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Lying and social norms: a lab-in-the-field experiment with children

Despoina Alempaki[a], Genyue Fu[b], Jingcheng Fu[c,*]

Abstract: We conduct a lab-in-the-field experiment with 567 children, aged four to eleven, in which we investigate the effect of social norms on lying and test whether norm sensitivity changes with age. Children think about a number between 1 and 6 in private, then roll a die, and report whether the number that came up is the same as the one they thought of. Just before making their report, we expose children to different empirical and normative information prescribing lying or honesty. We show that a normative intervention suggesting other children approve of honesty effectively reduces lying. We find limited evidence of the influence of our empirical interventions: information suggesting other children report honestly is effective only for younger children, while information suggesting other children report dishonestly does not influence lying patterns. We further observe that, although lying is omnipresent across all age groups, honesty significantly increases with age.

JEL classification: C9, D8

Keywords: truth-telling, lying, social norms, children, lab-in-the-field experiment

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1. Introduction

A substantial experimental literature has investigated the driving forces behind preferences for truth-telling (e.g., Abeler et al., 2019; Fischbacher and Föllmi-Heusi, 2013; Gerlach et al., 2019; Gneezy et al., 2018). Among other motives, compliance with *social norms* – collective perceptions of what constitutes socially appropriate behavior in a given situation[1] – has been suggested as a potential determinant of preferences for honesty. Social norms have been used to explain behavior in a variety of economic settings (e.g., Banerjee, 2016 – bribery; Barr et al., 2018 – discrimination; Frey and Meier, 2004 – conditional cooperation; Fromell et al., 2019 – saving behavior; Gächter et al., 2013 – reciprocity; Kölle et al., 2020 – voter registration; Krupka and Weber, 2013 – altruistic sharing). In the context of truth-telling, a desire to adhere to social norms mandates that lying will become more attractive, the more individuals believe that lying is acceptable within their reference group.

In this paper, we examine experimentally whether children's preferences for truth-telling are influenced by social norms and if so, whether norm sensitivity changes with age. We study how preferences for truth-telling driven by norms evolve during childhood, a period crucial for the development of moral reasoning (e.g., Bussey 1992, 1999; Strichartz and Burton, 1990), theory of mind (e.g., Talwar and Lee, 2008), executive functioning (e.g., Zelazo and Müller 2002) and conformity (e.g., Morgan et al., 2015).[2] Importantly, given the growing use of social norms in public administration in order to encourage a wide range of desirable behaviors (see e.g., DellaVigna and Linos, 2020; John et al., 2014; Sunstein and Reisch, 2017), our study provides useful insights on whether truth-telling can be manipulated through simple low-cost interventions and if so, what the optimal age cohort of such manipulations would be.

To examine the developmental trajectory of norm compliance on preferences for truth-telling, we conducted a lab-in-the-field experiment involving 567 children from early (4-5 and 7-8 years old) to middle childhood (10-11 years old). We provided children with different norm-based information regarding the social appropriateness of lying and then gave them the opportunity to lie to obtain their preferred outcome. Following Bicchieri's distinction (2006, 2016), we investigated separately the influence of *empirical* information, i.e. what most others do, and of *normative* information, i.e. what most others think is the appropriate thing to do.[3]

[1] See Bicchieri (2006), Elster (1989) and Ostrom (2000) for definitions of social norms.
[2] See also Talwar (2018) for a review in the development of lying and cognitive abilities.
[3] See also Cialdini (1990) for a discussion on the distinction between descriptive and injunctive norms.

Previous work has suggested that empirical information might exert a stronger influence on behavior (see e.g., the discussion in Bicchieri and Dimant, 2019), however, little is known on whether this holds true for children. In addition, we manipulated whether the provided information prescribes compliance or violation of the truth-telling norm. Existing evidence points to an asymmetry in compliance patterns: individuals have a higher tendency to violate a norm, if they observe other transgressors, compared to adhere to a norm, if they observe other followers (see, e.g., Bicchieri et al., 2020; Dimant, 2019; Gächter et al., 2018).

More specifically, our experiment consists of a *mind game* (Jiang, 2013), in which children had first to think about a number between 1 and 6 in private, then roll a die, and report whether the number that came up is the *same* as the one they thought of. Children were incentivized to report "Same" independently of whether this corresponded to the truth. Crucially, this simple game, where dishonesty is entirely hidden from view, allows us to isolate the intrinsic cost of lying by ruling out any concern of being exposed as a liar, since there is zero probability of detection or sanctioning at the individual level (see e.g., Abeler et al., 2019; Gneezy et al., 2018; Khalmetski and Sliwka, 2019 for the importance of social image concerns on lying behavior). However, we can still detect lying at the aggregate level: in the absence of lying, the expected number of children who report "Same" is 16.7% and any higher proportion of "Same" reports points to the presence of lies.

We implemented four different treatments. In the CONTROL treatment, children played directly the mind game. In the other three treatments, just *before* making their report in the mind game, children were presented with information regarding what other children do or approve of doing in the same game. More specifically, children were given empirical information prescribing dishonesty (DISHONESTY-EMPIRICAL), empirical information prescribing honesty (HONESTY-EMPIRICAL), or normative information prescribing honesty (HONESTY-NORMATIVE).[4] By contrasting the proportion of children who report "Same" in the treatments with information and the CONTROL treatment, where no information is provided, we can answer whether children are sensitive to the different types of information they receive, and whether any observed influence develops with age.

[4] As we will explain in detail in the experimental design section, we did not implement a DISHONESTY-NORMATIVE treatment, because we could not reliably argue that dishonesty is what most other children approve of.

Our results are as follows. In line with most of the existing literature, we find that a significant proportion of children lied, but not all the time, leaving room to investigate the influence of our norm interventions. Regarding the effects of social norms on lying, children generally conformed to normative information prescribing honesty. Empirical information prescribing honesty was effective only for younger children, while we do not find any systematic evidence that empirical information prescribing dishonesty influenced children's truth-telling. Regarding norm sensitivity across ages, norms had a differential impact only when they were empirical and they suggested honesty. Finally, in the context of our paradigm, lying significantly decreased with age.

We follow other research that relies on laboratory experiments to investigate the effectiveness of norm-based interventions on adults' truth-telling. This literature has produced rather mixed evidence, with some studies reporting significant, and other studies reporting no or limited effects (e.g., Abeler et al., 2019; Boonmanunt et al., 2019; Diekmann et al., 2015; Dimant et al., 2020; Fellner et al., 2013; Fosgaard et al., 2013; Gino et al., 2009; Innes and Mitra, 2013; Mitra and Shahriar, 2020). Our paper complements this literature by investigating the effect of similar norm-based interventions in children, enhancing our understanding of whether and when individuals internalize moral norms.

Our paper also relates to empirical work investigating the influence of social norms in children's lying behavior. Amato et al. (2019) showed that children 9 years old that made statements that appeal to social norms (such as, for instance, "you should always help") when motivating their judgements of unfair scenarios, were less likely to lie in a flip-coin task. Bucciol and Piovesan (2011) found that asking children 5 to 15 years old not to cheat, reduces their tendency to lie later in a flip-coin task. Zhang et al. (2020) asked children and adolescents to report the outcome of an individual die-rolling task, while queueing in groups. They found that the probability of reporting a high payoff number was increasing in the proportion of other group members of the same gender reporting a high payoff number. Since group members were queueing in close proximity, it is highly likely that children have overheard previous members' reports, and as such their own reports were prone to peer influence. Unlike these studies that tested indirectly the influence of social norms, our study attempts to provide a more complete picture of children's compliance patterns by providing both empirical and normative information about similar others in the exact same setting, while investigating how any observed effect varies with age.

We further contribute to the burgeoning economic literature examining how children's truth-telling preferences develop over time (Alan et al., 2019; Amato et al., 2019; Brocas and Carillo, 2019; Bucciol and Piovesan, 2011; Glätzle-Rützler and Lergetporer, 2015; Maggian and Villeval, 2016; Zhang et al., 2020). The evidence on the developmental path of lying is rather mixed, perhaps due to the differences in the age range and the experimental paradigms examined; some studies find a hump-shaped pattern (Maggian and Villeval, 2016; Zhang et al., 2020), while others document that dishonesty decreases (Glätzle-Rützler and Lergetporer, 2015 – only for white lies) or is similar over age (Brocas and Carillo, 2019; Bucciol and Piovesan, 2011).

The rest of the paper is set out as follows: Section 2 outlines the experimental design and procedures. Section 3 presents our results. Section 4 discusses our findings and concludes.

2. Experimental Design and Procedures

To examine the evolution of lying behavior driven by norms, we tested children in three age groups: 4-5, 7-8 and 10-11 years old. We conducted the experiment in a kindergarten and a primary school in Hangzhou in two waves, one week in March 2018 and one week in June 2019. In the first wave implemented in March 2018, we collected data only for the CONTROL, the DISHONESTY-EMPIRICAL, and the HONESTY-EMPIRICAL treatments. In the second wave implemented in June 2019, we collected data for the HONESTY-NORMATIVE treatment, and extra observations in the rest of the treatments. A full description of the observations collected per wave is reported in Table B1 in Appendix B. The sessions were run during school hours to minimize the possibility of any selection bias (see the discussion in Maggian, and Villeval, 2016). Ethics approval was obtained by the Hangzhou Normal University. In total 567 children (271 female) participated in the experiment.

We followed the same protocol in all of our sessions. The teachers were present in the classroom during the experiment, but the children were tested individually in a separate room outside the classroom. The instructions were explained to each child one-on-one by the experimenter to ensure full attention. In order to check for comprehension, we included control questions that children had to answer correctly before proceeding with the main task. It is reassuring that the great majority of children – 92% in total, 87% of the youngest cohort – correctly answered all control questions at once. At the end of each individual session, we

asked children to not communicate information about how to play the game with other children, and this was ensured by the presence of teachers upon their return to the classroom.[5]

To measure lying behavior, we used a modified version of the mind game (first introduced by Jiang, 2013, but see also e.g., Dimant et al., 2020; Kajackaite and Gneezy, 2017; Shalvi and De Dreu, 2014). Children were asked to think of and memorise a number between 1 and 6 without revealing it (their "secret" number). They then had to roll a six-sided die once, and report whether the outcome is the same or different from their secret number. If they reported "Same", they received three tokens; otherwise, they received one token. We chose the mind game for two reasons. First, the risk of getting caught is eliminated, ruling out any reputational concerns (see e.g., Abeler et al., 2019; Gneezy et al., 2018) that might have influenced differentially the lying behavior of the older compared to the younger children. Second, we ensure children as young as four years old can easily grasp the mind game's simple rules.

Our experimental treatments are as follows. In the CONTROL treatment, children played directly the mind game without receiving any information about other children's reports. In the other three treatments, we stimulated different perceptions of the propensity for truth-telling by providing children selective empirical and normative information about other children of their cohort, just before making their own report in the mind game. The procedure of giving selective information of previous participants using non-random samples is widely used to examine adherence to different social norms (e.g., Bicchieri and Xiao, 2009; Innes and Mitra, 2013).

More specifically, children in the DISHONESTY-EMPIRICAL treatment were informed that "Among 10 children of your age, 8 of them rolled the same number as their secret number and got three tokens and 2 of them rolled a different number and got one token". Similarly, children in the HONESTY-EMPIRICAL treatment were told that "Among 10 children of your age, 2 of them rolled the same number as their secret number and got three tokens and 8 of them rolled a different number and got one token". We were asked by the school for logistic reasons to test children from the same class sequentially, and in order to do this whilst randomizing the children into treatments, we could only guarantee that the empirical

[5] The English version of the experimental instructions is included in Appendix A.

information statements would be valid ex-post. That is, for each age group there were ultimately at least 8 children who got three tokens and 8 children who got one token.

Finally, children in the HONESTY-NORMATIVE treatment were told that "I asked 10 other children what is the right thing to do in this game. The majority of them said the right thing to do is, if a child rolled a number which is the same as their secret number they should report 'Same', if they rolled a number which is different from their secret number they should report 'Different'". We constructed the normative message as follows: in the second wave, before running the HONESTY-NORMATIVE treatment, we first ran extra sessions in the CONTROL and empirical information treatments and asked children to indicate what they think is the right thing to do in the mind game, after they had made their own report.[6] We then used these responses to construct the normative message. We changed the format in the normative information treatment from "8 out of 10" to "the majority", because ex-ante it was deemed highly unlikely that we would observe children saying that the right thing to do is to report "Same", if they rolled a number that is different from their secret number. Indeed, this is what we observed in our data, where none of the children reported dishonesty is the right thing to do. This expectation is also the reason we did not implement a normative information treatment prescribing dishonesty, as we could not argue that the majority of children approve of dishonesty.

Following the standard procedure for economic experiments with children, we incentivized choices using tokens which could be exchanged for small presents in our experimental shop. Children were informed that any earned token would be exchanged for prizes (animal-shaped erasers, smaller and bigger stickers), such that the higher the number of tokens they earned, the more prizes they would receive. We made sure that one token was enough to obtain at least one prize. The prizes were shown to the children at the beginning of their session. In the second wave of data collection, at the end of the experiment, we asked children whether they like or dislike the prizes, and by how much.

[6] We pool the extra observations collected in the second wave in the CONTROL and empirical information treatments with those in the first wave, since the additional questions come after children have made their report in the mind game. Our results are robust to the exclusion of these observations.

3. Results

We first focus on descriptive statistics and balancing across treatments and then we proceed with the main analysis.

Table 1 reports the summary statistics of our sample by treatment. We cannot reject the null hypothesis that our participants' observed characteristics are balanced across treatments (smallest p-value = 0.778).[7]

Table 1. Summary statistics by treatment

	CONTROL	DISHONESTY-EMPIRICAL	HONESTY-EMPIRICAL	HONESTY-NORMATIVE	p-value
Age	8.12 (2.50)	8.04 (2.50)	8.07 (2.47)	8.10 (2.45)	0.780
Female	0.49	0.46	0.50	0.46	0.860
Incorrect CQ	0.07	0.10	0.07	0.10	0.778
N	150	145	139	133	

Notes: "Age" is the exact age in years. "Female" is a gender dummy, while "Incorrect CQ" is a dummy for children who had at least one mistake in the control questions. Standard deviation for "Age" is reported in parentheses. In the last column, we report p-values from balance checks (Kruskal-Wallis test for variable "Age", and χ^2-test for binary variables "Female" and "Incorrect CQ").

Table 2 depicts the sample size together with the proportion of children reporting "Same" by treatment and age cohort. A first observation relates to the prevalence of dishonesty. The proportion of "Same" reports is significantly higher than 16.7% in all treatments (p-value = 0.081 for 10-11 years old in HONESTY-NORMATIVE, p-value <0.001 for all other age groups and cohorts, binomial test). That is, a substantial number of children in our sample lied independently of the treatment and the age cohort. The proportion in all treatments is also well below 100%, indicating that at least some children reported honestly. Summing up, we find the following on the prevalence of lying behavior.

Table 2. Sample size and proportion of "Same" reports by treatment and age cohort

	4-5 Yrs	7-8 Yrs	10-11 Yrs	Full Sample
CONTROL	50 (82%)	49 (67%)	51 (41%)	150 (63%)
DISHONESTY-EMPIRICAL	51 (80%)	47 (66%)	47 (55%)	145 (68%)
HONESTY-EMPIRICAL	48 (65%)	46 (70%)	45 (49%)	139 (61%)
HONESTY-NORMATIVE	47 (72%)	47 (43%)	39 (28%)	133 (49%)

Note: Proportion of "Same" reports is reported in parentheses.

Result 1. There is significant lying across all age groups and treatments; however, a positive fraction of children report honestly.

[7] All tests reported in the paper are two-sided.

Next, we consider whether our norm-based interventions influence children's truth-telling behavior at the aggregate level. Pooling all cohorts, we observe that the highest proportion of children reporting "Same" is highest in the DISHONESTY-EMPIRICAL treatment (68%), followed by 63% in the CONTROL, 61% in the HONESTY-EMPIRICAL, and 49% in the HONESTY-NORMATIVE treatment. The proportion of "Same" reports in the DISHONESTY-EMPIRICAL and HONESTY-EMPIRICAL treatment is not significantly different from the CONTROL (p-values = 0.443 and 0.702 respectively, χ^2-test). However, the HONESTY-NORMATIVE treatment significantly reduces the proportion of "Same" reports by 14 percentage points compared to the CONTROL (p-value = 0.014, χ^2-test). These results are further corroborated from a linear probability model estimated with and without controlling for individual characteristics (see Table B2 in Appendix B). Our findings on the effectiveness on norms on children's behavior at the aggregate level are summarized in Result 2.

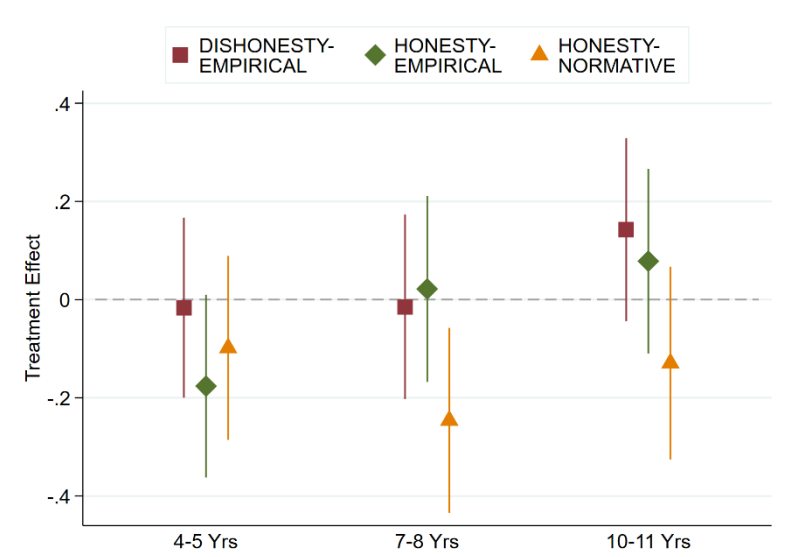
Result 2. Providing information suggesting other children approve of honesty significantly reduces lying among children. Information suggesting most other children are (dis)honest has no influence on children's lying behavior.

To examine the developmental path of norm sensitivity, we proceed by examining whether and how the influence of social norms changes over age. Are the patterns found at the aggregate level consistently observed across all age groups, or are some age cohorts more sensitive to social norms than others? To answer this question, we estimate a linear probability model where we regress children's choice of reporting "Same" in the mind game on the age cohorts, treatment dummies, and their interactions as explanatory variables.[8] Figure 1 depicts the estimated difference across the norm treatments relative to the CONTROL together with their 95% confidence intervals conditional on the age cohort. The estimates reported in Figure 1 are obtained while controlling for gender and comprehension, but the results are similar from the raw estimates, since neither gender nor comprehension predicts the probability of reporting

[8] We use OLS instead of probit regressions, because the significance of the multiplicative term in a non-linear model is not a proper indicator for the significance of the interaction (see Ai and Norton, 2003).

"Same". Full regression results with and without controlling for these individual characteristics are reported in Table B3 in Appendix B.[9]

Figure 1. Treatment effects relative to the CONTROL by age cohort



Notes: Joint estimates of the effects of norm interventions by age cohort, and their 95% confidence intervals from a linear probability model; each coefficient indicates the difference between the respective norm treatment and the CONTROL treatment in the probability of reporting "Same".

Eyeballing Figure 1, we observe that, in line with the aggregate data, the DISHONESTY-EMPIRICAL treatment does not influence lying behavior in any of the age groups. Although we do observe an effect in the expected direction among children 10-11 years old, the effect is not significant (p-values = 0.860 for 4-5 years old, 0.878 for 7-8 years old, and 0.133 for 10-11 years old). We further find that the treatment effect is stable, corroborating that all in all this intervention was not effective in any of the age groups (p-value = 0.989 for the difference between 7-8 years old and 4-5 years old, and 0.232 for the difference between 10-11 years old and 4-5 years old). We note here that for children 4-5 years old, the empirical information coincides with the actual frequency of "Same" reports in the CONTROL (80%, Table 2).[10] This means we cannot rule out the possibility that the empirical norm might have been effective in influencing behavior within the youngest age group were the prevalence of dishonesty lower in the CONTROL treatment.

[9] The results on treatment effects within age cohort are also robust when we use Fisher's exact tests to compare the respective norm treatment with the CONTROL of the same age cohort. The results are reported in Table B4 in Appendix B.

[10] We did not expect such a high prevalence of "Same" reports when we designed our treatments.

The HONESTY-EMPIRICAL treatment decreases the proportion of "Same" reports by 18 percentage points for the youngest age group (p-value = 0.066), but we do not find any evidence that the treatment has any influence on the middle and oldest age group (p-values = 0.822 and 0.414 respectively).[11] Indeed, the effect of HONESTY-EMPIRICAL treatment decreases over age: despite its negative effect on children 4-5 years old, the point estimates of its effects on the two older groups are positive, and the difference between the effect on the youngest and the oldest cohort is significant (p-value = 0.059).

Finally, the HONESTY-NORMATIVE treatment has a large effect of decreasing the proportion of "Same" reports by 25 percentage points within the middle age group (p-value = 0.011). We do find a decrease in the same direction in the youngest (10%), and the oldest age group (13%), but these effects are not statistically significant (p-values = 0.303 and 0.196 respectively). All in all, the treatment effect is relatively stable across age groups (p-values = 0.277 for the difference between 7-8 years old and 4-5 years old and 0.823 for the difference between 10-11 years old and 4-5 years old), suggesting that while the treatment might have a stronger effect in the middle age group, it also influences lying patterns in the other groups.

We now present an alternative, more parsimonious analysis of how norm sensitivity varies across age groups. The regression model presented in Table 3 incorporates the simplifying assumptions that preferences for honesty and social norm effects change with age at a constant rate (see e.g., Sutter, 2015 for a similar analysis with different age groups). The model includes the three treatment dummies, a single variable for the age cohort, and the interactions between age and treatment dummies. The effects of norm treatments on the youngest cohort are estimated by the treatment dummies, and the interaction terms allow us to test whether the effects are significantly different for older children. Column (1) reports the raw estimates, and column (2) controls for gender and comprehension.

[11] We have additional data on 67 children aged 5-6 years (35 in the CONTROL and 32 in the HONESTY-EMPIRICAL), which exhibit similar patterns as the 4-5 years old: 74% of them reported "Same" in the CONTROL and 53% in the HONESTY-EMPIRICAL; the difference between the two treatments is significant (p-value = 0.081, Fisher's exact test). We originally intended to study children one year older (5-6, 8-9 and 11-12 years old); after conducting those sessions with the 5-6 years old, the school informed us that children aged 11-12 cannot participate due to their time constraints, therefore we adapted the age groups by one year.

Table 3. OLS estimates of treatment effects interacted with age cohort

Dependent Variable = 1 if Report "Same"	(1)	(2)
DISHONESTY-EMPIRICAL	-0.041	-0.042
	(0.085)	(0.085)
HONESTY-EMPIRICAL	-0.152*	-0.154*
	(0.086)	(0.087)
HONESTY-NORMATIVE	-0.140	-0.142
	(0.087)	(0.087)
Age Cohort	-0.204***	-0.204***
	(0.047)	(0.047)
DISHONESTY-EMPIRICAL * Age Cohort	0.079	0.079
	(0.066)	(0.066)
HONESTY-EMPIRICAL * Age Cohort	0.127*	0.129*
	(0.067)	(0.067)
HONESTY-NORMATIVE * Age Cohort	-0.019	-0.018
	(0.069)	(0.069)
Female		0.031
		(0.039)
Incorrect CQ		0.037
		(0.071)
Constant	0.839***	0.821***
	(0.060)	(0.063)
Observations	567	567
R-squared	0.098	0.099

Notes: Coefficient estimates from a linear probability model. "Age Cohort" takes the value of 0 for 4-5 years old, 1 for 7-8 years old and 2 for 10-11 years old. "Female" is a gender dummy, while "Incorrect CQ" is a dummy for children who had at least one mistake in the control questions.

The estimated effects of norms on 4-5 years old are quite similar to those depicted in Figure 1: the HONESTY-EMPIRICAL treatment significantly reduces lying (p-value = 0.075), while the other two norm treatments do not have a significant effect (p-value = 0.624 for the HONESTY-EMPIRICAL and 0.104 for the HONESTY-NORMATIVE treatment). Moreover, the effect of HONESTY-EMPIRICAL significantly decreases with age (p-value = 0.056). For the other two norm treatments, we do not observe any evidence that the effects change with age (p-values = 0.232 for the DISHONESTY-EMPIRICAL and 0.796 for the HONESTY-NORMATIVE treatment). Our results are qualitatively similar when we use the exact age instead of the age cohort (See Table B5 in Appendix B).

Interestingly, the age group least sensitive to our norm interventions is the oldest one. This observation is consistent with evidence suggesting that older children are less susceptible to pressure for social conformity in their moral judgements (Kim et al., 2016), perhaps due to increasing confidence in their own judgments. It is also in line with studies suggesting that

adults do not respond to norm interventions targeting lying behavior (see e.g., Abeler at al., 2019; Dimant et al., 2020). The main implication of this finding is that possible policy and educational interventions that try to promote honesty would be more effective in young children. Of course, since this is the first study to examine how preferences for truth-telling dependent on perception of social norms evolve, replication is needed to test its robustness. Taken together, our findings on the effectiveness of norms across treatment between age groups are summarized in Result 3.

Result 3. Empirical information suggesting others are honest reduces lying among younger children but has no effect among older children. Empirical information suggesting others are dishonest has no effect for any of the age groups, while normative information suggesting others approve of honesty has similar effects across age groups.

Finally, we comment on the developmental path of lying. The regression results in Table 3 reveal that an elder cohort is 20 percentage points less likely to report "Same" compared to a younger cohort, and this difference is highly significant (p-value < 0.001). The developmental trajectory of lying is also captured by the proportion of "Same" reports in the CONTROL treatment across age cohorts, where older children are significantly less likely to lie than younger ones. In particular, the proportion of "Same" reports drops from 82% among children 4-5 years old to 67% among 7-8 years old, and further down to 41% among 10-11 years old (p-value < 0.001, Cuzick's nonparametric test for trend). The age trend is also present in the DISHONESTY-EMPIRICAL and HONESTY-NORMATIVE treatments (p-values = 0.008, and < 0.001 respectively, Cuzick's nonparametric test for trend). The age trend for the HONESTY-EMPIRICAL is insignificant due to that 4-5 years olds respond to the norm by lying less (p-value = 0.129), but the difference between 7-8 years old and 9-11 years old remains significant (p-value = 0.046, Cuzick's nonparametric test for trend).

Result 4: In our sample, lying significantly decreases with age.

We note that the age pattern of lying may have been affected by our incentivizing procedure. In total, out of 172 children participating in the second wave of data collection, only 5 children said that they did not like the prizes – none among 4-5 years old, 1 among 7-8 years old, and 4 among 10-11 years old. This is reassuring, suggesting the rewards were attractive for all age cohorts. However, we do find a negative age trend in the responses among the remaining 167 children when asked how much they liked the presents. More specifically, the average liking rate over the scale of 1 to 3 drops from 2.95 among 4-5 years old to 2.53

among 7-8 years old, and to 1.95 among 10-11 years old (p-value < 0.001, Kruskal-Wallis test). Given that very few children did not like the prizes, we think it is unlikely that the large decrease of lying over age is completely driven by this difference; however, we cannot rule out that if children liked the prizes equally, the age trend could be attenuated. In any case, the experimental currency we used is constant across the same age cohorts, and thus is irrelevant for the effectiveness of our norm interventions.

4. Discussion and Conclusion

Although the economics literature has extensively investigated lying behavior (see Abeler et al., 2019; Gerlach et al., 2019 for recent meta-analyses), the evidence linking preferences for truth-telling to social norms is inconclusive. We conducted a lab-in-the-field experiment with 567 children, aged four to eleven to study whether children's preferences for truth-telling are influenced by social norms and if so, whether norm sensitivity changes with age. In particular, we examined whether children's lying behavior is conditional on what other children do (empirical information) as opposed to what other children consider is the right thing to do (normative information). We further varied whether the provided information was in the direction of truth-telling or lying.

Our results show that only normative information in the direction of honesty has a significant overall effect on children's truth-telling preferences. Empirical information is only effective during early childhood, and only when the provided information prescribes honesty. Furthermore, while we do find that dishonesty is substantial across all age cohorts, it significantly decreases with age. Our findings suggest that possible policy and educational interventions that try to promote honesty in children would be more effective using normative information, and should come sooner rather than later.

One possibility for the aggregate null effects of the empirical treatments might relate to limited power. We want to emphasize that our sample size compares favourably with the studies examining economic decision making in children. Following the procedure reported in Bindra et al. (2020), we calculated the median and mean sample size of all studies using preschool and older children as subjects based on the survey by Sutter et al. (2019) on economic decision making of children and adolescents. Among the 21 studies we identified, the median (mean) sample size is 177 (316). Given our sample size of 576 children and the "Same" rate of 63% in the CONTROL treatment, we have an 80% power to detect an effect size of at least 0.15 at a 5% level of significance in a sensitivity analysis using a χ^2-test. We thus feel confident

that our sample size is sufficient to detect effects at the aggregate level. However, we suggest a cautious interpretation of our treatment differences when we split the data per age cohort.

Another possibility is that our empirical interventions did not successfully manage to influence children's beliefs about what most others do in the mind game. For instance, Dimant et al. (2020) utilized the same experimental paradigm and investigated the influence of empirical and normative interventions on adults' lying behavior. Dimant et al. (2020) found that none of their manipulations affected lying rates and concluded that, the null effects they observe are due to the norm-based interventions failing to shift individuals' perceptions about the existing norms. Note that in their study neither empirical nor normative information treatments were effective in influencing either perception or behavior. Abeler et al. (2019) using a die-rolling task a la Fischbacher and Föllmi-Heusi (2013), found that, although their empirical norm intervention successfully influenced participants' beliefs, it did not significantly affect subsequent lying behavior. Since we did not measure norm perceptions in our sample, we cannot really answer whether our empirical interventions were simply too soft to influence children's beliefs. We leave this question open for future research.

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Appendix A: Experimental Instructions[12]

1. Experimental Script

[Common to all treatments:]

So, today we are going to play a simple game. In this game you can get some tokens that you can later exchange for these presents (show them the prizes): small stickers, big stickers, and animal-shaped erasers.

Once you earn the tokens in the game you can exchange for presents. The presents are of different prices. The more tokens you get, the more and/or better presents you can take. Do you understand?

(Hand over the die) See what is this? (The child answers.) Do you know the numbers? (Show each side of the die and ask the child.)

Now I want you to roll the die, and write down the number on this piece of paper, see if you can do it. (The child roll the die and write down the number.) Well done! Very good!

Before we start let me first explain how to play this game.

First things first, I want you to think of a number from 1 to 6 and remember it, but this is your secret number and you won't say it, OK? You are the only one that will know the number. I just want you to choose a number from 1 to 6 and remember it.

Then you will be asked to roll this die. You will see what you roll, and write down the number on paper.

After that I will ask you if the number you rolled is the same as your secret number.

If the number you rolled is the same as your secret number, you will get three tokens.

If the number you rolled is different from your secret number, you will get one token.

OK, is that clear? (The child answer: Yes) Let's check if the rules are clear to you.

[Questions in random order, change the numbers and ask more questions until the child answered at least one three-token scenario and one one-token scenario correctly.]

What if your secret number is 1 and you roll a 6? Will you get three tokens or one token?

That is correct! / That is incorrect!

Because the number you rolled is different from your secret number, you will get one token.

What if your secret number is 4 and you roll a 4? How much will you get this time?

That is correct! / That is incorrect!

Because the number you rolled is same as your secret number, you will get three tokens.

Great!

[12] We report instructions in English. Instructions in Chinese are also available upon request.

So, these were the rules of the game. We will play this game only once, and see if you will get one token or three tokens.

[DISHONESTY-EMPIRICAL Only:]

One more thing before we start: I have played this game with other children. Among 10 children of your age, you know what happened? Well, 2 of them rolled the same number as their secret number and got three tokens and 8 them rolled a different number and got one token.

[HONESTY-EMPIRICAL Only:]

One more thing before we start: I have played this game with other children. Among 10 children of your age, you know what happened? Well, 2 of them rolled the same number as their secret number and got three tokens and 8 them rolled a different number and got one token.

[HONESTY-NORMATIVE Only:]

One more thing before we start: I asked 10 other children what is the right thing to do in this game. The majority of them said the right thing to do is, if a child rolled a number which is the same as their Secret Number they should report "Same", if they rolled a number which is different from their Secret Number they should report "Different".

[Common to all treatments:]

Are you ready to start? Great, let's start!

You can now choose your secret number but remember! It is your number and you won't say it.

Are you ready? (The child answers yes.)

Great – now I want you to roll the die and write down the number.

Okay, you get a 1/2/…/6. Is it same or different to your secret number? (The child answers.)

Then this means your prize is three tokens. / That's okay you will still win one token.

[Wave 2 only:]

I would like to find out whether you like the presents for this game. Do you like them?

If Yes: I want you to tell me how much you like them. You can give it "one star", meaning you like them somewhat, "two stars" meaning you like them, "three stars" meaning you like them very much. The more stars you give, the more you like it. Do you understand? Okay, so how much you like these presents?

If No： I want you to tell me how much you dislike them. You can give it "one cross", meaning you dislike them somewhat, "two crosses" meaning you dislike them, "three crosses" meaning you dislike them very much. The more crosses you give, the more you dislike it. Do you understand? Okay, so how much you dislike these presents?

[Common to all treatments:]

Now you can exchange for little presents.

You have one token - each token can be exchanged for two small stickers, so you can pick any two small stickers. Which ones do you like?

/ You have three tokens – each can be exchanged for two small stickers so you can take at most 6 small stickers. Or you can take the big stickers, which costs two tokens, and you can take two small stickers for the remaining one token. Or you can take one animal-shaped eraser, which costs three tokens, so you will not take any stickers. Which ones do you like?

You played this game really well! Thank you.

[Wave 2 CONTROL, DISHONESTY-EMPIRICAL, HONESTY-EMPIRICAL only]

Okay, now you have received your present. I still have some questions for you.

I want you to tell me what is the right thing to do in this game.

If a child rolled a number which is the same as their Secret Number, should they report "same" or "different"?

If a child rolled a number which is different from their Secret Number, should they report "same" or "different"?

[Common to all treatments:]

Now before we finish – may I ask you not to tell other children how to play this game, and how you get the little presents? Let's keep this a secret for now, because I will ask other children to play the game, and I want the game to be a surprise for them as it was for you. Is that ok? Perfect!

2. Photo of Tokens and Prizes

Appendix B Additional Tables

Table B1. Sample size by wave, treatment and age cohort

(b) Wave 1

	4-5 Yrs	7-8 Yrs	10-11 Yrs	Full Sample
CONTROL	47	46	48	141
DISHONESTY-EMPIRICAL	48	44	42	134
HONESTY-EMPIRICAL	43	42	35	120

(b) Wave 2

	4-5 Yrs	7-8 Yrs	10-11 Yrs	Full Sample
CONTROL	3	3	3	9
DISHONESTY-EMPIRICAL	3	3	5	11
HONESTY-EMPIRICAL	5	4	10	19
HONESTY-NORMATIVE	47	47	39	133

Table B2. OLS estimates of aggregate treatment effects

	(1)	(2)
DISHONESTY-EMPIRICAL	0.043	0.038
	(0.057)	(0.055)
HONESTY-EMPIRICAL	-0.022	-0.025
	(0.057)	(0.055)
HONESTY-NORMATIVE	-0.145**	-0.146***
	(0.058)	(0.056)
Age		-0.052***
		(0.008)
Female		0.031
		(0.040)
Incorrect CQ		0.030
		(0.072)
Constant	0.633***	1.039***
	(0.040)	(0.078)
Observations	567	567
R-squared	0.020	0.091

Notes: "Age" is the exact age in years, "Female" is a gender dummy, while "Incorrect CQ" is a dummy for children who had at least one mistake in the control questions.

Table B3. OLS estimates of treatment effects by age cohort

Dependent Variable = 1 if Report "Same"	(1)	(2)
β_1 7-8 Yrs	-0.147	-0.149
	(0.094)	(0.094)
β_2 10-11 Yrs	-0.408***	-0.408***
	(0.093)	(0.093)
β_3 DISHONESTY-EMPIRICAL	-0.016	-0.016
	(0.093)	(0.093)
β_4 DISHONESTY-EMPIRICAL * 7-8 Yrs	0.002	0.002
	(0.133)	(0.134)
β_5 DISHONESTY-EMPIRICAL * 10-11 Yrs	0.158	0.159
	(0.133)	(0.133)
β_6 HONESTY-EMPIRICAL	-0.174*	-0.176*
	(0.095)	(0.095)
β_7 HONESTY-EMPIRICAL * 7-8 Yrs	0.196	0.198
	(0.135)	(0.135)
β_8 HONESTY-EMPIRICAL * 10-11 Yrs	0.251*	0.255*
	(0.135)	(0.135)
β_9 HONESTY-NORMATIVE	-0.097	-0.098
	(0.095)	(0.095)
β_{10} HONESTY-NORMATIVE * 7-8 Yrs	-0.151	-0.148
	(0.135)	(0.136)
β_{11} HONESTY-NORMATIVE * 10-11 Yrs	-0.033	-0.031
	(0.138)	(0.138)
Female		0.030
		(0.040)
Incorrect CQ		0.032
		(0.072)
Constant	0.820***	0.803***
	(0.066)	(0.069)
Observations	567	567
R-squared	0.104	0.106

Notes: We estimate a fully saturated model, which include dummy indicators of all treatments, age cohorts and the interactions between treatments and cohorts, using OLS. The coefficients of interaction terms test whether children of different cohorts are affected differently by the norm treatments. The effects of DISHONESTY-EMPIRICAL are given by β_3, $\beta_3 + \beta_4$ and $\beta_3 + \beta_5$ for 4-5 years old, 7-8 years old and 10-11 years old, respectively. Analogously, β_6, $\beta_6 + \beta_7$, $\beta_6 + \beta_8$ give the effects of HONESTY-EMPIRICAL, and β_9, $\beta_9 + \beta_{10}$, $\beta_9 + \beta_{11}$ give the effects of HONESTY-NORMATIVE on the three age cohorts. The cohort-specific treatment effects from column (2) are plotted in Figure 2. "Female" is a gender dummy, while "Incorrect CQ" is a dummy for children who had at least one mistake in the control questions.

Table B4. Within age cohort treatment comparison using Fisher's exact test

	4-5 Yrs	7-8 Yrs	10-11 Yrs
DISHONESTY-EMPIRICAL	1.000	1.000	0.225
HONESTY-EMPIRICAL	0.068	0.829	0.538
HONESTY-NORMATIVE	0.333	0.023	0.267

Notes: Proportion of "Same" reports are compared between the CONTROL and each norm treatment of the same age cohort. The reported numbers are p-values.

Table B5. OLS estimates of treatment effects interacted with exact age

Dependent Variable = 1 if Report "Same"	(1)	(2)
DISHONESTY-EMPIRICAL	-0.029	-0.030
	(0.083)	(0.083)
HONESTY-EMPIRICAL	-0.147*	-0.150*
	(0.084)	(0.084)
HONESTY-NORMATIVE	-0.119	-0.120
	(0.086)	(0.086)
Age	-0.067***	-0.067***
	(0.015)	(0.015)
DISHONESTY-EMPIRICAL * Age	0.023	0.024
	(0.022)	(0.022)
HONESTY-EMPIRICAL * Age	0.043*	0.043*
	(0.022)	(0.022)
HONESTY-NORMATIVE * Age	-0.010	-0.009
	(0.023)	(0.023)
Female		0.032
		(0.039)
Incorrect CQ		0.036
		(0.071)
Constant	0.827	0.809
	(0.059)	(0.062)
Observations	567	567
R-squared	0.100	0.102

Notes: "Age" is the exact age in years, subtracted by the median age (5.22) of the youngest cohort, 4-5 years old, so that the coefficients of the three treatment dummies can be interpreted as the treatment effect for this cohort. "Female" is a gender dummy, while "Incorrect CQ" is a dummy for children who had at least one mistake in the control questions.