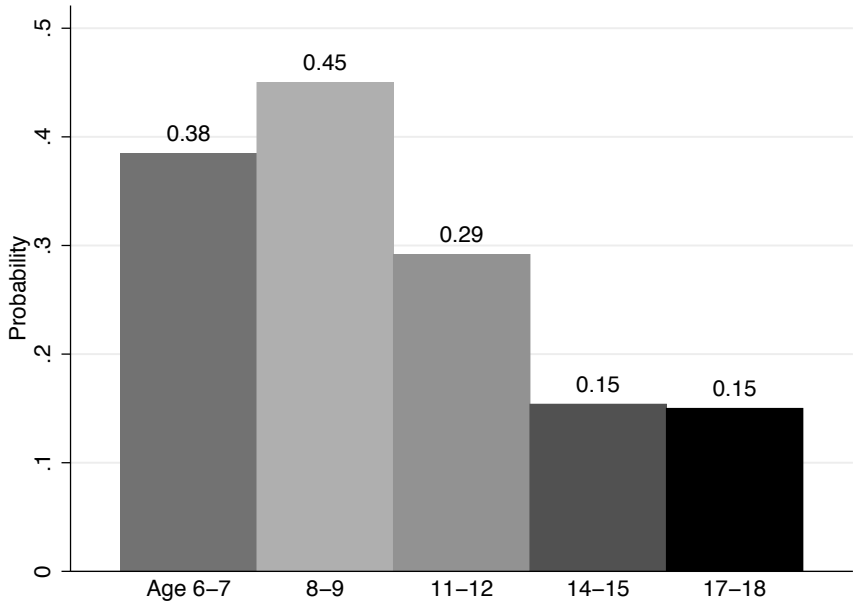
This figure displays the relative frequencies of choosing Smarties and apples for immediate consumption, i.e. choice on day 2, over age for all participants (n=244).

Figure 3: Time Consistent and Inconsistent Choices



In this figure the relative frequencies of choice combinations over age are depicted for all participants (N=244). Top Panel Left: Immediate choice of Smarties conditional on choice of Smarties for future consumption; Top Panel Right: Immediate choice of apple conditional on choice of apple for future consumption; Bottom Panel Left: Immediate choice of Smarties conditional on choice of apple for future consumption; Bottom Panel Right: Immediate choice of an apple conditional on choice of Smarties for future consumption.

Figure 4: Smarties for Immediate Consumption Conditional on Choice of an Apple for Future Consumption



This figure displays the relative frequencies of choosing Smarties for immediate consumption on the second day conditional on selection of an apple for future consumption on the first day over age (n=140).

Table 1: Sample Statistics

This table contains summary statistics—mean (m) and standard deviation (std)—for the respondents in our sample.

	all		**Age 6-7**		**Age 8-9**		**Age 11-12**		**Age 14-15**		**Age 17-18**	
	m	std	m	std	m	std	m	std	m	std	m	std
Female	0.55	0.50	0.49	0.51	0.53	0.50	0.57	0.50	0.52	0.50	0.65	0.49
Hungry (Day 1)	0.94	1.01	0.35	0.82	1.18	1.11	1.28	0.99	0.95	0.92	0.81	0.94
Hungry (Day 2)	1.11	0.95	0.63	0.80	1.17	1.12	1.26	0.85	1.11	0.93	1.50	0.91
Math	2.58	0.98	-	-	2.05	0.79	2.80	0.96	2.59	1.00	2.86	0.97
German	2.64	0.88	-	-	2.24	0.74	2.94	0.82	2.69	0.90	2.44	0.95
Parental Wealth	2.14	0.49	-	-	1.90	0.58	2.11	0.46	2.28	0.41	2.26	0.42
Parental Education	4.31	1.29	-	-	4.00	1.31	4.24	1.41	4.37	1.26	4.85	0.83
No. of classes	12		2		2		3		3		2	
N	244		47		43		65		63		26	

Table 2: Choice Alternatives

This table describes the alternatives participants could select on both days.

	Apple	Smarties
Weight	140 g	38 g
Price	0.30 /apple	0.35 /Smarties snack
Objective measure of healthiness	Low calorie: ca. 80 kcal	High calorie: ca. 174 kcal
	Low fat: ca. 0.6 g	High fat: 8 g
Subjective measure of healthiness*	Mean: 9.36	Mean: 2.49
	SD: 0.87	SD: 1.23
	Min: 7	Min: 1
	Max: 10	Max: 6

* Pretest score (on a scale of 1 to 10, where 10–very healthy, 1–very unhealthy) . Pretests are described in the appendix.

Table 3: Revealed Preferences for Immediate and Future Consumption (N= 244)

This table contains the choices pupils made on both days. The cells contain the pattern of time consitent and inconsistent choices. The last column describes choices made on the first day for consumption tomorrow. The last row contains choices made for immediate consumption on the second day. The symmetry of the choice reversal is rejected at 5% significance (p=0.022) by a McNemar test.

		Immediate consumption (day 2)		
		Unhealthy snack	Healthy snack	Total
Future consumption (day 1)	Unhealthy snack	85 (34.5%)	19 (7.8%)	104 (42.6%)
	Healthy snack	37 (15.2%)	103 (42.2%)	140 (57.4%)
	Total	122 (50%)	122 (50%)	244 (100%)

Table 4: Selecting an Apple for the Future

This table shows marginal effects after a probit regression of age, cognitive abilities, and various other covariates on selecting an apple for future consumption. The dependent variable is a dummy equal to one if pupils choose an apple for tomorrow. Age cohort is a categorical variable taking values from 1 (age 6-7) to 5 (age 17-18). Hungry is a dummy equal to zero if respondents did not feel hungry at all and one in all other cases. Parental wealth is the average over all seven wealth categories. Parent's education is a dummy equal to one if there are more than 250 books at home and zero if there are less. (d) indicates a dummy variable. Ref. refers to the omitted category if various dummies are used. Marginal effects in the model with interaction terms are calculated according to Ai and Norton (2003). Standard errors are clustered at the class level. In the first two specifications all pupils are included (N=231). In specification 2 and 3 the first graders drop out due to missing information on cognitive abilities and parental background (N=183).

	Model 0	Model 1	Model 2	Model 3
Age cohort	0.11			
	[0.05]**			
Age 6-7 (d)		-0.16		
		[0.19]		
Age 8-9 (d)		Ref.	Ref.	Ref.
Age 11-12 (d)		0.28	0.3	0.30
		[0.06]***	[0.06]***	[0.04]***
Age 14-15 (d)		0.17	0.2	0.19
		[0.04]***	[0.06]***	[0.05]***
Age 17-18 (d)		0.3	0.31	0.30
		[0.04]***	[0.04]***	[0.04]***
Female (d)	-0.02	-0.03	-0.02	-0.03
	[0.03]	[0.03]	[0.04]	[0.04]
Hungry (d)	-0.09	-0.04	-0.07	-0.07
	[0.09]	[0.06]	[0.07]	[0.06]
Apple first (d)	-0.07	-0.07	-0.03	-0.03
	[0.04]*	[0.05]	[0.06]	[0.06]
Parent's education (d)			0	-0.02
			[0.10]	[0.11]
Parental Wealth			-0.08	-0.07
			[0.09]	[0.09]
Math good (d)			0.07	-0.02
			[0.06]	[0.11]
Math* Age 11-12				0.09
				[0.06]*
Math* Age 14-15				-0.22
				[0.09]**
Math* Age 17-18				-0.09
				[0.13]
Observations	231	231	183	183
Pseudo R2	0.08	0.11	0.06	0.07

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Switching from Apple to Smarties

In this table the determinants of switching from apple to smarties on the second day are examined. The table shows marginal effects after a probit regression of age, cognitive abilities, and various other covariates on selecting smarties for immediate consumption conditional on having chosen an apple for future consumption. The dependent variable is a dummy equal to one if pupils choose smarties for now. Age-cohort is a categorical variable taking values from 1 (age 6-7) to 5 (age 17-18). Hungry is a dummy equal to zero if respondents did not feel hungry at all and one in all other cases. Parental wealth is the average over all seven wealth categories. Parent's education is a dummy equal to one if there are more than 250 books at home and zero if there are less. (d) indicates a dummy variable. Ref. refers to the omitted category if various dummies are used. Marginal effects in the model with interaction terms are calculated according to Ai and Norton (2003). Standard errors are clustered at the class level. In the first two specifications all pupils who selected an apple on the first day are included (N=131). In specification 2 and 3 the first graders drop out due to missing information on cognitive abilities and parental background (N=116).

	Model 0	Model 1	Model 2	Model 3
Age-cohort	-0.09			
	[0.02]***			
Age 6-7 (d)		-0.08		
		[0.04]**		
Age 8-9 (d)			Ref.	
Age 11-12 (d)		-0.2	-0.18	-0.25
		[0.05]***	[0.05]***	[0.09]***
Age 14-15 (d)		-0.28	-0.21	-0.29
		[0.03]***	[0.04]***	[0.08]***
Age 17-18 (d)		-0.25	-0.2	-0.26
		[0.03]***	[0.06]***	[0.06]***
Female (d)	0.14	0.14	0.19	0.21
	[0.06]**	[0.07]**	[0.06]***	[0.07]***
Apple first (d)	-0.05	-0.05	-0.12	-0.15
	[0.09]	[0.09]	[0.09]	[0.08]**
less hungry (d)	0	0.02	0.04	0.05
	[0.10]	[0.10]	[0.10]	[0.12]
more hungry (d)	-0.11	-0.09	-0.18	-0.18
	[0.07]	[0.08]	[0.07]**	[0.07]***
Parent's education (d)			0.07	0.06
			[0.13]	[0.06]
Parental wealth			-0.22	-0.07
			[0.08]**	[0.09]
Math good (d)			-0.15	0.06
			[0.08]*	[0.14]
Math* Age 11-12 (d)				0.53
				[0.08]***
Math* Age 14-15 (d)				0.95
				[0.10]***
Math*Age 17-18 (d)				dropped
Observations	131	131	116	108
Pseudo R2	0.08	0.09	0.18	0.21

* significant at 10%; ** significant at 5%; *** significant at 1%.

A Appendix A: Experimental Protocol (in German)

Experimental Protocol for 3rd to 12th grade. Among the first graders we slightly modified experimental procedures as they cannot answer the written questionnaire in any reasonable time. We asked them about their hunger and food items etc. face to face. We did not ask for their parental background. Neither did we ask for grades because they are not graded yet.

Tag 1:

- Den Schülern wird kurz das Ziel des Experimentes erklärt. Sie werden gebeten, ihre Nachbarn und Freunde nicht beim Ausfüllen des Fragebogens zu stören und sie auch sonst nicht zu beeinflussen.
- Die Fragebögen und Umschläge werden an alle Schüler verteilt. Es wird erklärt, wie der individuelle Code gebildet wird. Ein Beispiel wird anhand einer Folie auf dem Overhead vorgeführt.
- Danach werden die Schüler gebeten, selbständig den Fragebogen auszufüllen und ihn im Umschlag zu platzieren.
- Die Schüler werden der Reihe nach einzeln zum Experimentator geschickt.
- Der Experimentator sitzt an einem Tisch. Vor ihm liegen ein schöner Apfel und eine Packung Smarties.
- Der Experimentator fragt, welches Lebensmittel sie am kommenden Tag lieber möchten.
- Der Schüler schreibt die Entscheidung auf den Umschlag.
- Der Experimentator bittet den Schüler, zurück in die Klasse zu gehen und nichts zu verraten.

Tag 2:

- Wie am Tag 1 werden die Schüler gebeten, einen Fragebogen auszufüllen und mit ihrem persönlichen Code zu versehen. Der Fragebogen wird in einem Umschlag platziert und verschlossen.

- Die Schüler werden wieder der Reihe nach und einzeln zum Experimentator geschickt.
- Der Experimentator (eine andere Person als am Vortag) sitzt an einem Tisch. Vor ihm liegen ein schöner Apfel und eine Packung Smarties. Im Hintergrund steht ein Korb mit Äpfeln und eine Korb mit Smarties, die zu jedem Zeitpunkt etwa gleich voll sind, so dass klar ist, dass von beiden Lebensmitteln genügend vorhanden ist.
- Der Experimentator bittet die Schüler um den Umschlag und fragt, welches Lebensmittel sie jetzt möchten.
- Der Experimentator händigt entsprechend der Entscheidung ein Lebensmittel aus (aus dem Korb, so dass die zur Schau gestellten Lebensmittel immer identisch sind). Er schreibt die Entscheidung auf den Umschlag.
- Die Auszahlung wird in eine Papiertüte gelegt, damit die anderen Schüler die Auszahlung nicht sehen.
- Der Experimentator bittet den Schüler zurück in die Klasse zu gehen und nichts zu verraten.

Wörtlicher Ablauf des Experiments am ersten Tag

1. In der Klasse mit allen Schülern:

Guten Morgen. Ich bin Tabea Bucher-Koenen. Und das ist mein Kollege Carsten Schmidt. Wir kommen von der Universität Mannheim. Wir machen eine Studie zu Entscheidungen von Schülern. Deshalb sind wir heute hier. Zuerst bekommt ihr einen kurzen Fragbogen zum Ausfüllen. Bitte füllt den Fragebogen alleine aus und steckt ihn danach in den Umschlag und klebt ihn zu. Danach kommt ihr einzeln nach draußen und wir stellen euch eine einfache Frage. Dann geht ihr zurück in die Klasse. Es ist sehr wichtig, dass ihr bis zum Ende der Stunde auf keinen Fall mit euren Mitschülern über das Experiment sprecht oder anders kommuniziert. Eure Entscheidung bleibt geheim. Morgen kommen wir noch einmal und ihr bekommt eure Belohnung.

Welche Fragen habt ihr dazu?

Wir teilen jetzt den Fragebogen und den Umschlag aus. Bitte füllt noch nichts aus. Bevor ihr den Fragebogen ausfüllt, möchte ich noch erklären, wie ihr euren persönlichen Code bildet.

[Verteilen der Fragebögen und Umschläge]

Auf der ersten Seite des Fragebogens findet ihr unten vier Felder, in die ihr euren persönlichen Code schreibt. Es ist wichtig, dass in jedem Feld nur ein Buchstaben oder eine Zahl steht. Ich erkläre euch jetzt wie ihr den Code bildet.

In das erste Feld tragt ihr den Anfangsbuchstaben vom Vornamen eurer Mutter ein. Wenn ihr Name Anne ist, z.B. ein A. In das zweite Feld tragt ihr den Anfangsbuchstaben vom Vornamen eures Vaters ein. Wenn sein Name Peter ist, z.B. ein P. In das dritte Feld tragt ihr den Tag Eures Geburtstags ein. Ich habe zum Beispiel am 30. August Geburtstag, deshalb trage ich eine 30 ein. In das vierte Feld tragt ihr den letzten Buchstaben eures Vornamens ein. Ich heiße Tabea, deshalb trage ich ein A ein.

Habt ihr dazu noch Fragen?

Dann füllt jetzt bitte den Fragebogen aus und wenn ihr fertig seid, steckt ihr ihn in den Umschlag. Wenn ihr fertig seid, kommt ihr in folgender Reihenfolge einzeln nach draußen. Es fängt die Person an, die am nächsten an der Tür sitzt und dann kommt der Nachbar. Danach fangt ihr wieder außen an bis alle dran waren.

2. Während des Experiments:

Experimentator (E) 1: Hallo. Setz dich! Möchtest du morgen einen Apfel oder Smarties haben *(Reihenfolge zufällig wechseln, wird notiert)*? Schau dir beides genau an.

Schüler (S):

E 1: Bitte schreib deine Entscheidung auf den Umschlag.

E 1: Vielen Dank. Du kannst jetzt zurück in die Klasse gehen. Bitte verrate keinem, was wir dich gefragt haben und wie du dich entschieden hast. Tschüß.

Wörtlicher Ablauf des Experiments am zweiten Tag

1. In der Klasse mit allen Schülern:

Guten Morgen. Heute haben wir Euch eure Belohnung mitgebracht. Der Ablauf ist genau wie gestern. Zuerst bekommt ihr einen kurzen Fragbogen zum Ausfüllen. Bitte füllt den Fragebogen alleine aus und steckt ihn danach in den Umschlag und klebt ihn zu. Danach kommt ihr einzeln nach draußen und wir stellen euch eine einfache Frage. Dann geht ihr zurück in die Klasse. Es ist auch heute sehr wichtig, dass ihr bis zum Ende der Stunde auf keinen Fall mit euren Mitschülern über das Experiment sprecht oder anders kommuniziert.

Wir teilen jetzt den Fragebogen und den Umschlag aus. Bitte füllt zuerst die Felder mit eurem persönlichen Code aus. Es soll derselbe sein wie gestern.

[Verteilen der Fragebögen und Umschläge]

Dann füllt jetzt bitte den Fragebogen aus und wenn ihr fertig seid, steckt ihr ihn in den Umschlag. Wenn ihr fertig seid, kommt ihr wie gestern einzeln nach draußen, d.h. es fängt die Person an, die am nächsten an der Tür sitzt und dann kommt der Nachbar. Danach fangt ihr wieder außen an bis alle dran waren.

2. Während des Experiments:

Experimentator (E) 2: Hallo. Setz dich! Möchtest du jetzt Smarties oder einen Apfel *(Reihenfolge zufällig wechseln)*? Es ist nicht wichtig, wie du dich gestern entschieden hast. Bitte entscheide, was du jetzt lieber möchtest.

Schüler (S):

E 2: Bitte schreib deine Entscheidung auf den Umschlag.

(Experimentator legt Auszahlung in Papiertüte, damit die anderen Schüler das Ergebnis nicht sehen)

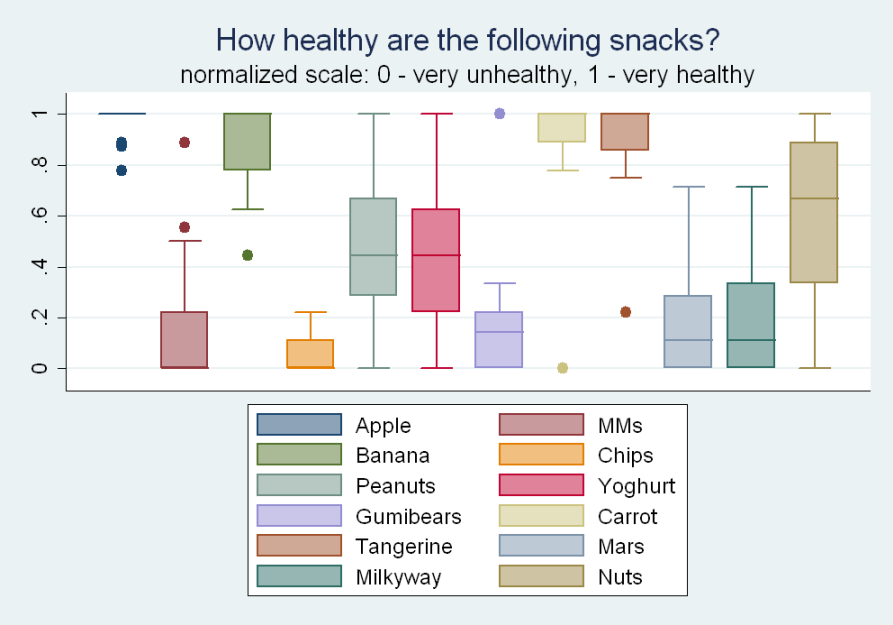
E 2: Vielen Dank. Du kannst jetzt zurück in die Klasse gehen. Bitte verrate keinem, was wir dich gefragt haben und wie du dich entschieden hast. Lass die Papiertüte zu, bis alle deine Mitschüler bei uns waren. Tschüß.

B Appendix B: Pretest

We conduct two pretests to select the food items for our experiment. The objective is to find two groceries that are perceived as healthy and unhealthy by many participants and that are chosen for consumption. Our first pretest is conducted among participants in a lab experiment at the University of Mannheim. Participants are between 18 and 24 years old. They are asked to rate 12 food items (which are displayed in front of them) on a scale from 1–"very unhealthy" to 10–"very healthy" and then select one as their pay-off for immediate consumption. The items and their rating are displayed in a boxplot in figure B5. The two most frequently selected items were apples and M&Ms. The boxplot indicates that the distribution of the ratings for the apple is very skewed towards one with few outsiders, i.e. apples are clearly rated as healthy. However, M&Ms were selected twice as frequently as apples and their rating as unhealthy is not so clear as we can see from the boxplot. Therefore, we conducted a second pretest.

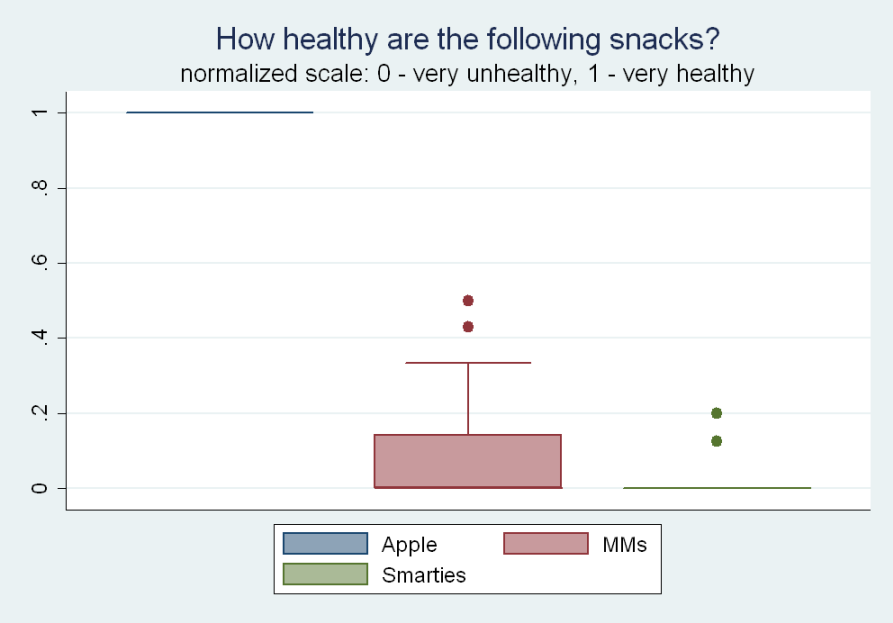
The second pretest was carried out among students and pupils aged between 12 and 29. We asked them to rate and select only among three items: apples, Smarties and M&Ms. The results are displayed in figure B6. We find that the ratings for the apple again are very skewed towards one. Surprisingly, M&Ms are not rated as unhealthy as Smarties. The distribution of ratings for Smarties is skewed towards 0, i.e. respondents clearly rate them as unhealthy.

Figure B5: Pretest 1 (N=24)



The box indicates the area in which the median 50% of the distribution are situated, i.e. the upper and lower edge of the box are the 25% and 75% percentile. The line in the box displays the median rating. The end of the whiskers indicate the 5th and 95th percentile of the ratings. Dots represent outsiders.

Figure B6: Pretest 1 (N=39)



The box indicates the area in which the median 50% of the distribution are situated, i.e. the upper and lower edge of the box are the 25% and 75% percentile. The line in the box displays the median rating. The end of the whiskers indicate the 5th and 95th percentile of the ratings. Dots represent outsiders.

C Appendix C: Questionnaires

Table C6: Questions Day 1

Nr	Question	Answer
1	Did you have breakfast today?	Yes
		No
2	What did you have for breakfast today?	
3	Did you have something to eat	Yes
	during your last break?	No
4	What did you eat during your last break?	
5	What else did you bring to eat today?	fruit (e.g. Apple, Banana)
		sandwich
		chocolate or other sweets
		nothing
		something else:
		I brought money with me and will buy some:
6	I am hungry	That's true
		That's mostly true
		That's mostly not true
		That's not true
		I don't know
7	How many books does your family have at home?	none
		1 to 10
		11 to 50
		51 to 100
		101 to 250
		251 to 500
		more than 500 Books
8	How many of the following objects does your family own?	
	Cell phone	none
		one
		two
		three or more
	TV	none
		one
		two
		three or more
	Calculator	none
		one
		two
		three or more
	Computers	none
		one
		two
		three or more
	Music instruments (e.g. piano, violine)	none
		one
		two
		three or more
	Cars	none
		one
		two
		three or more
	Bathrooms	none
		one
		two
		three or more
9	What was your grade on your last report	Mathematics
	in the following subjects?	German
10	Your age	
11	Gender	male
		female

Table C7: Questions Day 2

Nr	Question	Answer
1	Did you have breakfast today?	Yes
		No
2	What did you have for breakfast today?	
3	Did you have something to eat	Yes
	during your last break?	No
4	What did you eat during your last break?	
5	What else did you bring to eat today?	fruit (e.g. Apple, Banana)
		sandwich
		chocolate or other sweets
		nothing
		something else:
		I brought money with me and will buy me some:
6	I am hungry	That's true
		That's mostly true
		That's mostly not true
		That's not true
		I don't know
10	Your age	
11	Gender	male
		female

D Appendix D: List of variables

Table D8: List of Variables

variable	coding
applefirst	pupil was asked by the experimenter in the order apple, smarties: 1; smarties, apple: 0
cohort	age cohorts: 1 - 6/7 years, 2 - 8/9 years, 3 - 11/12 years, 4 - 14/15 years, 5 - 17/18 years
female	1 - female, 0 - male
hungry	hunger: 3 - very hungry, 2 - hungry, 1 - not so hungry, 0 - not hungry, null - I don't know
hungry less	1 - if less hungry on the second day, 0 - else
hungry more	1 - if more hungry on the second day, 0 - else
language	German language grade; 1 best, 6 worst
language good	1 - better than average German grade, 0 - else
math	math grade; 1 best, 6 worst
math good	1 - better than average math grade, 0 - else
parents' education	number of books at home: 0 - none, 1 - 1-10, 2 - 11-50, 3 - 51-100, 4 - 101-250, 5 - 251-500, 6 - 500+
high parental education	1 - more than 250 books, 0 - less than 250 books
wealth1	number of cell phones at home
wealth2	number of tvs at home
wealth3	number of calculators at home
wealth4	number of computer at home
wealth5	number of instruments at home
wealth6	number of cars at home
wealth7	number of bathrooms at home
wealth	Average of parents' wealth, i.e. average over wealth 1 to 7

E Appendix E: Additional Regression Results

Table E9: Selecting an Apple for Now

This table shows marginal effects after a probit regression of age, cognitive abilities, and various other covariates on selecting an apple for immediate consumption. The dependent variable is a dummy equal to one if pupils chose an apple for now. Age cohort is a categorical variable taking values from 1 (age 6-7) to 5 (age 17-18). Less hungry is a dummy equal to one if pupils were less hungry on the second day compared to the first. More hungry is a dummy equal to one if they indicated to be more hungry on the second day. Parental wealth is the average over all seven wealth categories. Parent's education is a dummy equal to one if there are more than 250 books at home and zero if there are less. (d) indicates dummy variables. Ref. refers to the omitted category if various dummies are used. Standard errors are clustered at the class level. In the first two specifications all pupils are included (N=227). In specification 2 and 3 the first graders drop out due to missing information on cognitive abilities and parental background (N=179).

	Model 0	Model 1	Model 2	Model 3
Age cohort	0.15			
	[0.04]***			
Age 6-7 (d)		-0.14		
		[0.18]		
Age 8-9 (d)				
Age 11-12 (d)		0.38	0.38	0.39
		[0.05]***	[0.05]***	[0.04]***
Age 14-15 (d)		0.28	0.25	0.25
		[0.02]***	[0.06]***	[0.05]***
Age 17-18 (d)		0.39	0.37	0.36
		[0.05]***	[0.06]***	[0.06]***
Female (d)	-0.08	-0.1	-0.12	-0.14
	[0.06]	[0.05]*	[0.06]*	[0.08]*
Less hungry (d)	0.01	-0.01	-0.02	0.03
	[0.10]	[0.10]	[0.11]	[0.11]
More hungry (d)	-0.12	-0.09	-0.08	-0.08
	[0.08]	[0.09]	[0.12]	[0.11]
Apple first (d)	0.04	0.06	0.09	0.1
	[0.07]	[0.07]	[0.08]	[0.08]
Parent's education (d)			-0.11	-0.1
			[0.09]	[0.09]
Parental wealth			0.12	0.11
			[0.07]*	[0.06]*
Language good (d)				0.14
				[0.07]**
Math good (d)			0.17	
			[0.07]**	
Observations	227	227	179	178
Pseudo R2	0.10	0.13	0.09	0.09

* significant at 10%; ** significant at 5%; *** significant at 1%.

Table E10: Switching from Smarties to Apple

In this table the determinants of switching from smarties to apple on the second day are examined. The table shows marginal effects after a probit regression of age, cognitive abilities, and various other covariates on selecting an apple for immediate consumption conditional on having chosen smarties for future consumption. The dependent variable is a dummy equal to one if pupils choose an apple for now. Age-cohort is a categorical variable taking values from 1 (age 6-7) to 5 (age 17-18). Hungry is a dummy equal to zero if respondents did not feel hungry at all and one in all other cases. Parental wealth is the average over all seven wealth categories. Parent's education is a dummy equal to one if there are more than 250 books at home and zero if there are less. (d) indicates a dummy variable. Ref. refers to the omitted category if various dummies are used. Standard errors are clustered at the class level. In the first two specifications all pupils who selected smarties on the first day are included (N=96). In specification 2 and 3 the first graders drop out due to missing information on cognitive abilities and parental background (N=63).

	Model 0	Model 1	Model 2	Model 3
Age-cohort	0.07			
	[0.04]			
Age 6-7 (d)		-0.16		
		[0.05]***		
Age 8-9 (d)				
Age 11-12 (d)		0.33	0.42	0.54
		[0.08]***	[0.13]***	[0.16]***
Age 14-15 (d)		-0.01	-0.03	0.03
		[0.08]	[0.15]	[0.15]
Age 17-18 (d)		0.11	0.18	0.39
		[0.22]	[0.26]	[0.26]
Female (d)	0.01	0.01	0.14	0.12
	[0.06]	[0.07]	[0.11]	[0.13]
Apple first (d)	0.08	0.07	0.17	0.18
	[0.07]	[0.06]	[0.09]*	[0.09]*
less hungry (d)	0.12	0.13	0.34	0.42
	[0.14]	[0.14]	[0.22]	[0.21]**
more hungry (d)	-0.21	-0.14	-0.16	-0.14
	[0.10]**	[0.11]	[0.18]	[0.18]
Parent's education (d)			-0.27	-0.33
			[0.12]**	[0.12]***
Parental wealth			0.14	0.11
			[0.17]	[0.16]
Language good (d)				0.28
				[0.14]*
Math good (d)			0.08	
			[0.12]	
Observations	96	96	63	63
Pseudo R2	0.17	0.29	0.29	0.34

* significant at 10%; ** significant at 5%; *** significant at 1%.