

# Busy little bees – An experiment on diligence and endogenous time scheduling in early childhood

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## Abstract

Diligence, being able to work hard, is a positive predictor of educational success. In an experimental setting we analyze the development of diligence and the impact of exogenous versus endogenous time scheduling on effort provision in early childhood. A total of 429 children aged 3 to 6 worked on a real effort task for as long as they wanted to. Giving the children the possibility to decide when to work on the task - either today or tomorrow - shows that those who procrastinate the task to the following day provide significantly less effort. While younger children are more likely to procrastinate, the effort provision under procrastination is lower for all age groups. In addition, we find that children's ability to work extensively on a task relates to their willingness to challenge themselves in an unrelated task. Our results shed light on the development of diligence and can be used as a first step for designing interventions fostering the skill of being hard working in a real effort task.

**JEL classification:**

**Keywords:** children, diligence, grit, perseverance, procrastination, time preferences, experiment

# 1 Introduction

The importance of non-cognitive skills has become prevalent in the economics and psychology literature, emphasizing their influence on lifetime success, health, and education and asserting them as a fundamental requisite in the labor market (Heckman et al., 2006; Duckworth et al., 2007; Roberts et al., 2007; Almlund et al., 2011; Kautz et al., 2014). Among these non-cognitive skills grit has been proven to be highly indicative of educational achievement (Duckworth et al., 2007; Duckworth and Quinn, 2009; Burks et al., 2015), outperforming IQ as a predictor of success. Grit is defined as the ability to work persistently on a task, related to being self-disciplined, setting long-term goals, and pursuing them in response to negative performance feedback. Grit is highly correlated with long term success including higher earnings even when controlling for schooling (Diaz et al., 2013), predicts employees' likelihood to keep their jobs (Eskreis-Winkler et al., 2014), and is an indicator of innovativeness and success for entrepreneurs (Mooradian et al., 2016). Non-cognitive skills have furthermore been shown to be malleable in children (Almlund et al., 2011; Kautz et al., 2014; Alan et al., 2016). In a recent study Alan et al. (2016) stage a successful school intervention on grit for 10 to 11 year-old children, aimed at improving children's beliefs about the malleability of their own ability. The authors find a significant increase in children's willingness to undertake a more challenging and rewarding task, a decrease in the likelihood to give up after failure, and an improvement of ability accumulation, consequently improving children's success and their payoffs.

Alaoui and Fons-Rosen (2016) split grit into two components - tenacity, a nuanced interplay of perseverance and stubbornness, and diligence, the notion of being hard-working. We focus on the latter aspect, diligence, as it plays an especially critical role as a predictor of educational success - even more so than tenacity - during childhood and adolescence (Alaoui and Fons-Rosen, 2016). With this study we aim to further examine the development of diligence, the influence of time scheduling on effort provision, and its driving determinants. We extend our focus to early childhood, namely 3 to 6 year-old children, as this age span has already proven particularly relevant for the formation of preferences (Fehr et al., 2008). We investigate how giving children the decision power of when to do a tedious task impacts their diligence in the task. While even very young children face increasing pressure of time schedules - be it for their leisure activities or later on class schedules - we analyze whether young children's effort provision can be increased by allowing them to choose the time setting for themselves. Companies, for instance, increasingly offer flexible work hour arrangements to their employees (Katz and Krueger, 2016). This practice could indicate a positive correlation between endogenous time setting and effort provision. However, little empirical evidence in this domain exists (Shepard et al., 1996; Wolf and Beblo, 2004; Mas and Pallais, 2017). We address this vacancy and investigate whether children's effort provision is dependent on having the decision power over their "work" schedule. Specifically, we consider whether children's level of diligence can be increased by giving them more flexibility on when to do a tedious task. For this purpose, we measure children's diligence in a real effort task

under exogenously given or endogenously set scheduling.

Furthermore, we consider the underlying determinants of diligence and whether the decision to challenge oneself serves as an indicator of more diligent behavior. Both diligence and the willingness to challenge oneself are important components of grit. While experimental papers by Gerhards and Gravert (2015) and Alan et al. (2016) so far focus on grit as one single fundamental skill we consider diligence and the willingness to take a challenge separately. By teasing these two aspects apart we are able to examine whether children who are hard workers are also more willing to challenge themselves in an unrelated task. Both aspects have individually been proven to be important for later success. While we have emphasized the role of diligence for educational success, a study by Ashby and Schoon (2010) shows that the willingness to challenge oneself is as well important for life outcomes. Specifically, the authors find that young people for whom it is important to succeed at their job earn more money in adulthood compared to their less ambitious<sup>1</sup> peers. Niederle and Yestrumskas (2008) observe heterogeneity in students' willingness to seek a challenge. Male students chose a difficult task 50% more frequently than women did even when controlling for actual or expected performance levels. As Niederle and Yestrumskas (2008) implemented a fixed time span they cannot make any inference regarding the correlation between seeking challenges and persistence in effort. This study is able to address this point.

We find evidence of a negative procrastination effect on diligence. Children who actively postpone the task to the next day display significantly lower levels of diligence by producing a lower output in the real effort task. Procrastination in our sample is mostly driven by younger children (3 and 4 year-olds), however the effort provision under procrastination is vastly lower irrespective of age. This is in line with findings by Alaoui and Fons-Rosen (2016) who show a higher likelihood of procrastination in less diligent adult subjects.

Concerning the influencing factors of diligence, we find support for more diligent children to be more likely to choose the challenging task over the easy option. Children were presented with two identical puzzles with different levels of difficulty, where the difficult puzzle yielded a higher reward. We find that the mere choice of the difficult puzzle is highly indicative of being more diligent in the real effort task. Children were also given the option on whether to actually follow through on their choice and complete the puzzle (by themselves, after the main part of the experiment was over) or whether to shirk from their decision. We find that those who follow through on their choice display more diligent behavior.

Literature concerning economic decision making during childhood and adolescence has highlighted the importance of time preferences for children. More patient children who are willing to wait for larger rewards have been shown to have higher grades at school, better conduct, and are less likely to engage in health damaging behavior like smoking or drinking alcohol (Castillo et al., 2011; Golsteyn et al., 2013;

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<sup>1</sup>Ambition stands for teenagers' willingness to be challenged in their job and to move up.

Sutter et al., 2013; Alan and Ertac, 2018). We, therefore, elicited time preferences to investigate whether delay of gratification for a greater reward and working for a greater reward are interrelated. Our sample shows that younger children who are more impatient are also less diligent but we fail to find an overall influence of patience on diligence. This is in line with findings of Non and Tempelaar (2016) who report no correlation between university students hypothetically elicited time-preferences and their study effort measured by the time they were logged in on an electronic learning platform, their number of solved exercises on this platform, the fraction of topics completed on the platform as well as their participation in an online summer course. Similarly, Gerhards and Gravert (2015) report no significant correlation for adults between self-reported, unincentivized time preferences and the decision not to shirk in a real effort task<sup>2</sup>. Likewise, Burks et al. (2012) do not find any evidence on truck drivers'  $\beta$ ,  $\delta$  values (their discount rates for present and future delays) and their tendency to stay at least 6 months on the job.

Family background has been shown to heavily influence children's behavior. Socio-economic background, for instance, affects children's social-, time-, risk-, and competitive preferences (Bauer et al., 2014; Deckers et al., 2015; Almås et al., 2016, 2017; Deckers et al., 2017). We use a parental questionnaire to elicit demographic data, and self-assessed levels of diligence and procrastination, as well as incentivized time preferences. Parents who report to procrastinate more frequently have children who procrastinate more often in the experiment. We find no evidence of parental diligence to be correlated with the children's diligent behavior. Higher education of parents positively affects the child's diligence.

Overall, our paper sheds light on the development of diligent behavior in early childhood. The following sections give a detailed insight into the design and the procedures. Section 3 discusses the results, section 4 focuses on the influence of family background, and section 5 concludes.

## 2 Design

We ran an experimental study with three to six year-old children in eight different kindergartens in Innsbruck, Austria.<sup>3</sup> Overall 429 children, among those 219 (51%) females, participated in our study (see Table 1). Children were paid in tokens which could be exchanged one-to-one for small presents like balloons, hair clips, key chains etc. Each child received one show-up token at the beginning of the experiment. All

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<sup>2</sup>Gerhards and Gravert (2015) run a real effort task where students were asked to solve anagrams. They consider shirking as the decision to skip anagrams as well as the decision to switch to easier anagrams.

<sup>3</sup>The experiment was approved by the ethics committee of the University of Innsbruck and the municipal authorities of the city of Innsbruck. Kindergartens were informed about our study by the city authorities but were blind to the research question. Participation of kindergartens was voluntary. 8 kindergartens participated in our study. 6 kindergartens used an opt-out option, where parents could inform teachers if they did not want their child to participate, which only one parent did. Two kindergartens required an opt-in option where over 70% of parents consented.

decisions were collected anonymously by assigning a code to children. The experimenter additionally emphasized that the child’s answers were to be kept a secret to avoid spill-over effects.

Table 1: Number of observations

age	male	female	total
3	21	22	43
4	64	72	136
5	73	69	142
6	52	56	108
	210	219	429

We visited each kindergarten on two (or three - if the number of children was very large) consecutive days. Each session followed the same procedure. Children were asked by a trained experimental assistant (experimenter, henceforth) whether they wanted to participate and were then accompanied to a separate “game” room (only two children opted out of participation). On day one, all children were seated one-on-one with an experimenter for the first part of the experiment, namely the elicitation of time preferences, the puzzle task, and the explanation of the diligence task - a real effort task. On day two, children were able to collect their payoffs for the delayed tokens of the time preference task. Additionally, children in the *tomorrow* treatment option were brought back to complete the diligence task (more information in subsection 2.3). At the end of each session the child was able to trade her tokens for presents and was then accompanied back to the teacher. To ensure comprehension all children had to answer questions for each task (see appendix for more details).<sup>4</sup>

## 2.1 Time preferences

We adapted the convex budget set procedure developed by Andreoni and Sprenger (2012) and presented children with three options of consumption allocation.

- Option 1 yielded 2 tokens today and none tomorrow.
- Option 2 yielded 1 token today and 2 tokens tomorrow.
- Option 3 yielded no tokens today and 4 tokens tomorrow.

By measuring children’s preferences for delaying gratification to the next day we assess children’s level of patience. Children opting for option 1 are therefore classified as impatient, whereas very patient children will delay all gratification to the next day doubling the amount of tokens received. To make the *tomorrow* payoff more salient, children collected their tokens for *today* in one bag and tokens for *tomorrow*

<sup>4</sup>Overall, 91% of the children could answer all control questions correctly, indicating that we succeeded in sufficiently explaining the task even to the youngest children. Our results remain valid when we exclude all children who didn’t answer all control questions correctly from our sample.

were put in a separate bag with the child’s name written on it. The *tomorrow* bags were returned to children the following day, to allow children to exchange the saved tokens for additional presents.

## 2.2 Puzzle task to challenge oneself

The puzzle task measured children’s willingness to challenge oneself. Children were presented with two puzzles with the same picture which differed in piece size and number of pieces. The experimenter showed the child two identical puzzle boxes and took out one piece each to show the difference in piece size (see Figure A-1). The puzzle with larger pieces was identified as easy and the puzzle with smaller pieces as difficult. Children were asked to repeat why the puzzle was either easy or difficult. Taking into account that the difficulty of doing such a task differs with age, we presented children aged 3 and 4 with an easy puzzle with 6 pieces while the difficult puzzle entailed 12 pieces. 5 and 6 year-olds were given the option of an easy puzzle with 12 pieces and a difficult puzzle with 24 pieces. For all age groups the completion of the easy puzzle yielded 1 token and the completion of the difficult puzzle paid 2 tokens. The tokens were presented next to the respective puzzle to make the payoff difference salient. During the experiment, children’s choices of easy versus difficult were recorded and the chosen puzzle was handed over for the child to keep. Children were not required to complete the puzzle, however, they were informed that in order to receive the tokens for the puzzle they had to complete it at the very end of the experiment by themselves.<sup>5</sup>

## 2.3 Diligence task

As a third task children were introduced to the diligence task. It consisted of a real effort task where children were told to collect only yellow beads from a bowl of small, multicolored beads (see Figure A-2). Children could autonomously decide for how long they worked on this task and how many beads they collected. They were asked to notify the experimenter (e.g. by raising their hand) once they decided to stop working on the task.

First children were introduced to the task. The experimenter then showed them a bowl with 20 yellow beads and explained that they are worth 1 token. If they were to collect more yellow beads, they would receive more tokens. To control for ability, children were asked to practice the task for 30 seconds.<sup>6</sup> To avoid any external influences, children were seated in a separate “cubicle” while working on the real effort task (RET, henceforth).<sup>7</sup> This was done, because of evidence showing that in-

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<sup>5</sup>After children received their presents at the end of the experiment, the experimenter reminded them of the potential additional payoff if they completed the puzzle. Children could voluntarily do the puzzle by themselves and once an experimenter verified the puzzle, they received their additional present(s).

<sup>6</sup>Children were not aware that they were being timed to avoid inconsistent results due to time pressure.

<sup>7</sup>Strict no talking and no peeking rules were enforced during the RET. A different experimenter oversaw the RET to reduce demand effects.

dividual productivity is affected by the peers one is surrounded by (Falk and Ichino, 2006; Mas and Moretti, 2009). Once children signaled that they were “done” with the task, the experimenter weighed the sorted beads and paid children their earned tokens. Additionally, the time spent on the RET was recorded as a control measure.<sup>8</sup>

**Treatments.** To test the effect of time scheduling on diligence we introduce a between-subjects treatment variation. After completing stages 1 and 2 of the experiment (time preferences and puzzle task) the subject pool was split into two groups where the timing of the RET was set either *exogenously* or *endogenously*. Specifically, after the ability check children in the *exogenous* treatment were instructed to either work on the RET **today** or **tomorrow**, while children in the *endogenous* treatment autonomously decided whether to work on the RET **today** or **tomorrow**. We hence consider four different dimensions: a) *exogenous today*, b) *exogenous tomorrow*, c) *endogenous today*, and d) *endogenous tomorrow*.

Children that (actively or passively) postponed the task to tomorrow were fetched from their group by the experimenter the following day to work on the RET. It was common knowledge to children that the experimenter would return the following day. Children were then seated in their respective “cubicle” and again briefly reminded of the instructions. The remaining procedure closely followed the *today* condition, where children worked on the task for as long as they chose to and were then paid out according to the number of beads collected.<sup>9</sup>

## 2.4 Parent questionnaire

In addition to collecting data from children, parents received a questionnaire asking for information on demographic variables like the socio-economic status of the family, parents’ assessment of their child in terms of diligence, patience, and willingness to take a challenge, and parents’ assessment regarding their own behavior. Specifically, parents were asked to fill out the grit scale<sup>10</sup> (Duckworth et al., 2007; Breyer and Danner, 2015), a questionnaire about their tendency to postpone tasks (Lay, 1986), and to state their time preferences. The latter task presented parents with a choice list where they could choose between a fixed amount of money (€ 50) earlier in time versus a higher monetary reward in the future (max € 70). Among all participants five parents were randomly chosen to be paid out. To maintain anonymity, parents received a code that was matched to their child’s decisions.

<sup>8</sup>Again, children were not aware of the time measure to avoid confusion about time pressure. The payoff relevant variable was the output and not the time spent on the task.

<sup>9</sup>Note that the order of tasks remained the same for all children for the following reasons: First, we did not want children to be distracted during the RET. Children might cut down on effort and time out of sheer curiosity for upcoming tasks. Second, as the RET is a non-cognitive task and the other tasks demand more cognitive skills we opted to start with the more demanding skills. As all children completed the tasks in the same order, our results also account for possible depletion effects across the experiment.

<sup>10</sup>By considering parents agreement with the statements “I am a hard worker” and “I am self-disciplined” - two items taken from the grit scale used in the PIAAC field trial (Tamassia and Lennon, 2013) - we infer parents’ level of diligence.

### 3 Results

The result section first gives an overview of the decisions made in each task (see Table 2). Section 3.2 provides a detailed analysis for treatment results, of the effect on time scheduling on diligence. Section 3.3 presents the regression analysis and discusses various driving factors of diligence in early childhood.

#### 3.1 Descriptive analysis

**Time preferences.** In the time preferences task we measure children’s patience. 40% of children chose the very patient option of delaying all tokens to tomorrow, forgoing all immediate rewards to maximize their payoff. 29% of the children display high impatience opting for two tokens today and nothing tomorrow. The same fraction of children split consumption between today and tomorrow (1 token today and 2 tokens tomorrow) choosing the intermediate option. For the data analysis we use a measure of impatience accounting for the total number of tokens claimed for immediate consumption. In line with previous literature on time preferences we observe a slight decline of impatient choices with increasing age ( $p=.047$ , Cuzick’s Wilcoxon-type test for trend), which is more pronounced for strictly impatient choices of two immediate rewards ( $p=.010$ , Cuzick’s Wilcoxon-type test for trend) as shown in Figure 1. Females in our sample are slightly more impatient compared to males (33% vs. 26% for two tokens today;  $p\text{-value}=.084$ , Mann-Whitney-U-test), choosing the strictly patient option significantly less often (37% vs. 45% for four tokens tomorrow;  $p\text{-value}=.067$ , Mann-Whitney-U-test).

**Puzzle task to challenge oneself.** The second task measures children’s willingness to challenge themselves. Children were asked to choose between an easy and a difficult puzzle. A little more than half (56%) of children opted for the difficult puzzle. As the number of pieces for the difficult puzzle varied between the younger (3 and 4 year-olds) and older cohort (5 and 6 year-olds) we consider children’s choices in the respective age groups. We again observe a significant age trend where the choice of the difficult puzzle increases with age with 30% of 3-year-olds taking the challenge compared to 49% of 4-year-olds ( $p=.036$ , Mann-Whitney-U-test), and 52% of 5-year-olds compared to 81% of 6-year-olds ( $p<.001$ , Mann-Whitney-U-test). Additionally, we find a significant gender effect for males being more likely to challenge themselves compared to females (61% vs 51%;  $p=.032$ , Mann-Whitney-U-test). This is in line with previous findings who also find males to be more willing to seek a challenge (Niederle and Yestrumskas, 2008).

**Following through on the challenge.** Children only received tokens for the puzzle once they completed it at the very end of the experiment. While the easy puzzle paid one token, the difficult puzzle awarded two tokens. We use this as an additional commitment measure to test for who follows through on their choice. Overall, 87% of children chose to complete the puzzle and earn their additional reward. The fraction of children completing the puzzle does not differ over their choice of easy or

difficult (86% vs 89%; p-value= .328, Mann-Whitney-U-test). Again, we find an age trend where the likelihood of completing the task increases with age (p=.025, Cuzick’s Wilcoxon-type test for trend). Pairwise comparisons, however, do not yield statistically significant results. Specifically, 77% of the 3-year-olds completed the puzzle compared to 88% of 4-year-olds (p=.087, Mann-Whitney-U-test), and 87% of 5-year-olds compared to 93% of 6-year-olds (p=.133, Mann-Whitney-U-test).

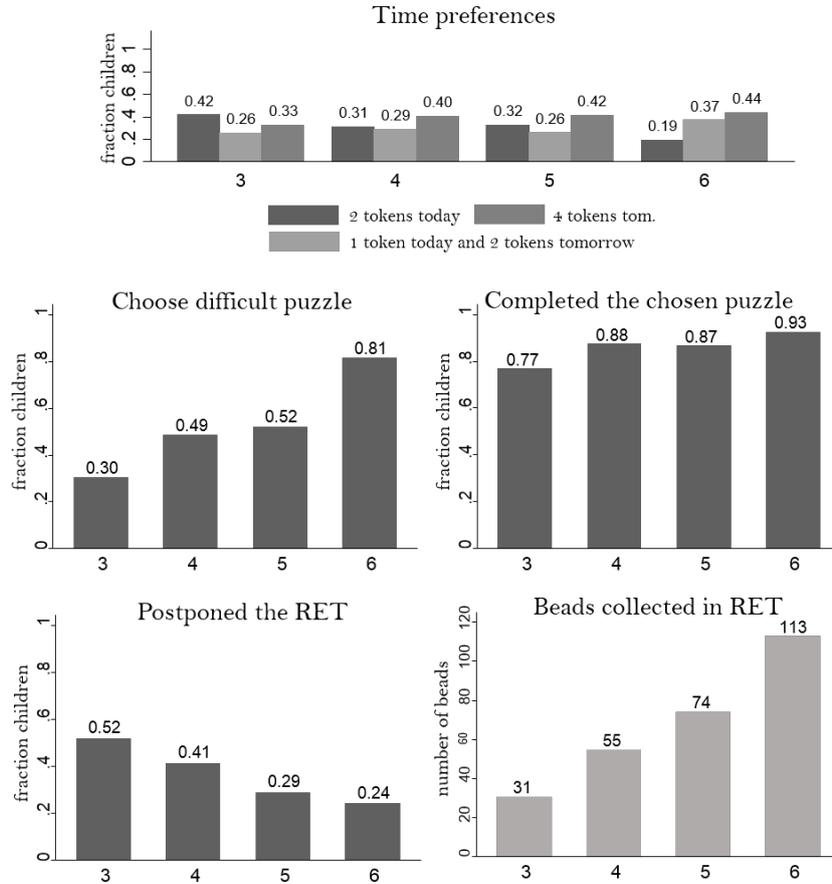
Table 2: Summary statistics

Variable	Mean	N
<b>PATIENCE</b>		
2 tokens today	0.30	429
1 token today, 2 tokens tomorrow	0.30	429
4 tokens tomorrow	0.40	429
<b>WILLINGNESS TO CHALLENGE ONESELF</b>		
chose difficult puzzle	0.56	429
completed the chosen puzzle	0.87	429
<b>DILIGENCE</b>		
postponed the task	0.34	241
beads collected in ability check	10	429
beads collected in RET	73	429

**Diligence task.** The third task assesses children’s level of diligence in a real effort task measured by the output, namely the number of yellow beads collected. The output increases significantly from 31 beads collected by 3 year-olds, to 55, 74 and 113 beads for 4-, 5- and 6 year-olds respectively (p<.001, Cuzick’s Wilcoxon-type test for trend). The maximum number of beads collected was 440 confirming great variance for the measured output. Girls display higher levels of diligence, sorting significantly more beads than their male counterparts (80 vs. 66, p=.0163, Mann-Whitney-U-test). Average time spent on the task was 7.9 minutes, increasing with age from 5 minutes for 3 year-olds to 10 minutes for 6 year-olds (7 and 8 minutes for 4- and 5 year-olds respectively, p<.001, Cuzick’s Wilcoxon-type test for trend).<sup>11</sup> As expected, the ability check also reveals different levels of ability between younger and older children. While 3 year-olds sorted on average 7 beads in the 30 seconds, this number steadily increased to 12 beads for 6 year-olds (p<.01, Cuzick’s Wilcoxon-type test for trend).

<sup>11</sup>While we tried to time children as closely as possible to their actual working time this measure is not as exact as we wished and leaves some room for errors. Hence, we use the number of beads as our dependent variable for further analysis, relying on time as a separate control measure.

Figure 1: Development by age



The next sections discuss correlations between the experimentally elicited variables and show that children who sort more beads are (i) more likely to choose the difficult puzzle ( $p < .001$ , Mann-Whitney-U-test), (ii) more likely to follow through on their choice by completing the puzzle ( $p < .001$ , Mann-Whitney-U-test), (iii) less likely to procrastinate the sorting task to the next day ( $p < .001$ , Mann-Whitney-U-test), and (iv) more likely to score higher in the ability check ( $p < .01$ , Spearman's rank correlation). Concerning the last point, namely children's performance in the ability check, we observe that children who score higher in the ability check are more likely to choose the difficult puzzle ( $p < .001$ , Mann-Whitney-U-test), and to complete the puzzle independently of the chosen level of difficulty ( $p < .001$ , Mann-Whitney-U-test). The other measured choices are not correlated according to Spearman's rank correlation coefficients at a 5% significance level.

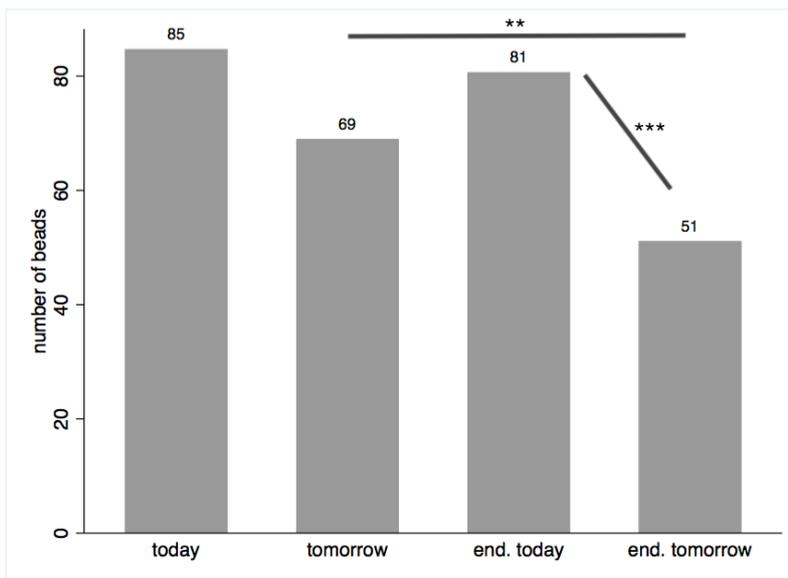
### 3.2 Impact of time scheduling on diligence

In this section we consider the treatment variations on exogenous and endogenous time scheduling of the diligence task. Children were randomly allocated to the different treatment groups<sup>12</sup>: 188 children participated in the **exogenous** treatment of

<sup>12</sup>Treatments were randomized at class level.

which 91 were told to do the diligence task today (*exogenous today*) and 97 children were told to do the diligence task tomorrow (*exogenous tomorrow*). The remaining 241 children were assigned to the **endogenous** treatment, where they could decide whether to work on the diligence task today or tomorrow. About one third of the children (N=83) in the endogenous treatment decided to postpone the task to the next day (*endogenous tomorrow*), while 158 children preferred to work on the task today (*endogenous today*).

Figure 2: Diligence over treatments



First, we examine whether an exogenously given time schedule reveals differences in diligence compared to children who could autonomously decide the scheduling of the diligence task. Children who were given a schedule for either today or tomorrow collected on average 77 beads, while children who decided for themselves when to work on the diligence task collected on average 70 beads. Comparing the *exogenous* vs *endogenous* treatment does not yield any differences in diligence ( $p=.622$ , Mann-Whitney-U-test). Letting children decide autonomously when to work on the real effort task did not yield a more efficient outcome compared to exogenously imposing the schedule upon children.

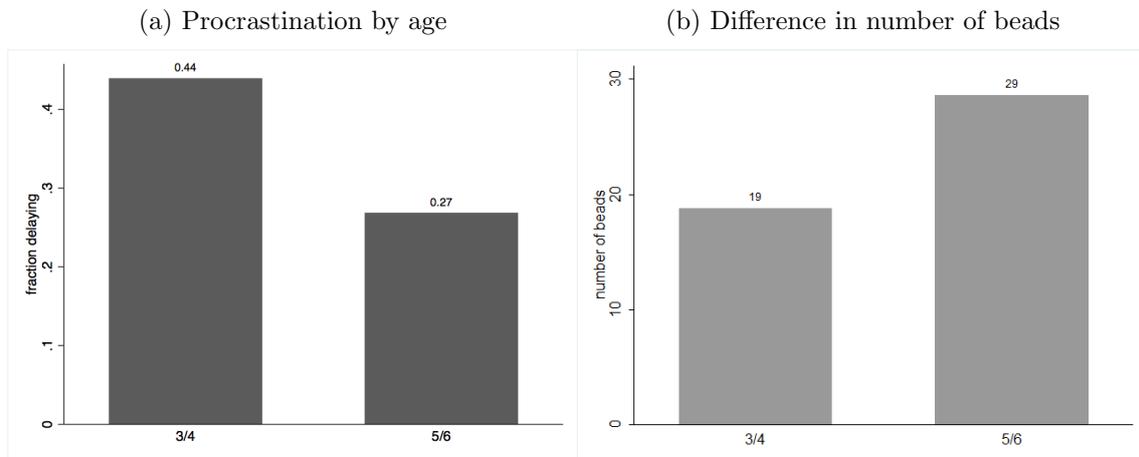
We now continue to split the treatments into their sub-groups of either *today* or *tomorrow*. This additional level of detail reveals diligence to be contingent on the time scheduling of the task (see Figure 2). While in the *exogenous today* sub-treatment children sort on average 85 beads, the level of displayed diligence slightly declines to 69 beads for the *exogenous tomorrow* sub-treatment. This difference in diligence, however, is not significant ( $p=.234$ , Mann-Whitney-U-test). Children’s diligence levels when actively selecting to work today (*endogenous today*) are on par with children who were told to do the task today (81 vs 85 beads,  $p=0.700$ , Mann-Whitney-U-test). Those children who actively procrastinated the task *endogenous*

*tomorrow* sort significantly fewer beads (51 beads) compared to all other treatments ( $p=.002$  for exogenous today vs endogenous tomorrow;  $p=.024$  for exogenous tomorrow vs endogenous tomorrow;  $p<.001$  for endogenous today vs endogenous tomorrow, Mann-Whitney-U-tests). We hence observe a self-selection effect of children who procrastinate to sort less beads.

Focusing only on the children who procrastinate, we examine the driving forces behind procrastination. Due to the lower number of observations we pool the data by age groups into the younger (3 and 4 year-olds) and older cohort (5 and 6 year-olds) to receive 47 and 36 observations, respectively.<sup>13</sup> Age plays a relevant role in procrastination behavior. Younger children in our sample are more likely to procrastinate the task to the next day (see Figure 3a). 44% in the younger cohort and 27% of the older cohort chose to postpone collecting beads ( $p=.006$ , Mann-Whitney-U-test).

**Result 1** *Younger children are significantly more likely to procrastinate the real effort task to the next day.*

Figure 3: Procrastination



**Notes:** Figure 3a reports the fraction of children delaying the RET by age group. The left bar stands for the younger (3- and 4 year-olds) and the right bar for the older (5- and 6 year-olds) cohort. Figure 3b reports the difference in collected beads between the endogenous today and endogenous tomorrow treatment by age group.

We examine whether lower effort provision under procrastinators is merely driven by the age effect of younger children producing less output. We can refute this claim by looking at the number of beads collected in the *endogenous tomorrow* sub-treatment again split by age groups. Figure 3b displays the difference in output between *endogenous today* and *endogenous tomorrow*. Both age groups significantly reduce their performance under procrastination ( $p=.011$  for 3- and 4 year-olds,

<sup>13</sup>The number of children who procrastinated the task by increasing age was 15, 32, 24, and 12.

$p=.013$  for 5- and 6 year-olds, Mann-Whitney-U-test) accounting for a difference in output of approximately 19 beads for younger children and 29 beads for older children. As an additional check we standardized diligence over age which further supports the difference in output under procrastination (see Figure A-3 and Figure A-4). Children who self-selected into *endogenous tomorrow* performed significantly worse, independent of their age. Procrastination is, hence, an indicator of lower levels of diligence.

When controlling for other factors, ability seems to play a role in the decision to procrastinate. Table A-1 shows that those who have a high ability in the task are less likely to choose to postpone it. Ability is, however, positively correlated ( $p<.001$ ) with age and running separate regressions for the age groups reduces the significance of the ability effect on procrastination.

While effort provision under procrastination is significantly lower, we detect less procrastination behavior of older children. Hence, with increasing age children select more frequently into the *endogenous today* option. From this we can infer that with increasing age not only do children display more diligence in executing a task but also become more proficient in self-management by choosing not to delay the task itself.

**Result 2** *Children who self-select into the procrastination option display significantly lower levels of diligence, independent of their age.*

### 3.3 Influencing factors

In this section we investigate underlying driving factors of diligence by examining the influence of the willingness to challenge oneself and time preferences on the number of beads sorted. First, we consider diligence overall. We find the choice of the difficult puzzle and the willingness to complete the chosen puzzle to be indicators of higher levels of diligence. Then, we split the sample by age groups to deduce the development of the driving factors with age.

The willingness to challenge oneself was measured with the choice between two almost identical puzzles, differing only in number of pieces and therefore in the level of difficulty. The choice of the difficult puzzle ("difficult" dummy in Table 3) is representative of choosing the challenge over an easier, lower paying option. A little more than half of the children (56%) chose the difficult puzzle, with boys being more likely to take the challenge. The choice of the difficult puzzle is highly indicative of the level of diligence, sorting on average 20 additional beads as shown in column (1) in Table 3, which is equal to one token in payoff.

As an additional measure we control for those who have actually completed the chosen puzzle ("complete" dummy in Table 3). While completion of the puzzle was voluntary, the tokens for the puzzle task (1 token for easy, 2 tokens for difficult)

were only paid out if the child completed the puzzle.<sup>14</sup> Completing the puzzle is another strong indicator for providing more effort and exhibiting higher levels of diligence. Children who completed the puzzle collected on average additional 16 beads as shown in column (1) in Table 3. Irrespective of whether children chose the difficult or the easy task, those who persist and follow through on their choice also collect a greater number of beads. Overall, it is therefore not only beneficial for diligence to be willing to challenge oneself but also to follow through on the choice made.

The variable impatience has a negative coefficient, indicating that more impatient children exhibit lower levels of diligence. For the whole sample it is, however, not significant. Girls in our sample provide significantly more output in the RET than boys. Moreover, high ability, which increases with age, shows that those who are more able also provide more output in the RET.<sup>15</sup> <sup>16</sup>

**Result 3** *The choice of the (more rewarding) difficult task over the easy one is highly indicative of higher levels of diligence. Additionally, following through on that choice (irrespective of the level of difficulty) is highly correlated with higher diligence.*

Columns (2) and (3) in Table 3 consider the driving factors for diligence in the respective age groups for 3- and 4 year-olds and 5- and 6 year-olds. While the effect of ability on diligence is stable over all age groups, we observe some distinctions in the importance of the influencing factors between the younger and older age cohort. Most prominently, the influence of the willingness to take a challenge (difficult) and following through on the task (complete) on diligence both emerge at the ages of 5 and 6 but not for younger children. Those children of the older cohort who chose the difficult puzzle collected on average 26 beads in addition, which is more than one additional reward. Those who completed the puzzle show very similar effects of collecting 24 beads in addition. It seems the importance of challenging oneself and the decision not to shirk from completing the puzzle gains importance at age 5 and 6. Impatience, on the other hand, plays a significant role for the younger cohort resulting in a reduction of 7 beads in output. With increasing age, however, this effect disappears. Females become significantly more diligent with increasing age leading to an overall improvement of output of 20 beads.

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<sup>14</sup>The child was required to complete the puzzle by herself without help or supervision. 88% of children completed the puzzle.

<sup>15</sup>Table A-2 replicates the regression using productivity (number of beads collected over time spent on task) as dependent variable. The influence of female, ability, difficult and complete are robust to this measure. We consider the measure of number of beads as dependent variable as nonetheless more accurate measure for diligence compared to productivity. While the number of beads measures exactly the output (contingent for payment) productivity only considers the efficiency of children in the task.

<sup>16</sup>In Table A-3 we additionally control for treatment differences. Our results do not change. For the whole sample, we see that the children who decide to procrastinate the RET (“en. tomorrow”) collect on average 25 beads less.

Table 3: Diligence and influencing factors by age groups

<i>Dep. var.: number of beads</i>	(1)	(2)	(3)
	all	3/4 year olds	5/6 year olds
female	14.87*** (5.531)	8.123 (5.162)	20.13** (8.627)
ability	5.717*** (0.867)	3.383*** (0.839)	4.832*** (1.305)
difficult	20.65*** (5.109)	7.841 (5.361)	25.80*** (7.705)
complete	15.71*** (5.645)	8.836 (5.961)	24.01*** (9.129)
impatience	-1.502 (3.227)	-7.480** (2.883)	2.691 (5.239)
Constant	-14.17 (9.298)	13.92 (8.900)	-13.36 (15.63)
Observations	429	179	250

OLS regression with robust standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## 4 Parent data

In this section, we focus on information regarding family background in order to gain better understanding of its influence on children’s behavior. Approximately half of parents (48%) agreed to our request and returned the filled in questionnaire<sup>17</sup>. As highlighted in Table 4, we find no differences in children’s time preferences, their tendency to procrastinate, to choose the difficult puzzle, to actually complete the puzzle, and their performance in the RET task between the samples including parent data and excluding parents, making it a representative sample for the children subpool. First, we give an overview of the parent sample and their provided information. Next, we analyze the effects of socio-economic background of parents and the estimation of their child’s behavior on children’s level of diligence.

### 4.1 Descriptive analysis

Among all participating parents 87% are mothers. Our sample of parents proves to be highly educated with 57% reporting at least one parent with a university degree. 71% of mothers report to work part-time compared to 7% of fathers, and 11% of mothers work full-time while 88% of fathers work full time. The vast majority (90%) of the participating families prevalently speak German at home. 10% are single-parents. On average families have 2 children and a monthly net income pre-

<sup>17</sup>As submission of the questionnaire was voluntary we acknowledge that the data analysis in this section may be influenced by a selection bias of parents regarding parental behavior. Some questionnaires did not contain full information on all questions, accounting for the difference in number of observations.

Table 4: Means by parental participation

Variable	Parents participated N=206	Parents didn't participate N=223	p-value M.-Whit.-U-Test
impatience	0.90	0.87	0.702
difficult puzzle	0.58	0.55	0.524
completion of puzzle	0.87	0.88	0.756
procrastination	0.32	0.37	0.377
ability	10	10	0.741
number beads	74	72	0.896

dominantly between €2,500-3,500 (35%), and in 28% of cases above €3,500.

Focusing on the role of parental education<sup>18</sup>, we observe that parents with higher education displayed more patience in the incentivized intertemporal choice task ( $p < .01$ , Cuzick's Wilcoxon-type test for trend). Specifically, we presented parents with a choice list between a fixed amount of €50 earlier in time or an increasing amount of money (between €50-70) three months later. While parents with vocational training or lower education required on average an additional €14 in order to be willing to wait three months for the reward, parents with a high-school degree required an additional €10 and those with a university degree an additional €8.

We find that parents with a higher level of education score higher on the (self-reported) grit scale ( $p < .001$ , Cuzick's Wilcoxon-type test for trend) confirming previous findings regarding higher levels of grit and educational achievement (Duckworth et al., 2007; Duckworth and Quinn, 2009; Burks et al., 2015).

## 4.2 Parent data on diligence

To investigate the influence of socio-economic background of the child's family on diligence, we asked for information on family composition, occupation, and education. Table 5 shows that we do not observe any influence of having at least one parent staying at home full time ("stay-at-home parent") or working part-time ("working part-time") on children's level of diligence. Also, the number of siblings or whether parents raise their children without a partner does not affect the number of beads children sorted. Families' highest obtained degree has a positive - albeit only weakly statistically significant - effect on children's diligence when controlling for parents' own behavior. This effect becomes significant when we additionally control for income in column (3) providing suggestive evidence for parents who hold a higher degree having children who display higher levels of diligence.<sup>19</sup>

<sup>18</sup>The variable for education is coded as an ordinal scale where a value of 1 equals minimum amount of schooling required (9 years in Austria) and the maximum value of 5 equals a PhD.

<sup>19</sup>When asking parents about family's net monthly income we explicitly framed it as a voluntary disclosure in order not to be invasive. 80% of the parents agreed to answer this question.

Table 5: Diligence and parental data

<i>Dep. var.: number of beads</i>	(1)	(2)	(3)	(4)
age	13.78*** (4.456)	13.62*** (4.530)	12.01*** (4.546)	16.62*** (5.413)
female	12.37* (7.391)	15.88** (7.265)	16.60** (7.504)	18.26** (8.460)
ability	5.223*** (1.159)	5.236*** (1.147)	5.809*** (1.106)	5.757*** (1.391)
difficult	17.48** (6.753)	16.88** (6.799)	17.68** (7.323)	22.11** (8.552)
complete	16.86** (8.025)	14.62* (8.493)	13.18 (9.730)	13.78 (12.56)
impatience	-1.424 (4.406)	0.431 (4.453)	0.338 (4.550)	3.577 (5.065)
siblings		-3.581 (4.714)	-1.854 (4.873)	-6.688 (6.076)
single		-10.61 (12.12)	-9.303 (14.04)	-20.18 (19.57)
stay-at-home parent		-3.051 (15.69)	-1.274 (15.71)	-6.258 (17.27)
working part-time		5.167 (13.70)	6.628 (14.03)	-3.188 (17.27)
education		4.485 (3.341)	6.808* (3.782)	9.579** (4.473)
parent's procrastination			0.433 (0.603)	0.268 (0.682)
parent's diligence			-1.645 (3.455)	-5.086 (3.549)
parent's patience			-1.563 (0.960)	-1.802 (1.153)
income				-5.165 (6.513)
Constant	-70.30*** (20.58)	-86.15*** (27.38)	-70.57* (38.17)	-48.98 (44.64)
Observations	206	206	197	157

OLS regression with robust standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Parents were furthermore prompted to fill in self-reported scales on grit (Duckworth and Quinn, 2009; Breyer and Danner, 2015), and procrastination (Lay, 1986) (see appendix for details). The grit scale - besides informing us about parents self assessed level of grit - also helps in inferring parents' self assessed level of diligence by considering two items of the grit scale, namely their agreement with the notions "I am a hard worker" and "I am self-disciplined". We find no evidence of neither parents' assessed level of grit (see Table A-4) nor diligence to influence their child's

diligence (see Table 5). While parental self assessed procrastination has no effect on children’s diligence, we see that parents who score high on the procrastination scale are also more likely to have children who procrastinate ( $p=.058$ , Mann-Whitney-U test). In this sense, procrastination behavior seems to be more transferable from one generation to the next than diligence.

**Result 4** *Parents who score high on the procrastination scale are more likely to have children who procrastinate. While parental education seems to positively affect children’s diligence, there is no evidence for parent’s diligence to correlate with that of their child’s.*

### 4.3 Parent’s estimation of child’s behavior

As a next step we analyze the correlations between the parent’s assessment of their child on an ordinal scale from 1 to 5 and a child’s actual behavior. Parents’ estimation about whether their child likes to spend a lot of time on a given task<sup>20</sup> and their believed child’s level of patience significantly correlate with children’s actual behavior in the RET task ( $p<.001$ , Spearman’s rank correlation coefficients) and the time preferences elicitation ( $p=.014$ , Spearman’s rank correlation coefficients). The same is true for parents’ beliefs about their child’s willingness to take a challenge and children’s actual choice of the more difficult puzzle ( $p=.077$ , Spearman’s rank correlation coefficients). Parents’ assessed procrastination behavior of their child does not correlate with children’s actual procrastination ( $p=.298$ , Spearman’s rank correlation coefficients), while we have previously shown that parents’ self-assessed and children’s displayed procrastination behavior does.

Table 6: Parental assessment and children’s behavior

Parental assessment	Child’s behavior	Spearman coefficient	p-value
spends a lot of time on a task	no. sorted beads	.280	<.001
has a hard time waiting	impatience	.178	.014
likes challenging games	difficult puzzle	.128	.077
procrastinates unpleasant jobs	procrastination RET	.104	.298

## 5 Conclusion

Our study contributes to the emerging literature on grit - a skill found to be highly predictive of success in life. We focus on diligence, a crucial component of grit, in early childhood. We measure diligence as the output in a real effort task where children aged 3 to 6 were able to not only decide on how much effort to invest but

<sup>20</sup>Note: We asked parents whether their child liked to spend a lot of time on any given task and did not specify the RET from the experiment.

also when to schedule the task. While it did not matter in terms of effort provision whether children were given an exogenous schedule or were able to decide for themselves when to do the task, there is a significant negative effect of self-selected procrastinators on exerted effort. While younger children are much more likely to procrastinate the task, effort provision under procrastination is lower, irrespective of the age group. Procrastination behavior is thus more pronounced in 3- and 4 year-olds, while 5- and 6 year-olds are significantly more likely to do the task right away. As effort provision in the self-selected today treatment is higher, older children in our sample seem more proficient in knowing when they will exert maximal effort and thus select the immediate option, earning more tokens.

Considering the determinants and influencing factors of diligence, the willingness to choose the challenging and more rewarding task over the easy task serves as an indicator for the child to provide more effort, displaying more diligent behavior. Additionally following through on the choice, irrespective of level of difficulty, and not shirking is also highly indicative of being more diligent. In this sense we are able to show that diligent behavior, taking a challenge, and not shirking from a made choice - all important aspects of grit - highly affect each other. This effect is especially pronounced for older age cohorts.

Additionally we see an age effect, where effort provision increases significantly with age even when controlling for ability. Girls also display more diligent behavior, outperforming boys in the real effort task. When analyzing children's diligence and their family background we find a statistically weak effect of parent's education on their children's level of diligence. While parents self reported diligence does not correlate with children's diligence in the RET, we see that procrastination behavior of parents is correlated with that of children.

This paper is the first to study the development of diligence and how it is affected by time scheduling in early childhood. From a policy stand point, it is important to foster diligent behavior in children starting at early childhood. While we are able to show that with age children become more proficient, one might identify those who are more prone to procrastination and offer them advice and support in their endeavor to work more diligently.

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## Appendix: Tables and Figures

Figure A-1: Puzzle task to challenge oneself



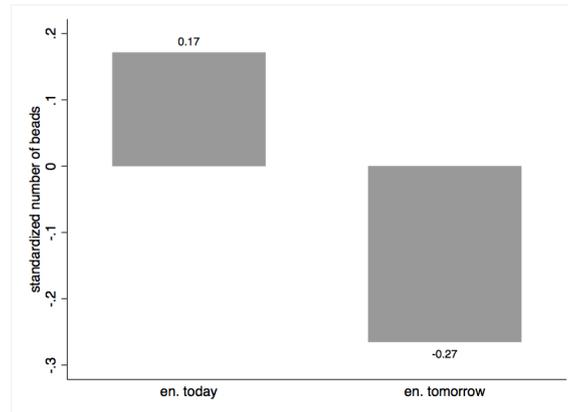
**Notes:** Children could choose between two different puzzles with the same picture which differed in the piece size and consequently the number of pieces. We presented children aged 3 and 4 with an easy puzzle with 6 pieces while the difficult puzzle entailed 12 pieces. 5 and 6 year-olds were given the option of an easy puzzle with 12 pieces and a difficult puzzle with 24 pieces. The experimenter showed the child the two identical puzzle boxes and took out one piece each to show the difference in piece size.

Figure A-2: Setup diligence task



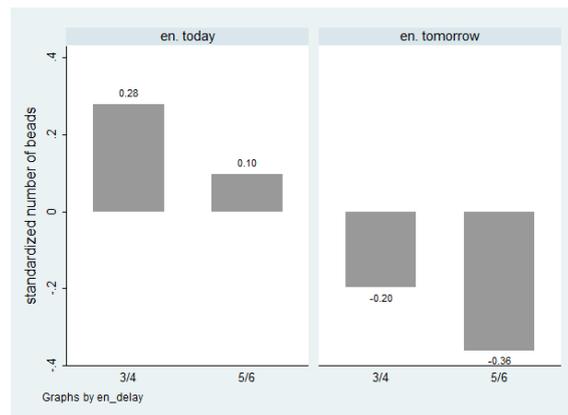
**Notes:** Children were seated in separate “cubicles” while working on the RET. The RET consisted of collecting the yellow beads out of the green bowl putting them into the yellow bowl.

Figure A-3: Standardized diligence in endogenous treatment



**Notes:** Diligence standardized over age to account for age and ability.

Figure A-4: Standardized diligence in endogenous treatment by age groups



**Notes:** Diligence standardized over age to account for age and ability.

Table A-1: Procrastination

<i>Dep. var.: endogenous delay</i>	(1)	(2)	(3)
	all	3/4 year olds	5/6 year olds
number of beads	-0.00172*** (0.000636)	-0.00278** (0.00137)	-0.00106 (0.000650)
ability	-0.0218** (0.00847)	-0.0184 (0.0175)	-0.0172* (0.0102)
female	-0.0516 (0.0586)	-0.00286 (0.0936)	-0.0744 (0.0734)
difficult	0.00137 (0.0612)	0.0291 (0.0974)	-0.0173 (0.0780)
complete	-0.0643 (0.0957)	0.0395 (0.146)	-0.161 (0.123)
impatience	0.0332 (0.0342)	0.0539 (0.0557)	0.00477 (0.0436)
Observations	241	107	134

Probit regression with average marginal effects and robust standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table A-2: Productivity and influencing factors by age groups

<i>Dep. var.: productivity</i>	(1)	(2)	(3)
	all	3/4 year olds	5/6 year olds
female	0.994** (0.488)	0.729 (0.896)	1.308** (0.537)
ability	0.299*** (0.0750)	0.0604 (0.163)	0.221*** (0.0730)
difficult	0.995** (0.480)	0.140 (0.737)	1.228** (0.569)
complete	1.202** (0.585)	2.102** (0.878)	0.471 (0.748)
impatience	-0.358 (0.251)	-0.571 (0.416)	-0.173 (0.324)
Constant	5.817*** (0.868)	6.573*** (1.553)	7.655*** (0.987)
Observations	426	178	248

OLS regression with robust standard errors in parentheses.

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

**Notes:** Productivity defined as number of collected beads over time spent on task. We miss three observations because due to technical difficulties time recording did not work for those three children.

Table A-3: Diligence by treatment

<i>Dep. var.: number of beads</i>	(1)	(2)	(3)
	all	3/4 year olds	5/6 year olds
female	14.06** (5.504)	8.548 (5.184)	20.05** (8.666)
ability	5.360*** (0.889)	3.152*** (0.858)	4.615*** (1.320)
difficult	20.95*** (5.099)	7.520 (5.312)	25.94*** (7.731)
complete	16.86*** (5.500)	8.053 (5.866)	24.70*** (8.787)
impatience	-1.418 (3.234)	-7.033** (2.937)	1.784 (5.254)
ex. tomorrow	-12.32 (8.774)	3.804 (9.259)	-16.17 (12.38)
en. today	-9.067 (8.404)	10.77 (8.905)	-16.47 (11.48)
en. tomorrow	-24.69*** (8.531)	-1.977 (8.598)	-31.29** (13.37)
Constant	-0.624 (11.37)	11.92 (11.22)	3.666 (18.50)
Observations	429	179	250

OLS regression with robust standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Table A-4: Diligence and parental data

<i>Dep. var.: number of beads</i>	(1)	(2)	(3)	(4)
age	13.78*** (4.456)	13.62*** (4.530)	13.09*** (4.455)	17.25*** (5.258)
female	12.37* (7.391)	15.88** (7.265)	16.80** (7.311)	18.86** (8.365)
ability	5.223*** (1.159)	5.236*** (1.147)	5.452*** (1.147)	5.417*** (1.445)
difficult	17.48** (6.753)	16.88** (6.799)	15.54** (6.987)	20.90** (8.404)
complete	16.86** (8.025)	14.62* (8.493)	13.55 (8.886)	12.96 (12.03)
impatience	-1.424 (4.406)	0.431 (4.453)	0.149 (4.409)	2.943 (5.005)
siblings		-3.581 (4.714)	-3.702 (4.816)	-8.611 (5.935)
single		-10.61 (12.12)	-10.64 (12.27)	-25.66 (17.25)
stay-at-home parent		-3.051 (15.69)	1.629 (15.85)	-2.193 (17.50)
working part-time		5.167 (13.70)	8.298 (13.78)	0.157 (17.35)
education		4.485 (3.341)	6.651* (3.660)	9.510** (4.246)
parent's procrastination			0.835 (0.620)	0.838 (0.723)
parent's grit			0.712 (0.771)	0.446 (0.896)
parent's patience			-1.814* (0.953)	-2.030* (1.166)
income				-7.712 (6.016)
Constant	-70.30*** (20.58)	-86.15*** (27.38)	-93.64*** (29.06)	-86.02** (34.74)
Observations	206	206	206	163

OLS regression with robust standard errors in parentheses

\*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## Instructions

*Instructions translated from German. German instructions available upon request.*

Hello! My name is .... *[name of experimenter]*. What's your name? Would you like to play a game with us?

*[Experimenter and child walk to experimenter room, showing the presents at the entrance and sit down in dedicated space. Two bags with the child's name are prepared.]*

I will explain how the game works, so listen closely. In this game you can collect tokens which you can exchange for some presents afterwards. After I explain the game you will repeat it back to me, alright? And since you've been paying close attention I will already give you one token, which you can exchange for one present at the end of the game. Let's put the token over here and start the game. *[token placed in today bag]*

### TIME PREFERENCES

In this game you can collect tokens for today and for tomorrow, which you can exchange for presents either today or tomorrow. Look, here I have pink and blue bowls. The tokens in the pink bowl can be exchanged into presents TODAY, the tokens in the blue bowl can be exchanged into presents TOMORROW.

Do you know what tomorrow means? Tomorrow means that you will sleep for one night to receive the tokens from the blue bowl and then you can exchange them into presents. I'm sure your kindergarten teacher has told you that we will be back tomorrow. We will be back tomorrow morning and also bring the same presents with us.

Now, the tokens from the pink bowl can be exchanged for presents today and the tokens from the blue bowl can be exchanged for presents tomorrow. Got it? Here we have three possibilities and you can pick one: *[show three sets of cardboards with bowls]*

- Option 1: If you choose option 1, there are 2 tokens in the pink bowl and none in the blue bowl. That means you will receive 2 presents today and no presents tomorrow.
- Option 2: If you choose option 2, there is 1 token in the pink bowl and 2 tokens in the blue bowl. That means you will receive 1 present today and 2 presents tomorrow.
- Option 3: If you choose option 3, there are no tokens in the pink bowl and 4 tokens in the blue bowl. That means you will receive no presents today and 4 presents tomorrow.

You may now choose one of these three options. But first please answer some questions:

- How many options can you choose? *[child: one]*
- What happens if you choose option 1? How many tokens will you receive today and how many tokens will you receive tomorrow? *[let child count tokens in each bowl]*
- What happens if you choose option 2? How many tokens will you receive today and how many tokens will you receive tomorrow? *[let child count tokens in each bowl]*
- What happens if you choose option 3? How many tokens will you receive today and how many tokens will you receive tomorrow? *[let child count tokens in each bowl]*

*[repeat instructions if child cannot answer correctly repeat up to two additional times] Control questions asked in randomized order for each experimenter.*

Well done! Now please choose one option.

Great, you have chosen option ... . That means you will receive X tokens presents today and X presents tomorrow. Can you tell me why you chose this option? *[note down answer]* Let me put the tokens you will receive tomorrow into this bag. See, I wrote your name on it so I can save it for tomorrow. Tomorrow you will come back and exchange these tokens for presents. *[put tokens into today and tomorrow bags]*

### **PUZZLE TASK**

*[prepare puzzles: 3 and 4 year-olds - 6 and 12 pieces; 5 and 6 year-olds 12 and 24 pieces]* You've done a great job so far! Would you like to play another game? Look, here I have two puzzles. Both puzzles have exactly the same picture. But one puzzle is more difficult and one puzzle is easier to do. This puzzle is difficult *[show puzzle with more pieces]*, because the puzzle pieces are smaller. This puzzle is easier because the puzzle pieces are bigger *[show one larger and one smaller puzzle piece for comparison]*. Do you see the difference? If you manage to do the difficult puzzle, you will receive two additional tokens. If you manage to do the easier puzzle, you will receive one additional token. You will have until lunch time to do the puzzle.

Now, before you decide which puzzle to keep, I have some questions for you.

- Which puzzle is more difficult?
- How many presents will you receive if you complete the easy puzzle? How many presents will you receive if you complete the difficult puzzle?
- Until when do you have to do the puzzle to still receive your presents for this task?

*[repeat instructions if child cannot answer correctly repeat up to two additional times]* Great, now you can decide which puzzle you would like. You will be able to keep that puzzle and take it home with you afterwards.

## REAL EFFORT TASK

Well done! Now I have one last task for you. You can collect some additional tokens in this task, which you can again exchange for presents afterwards. Should I explain how the task works?

Look, here I have another bowl. There are many colorful beads in this bowl. The task is to collect ONLY YELLOW beads. The more yellow beads you collect, the more presents you will get. You can collect the yellow beads for as long as you want to. If you want to stop collecting beads, just say stop and we will count how many beads you have collected. Depending on the number of yellow beads you collect you will receive a few or many presents. If you, for example, collect this many yellow beads - these are 20 beads - *[show bowl with 20 yellow beads]* you will receive one present.

Do you understand how the task works?

- What do you have to do? *[child: collect yellow beads]*
- If you collect many yellow beads, will you receive more presents or fewer presents? *[child: more]*
- When will you stop the task? *[child: when I want to]*

Great! So let's do a trial round to see how it works. You can start picking yellow beads from the bowl. Ready? Go! *[stop child after 30 seconds, note number of beads]*

Great job!

*[Read assigned treatment only!]*

**T1a (today):** Since you've done such a good job, you can sit down over there right now and start collecting yellow beads from the bowl. You can collect yellow beads for as long as you want to. If you want to stop collecting yellow beads signal to .... over there and she/he will count your beads and exchange your tokens into presents.

**T1b (tomorrow):** Since you've done such a great job, you can do this task tomorrow. Tomorrow we will come back to this room and then you can sit in one of those spots over there and collect yellow beads. You will be able to collect yellow beads for as long as you want to. If you want to stop collecting yellow beads you will signal to ... over there and she/he will count your beads and exchange your tokens into presents tomorrow. *[repeat explanation of RET when child comes back the next day]*

**T2 (endogenous):** Since you've done such a great job, you can decide when you want to do this task. You can either do the task right now or you can do it tomorrow remember we will be back tomorrow with the same presents. For this task you will sit in one those spots over there and collect as many yellow beads as you want to. You can collect yellow beads for as long as you want to. If you want to stop collecting yellow beads signal to ... over there and she/he will count your beads and exchange your tokens into presents.

When would you like to do this task? Now or tomorrow? *[note down decision and read the according paragraph below]*

- You have decided to the task now. That means you can sit down over there and start collecting yellow beads. If you want to stop collecting yellow beads just signal to ... over there. Then you can exchange your tokens for presents afterwards.
- You have decided to the task tomorrow. That means we will pick you up tomorrow and take you to this room again. We're almost done for today! Now you get to exchange your tokens for presents and then I'll take you back to your class. Thank you for doing such a great job today!

### **RET**

*[different experimenter is responsible for supervising RET; child signals to stop the task, note down time and weigh beads on scale, convert into tokens]*

You've done a great job! Can you tell me how much fun it was to collect beads? Look, here I have five smiley faces. This face is sad because it did not like the task at all. The face next to it didn't think it was that much fun either but not as bad as the first one. The face in the middle thought it was kind of ok. This face is smiling because it liked the task. And this face here is laughing a lot because it really liked the task. How much did you like the task? Can you show me the face that fits you the most?

Alright that's it for today! Now let's exchange your tokens for presents! Then I will take you back to your class (if applicable: and I'll see you again tomorrow). Thank you for doing such a great job today! *[exchange tokens into presents with child; put chosen presents into bags, add parent questionnaire and seal them; take child back to class and leave bag at child's spot in wardrobe]*

## Parental questionnaire

*Parental questionnaire translated from German. German version available upon request.*

Dear parents, we kindly ask you to fill in this anonymous questionnaire. All answers are voluntary. Thank you for your collaboration!

### Demographic information about your person

Gender:

- female
- male

Age: .... years

Occupation:

- full-time job
- part-time job
- momentarily unemployed

Highest educational degree:

- Mandatory schooling
- Vocational training
- High-School
- University (Bachelor/Master Degree)
- University (PhD)

Language, primarily spoken at your home (please indicate only one):

- German
- Turkish
- Serbian/Croatian
- other: .....

Number and age of children:

- 1 child, age: .... years
- 2 children, age: .... years & .... years
- 3 children, age: .... years & .... years & .... years
- 4 children or more, age: .... years & .... years & .... years & .... years & .... years

I'm raising my children:

- alone
- with my partner

Age of my partner: .... years

Partners occupation:

- full-time job
- part-time job
- momentarily unemployed

Partners highest educational degree:

- Mandatory schooling
- Vocational training
- High-School
- University (Bachelor/Master Degree)
- University (PhD)

Net monthly income of our family (voluntary disclosure):

- below €1,500
- €1,500- €2,500
- €2,500- €3,500
- above €3,500

We live in a:

- rental flat/house
- own flat/house

### Self assessment

Please indicate for each of the following statements how well it describes you.

**1= not at all to 5= to a very high extent**

I am a hard worker.	1	2	3	4	5
I get enthusiastic about ideas for a short time but later lose interest.	1	2	3	4	5
I am self-disciplined.	1	2	3	4	5
I can cope with setbacks.	1	2	3	4	5
New projects sometimes distract me from previous ones.	1	2	3	4	5
I am good at resisting temptation.	1	2	3	4	5
I finish whatever I begin.	1	2	3	4	5
I have difficulty maintaining focus on projects or tasks that take more than a few months to complete.	1	2	3	4	5
I have trouble concentrating.	1	2	3	4	5

I often find myself performing tasks that I had intended to do days before.	1	2	3	4	5
I often miss concerts, sporting events, or the like because I don't get around to buying tickets on time.	1	2	3	4	5
Even with jobs that require little else except sitting down and doing them, I find they seldom get done for days.	1	2	3	4	5
In preparing for a deadline, I often waste time by doing other things.	1	2	3	4	5
New projects sometimes distract me from previous ones.	1	2	3	4	5
I usually return an RSVP request very shortly after receiving the invitation.	1	2	3	4	5
I often finish a task sooner than necessary.	1	2	3	4	5
I usually accomplish all the things I plan to do in a day.	1	2	3	4	5
I have difficulty maintaining focus on projects or task that take more than a few months to complete.	1	2	3	4	5
I am continually saying "I'll do it tomorrow".	1	2	3	4	5
I usually take care of all the tasks I have to do before I settle down and relax for the evening.	1	2	3	4	5

## Lottery

Among the parents who will return the filled in questionnaire we will randomly pick five parents. In case you get picked, the following part will determine your earnings.

In the following lines (1-11) you are asked to choose between:

- receiving €50 directly after the end of our study (end of June), or
- receiving an amount between €50 and €70 at the end of September (hence, three months after the end of our study).

Please choose in each of the following lines, which of the two options you prefer. One of these lines will ultimately be randomly drawn for payment.

**Example:** In case line 6 will be randomly picked for payment and in this line you have chosen the amount in the right column (€60) you will get €60 in three months.

	<b>End of June</b>	<b>or</b>	<b>End of September</b>
1)	€50	or	€50
2)	€50	or	€52
3)	€50	or	€54
4)	€50	or	€56
5)	€50	or	€58
6)	€50	or	€60
7)	€50	or	€62
8)	€50	or	€64
9)	€50	or	€66
10)	€50	or	€68
11)	€50	or	€70

In the envelope - which contained your questionnaire - you will find a code. This code facilitates your payment. Please transfer your personal code into the following box. Please ensure that you transfer the code correctly.

Participation code: ... ..

The codes of the winning participants will be announced via the information board in the kindergarten. The winners will be notified when to pick up their payments (either right away or in three months). In case you are one of the winners, you are kindly asked to present the piece of paper with your participation code in kindergarten. Please present this piece of paper at the communicated point in time in order to get your payment.<sup>21</sup> You will receive your payment in a sealed envelope. Please store your participation code in a safe place so we can verify your code for the payment.

For your information: The participation code ensures full anonymity.

### **Assessment of your child**

In the following we will report several statements. Please indicate for each statement how well it describes your child.

**1= not at all to 5= to a very high extent**

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<sup>21</sup>In case your child has left kindergarten at this point in time, please notify us and we will send your payments.

If I ask my child to perform an unpleasant task he/she tries to postpone the task for as long as possible.	1	2	3	4	5
My child likes to dawdle.	1	2	3	4	5
My child likes to spend a lot of time on a given task.	1	2	3	4	5
My child gets easily distracted.	1	2	3	4	5
Whatever my child begins, he/she wants to finish.	1	2	3	4	5
It's hard for my child if he/she has to wait.	1	2	3	4	5
My child likes playing challenging games.	1	2	3	4	5

**During our project in kindergarten, we asked children to choose between three alternatives:**

- 1) Option 1: two presents today, nothing tomorrow.
- 2) Option 2: one present today, and two presents tomorrow.
- 3) Option 3: nothing today, and four presents tomorrow.

We promised children to come back the next day with presents, which were as nice as the ones they could get on the first day. Independently of what your child might have chosen, which option would you prefer for your child? The decision you make now has no impact on your child.

*Which option would you choose for your child?*

- Option 1: two presents today, and no present tomorrow
- Option 2: one present today, and two presents tomorrow
- Option 3: no present today, and four presents tomorrow

**We also played the following game with the children. Now we are interested in your opinion.**

The children were told to collect only yellow beads from a bowl of small, multi-colored beads. The children could autonomously decide for how long they wanted to work on this task and how many beads they collected. Moreover, children could decide if doing the task right away or postponing it to the next day.

*Which option would you choose for your child?*

- “What is done, is done.” My child should do the task right away.
- “Better late than never.” My child should take his/her time and conduct the task on the following day.

Thank you for your participation.