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RESEARCH ARTICLE

# Subtle alterations of the physical environment can nudge young children to cheat less

Li Zhao[1] | Yi Zheng[1] | Brian J. Compton[2] | Wen Qin[1] | Wenjin Sun[1,3] | Fang Fang[4,5,6] | Genyue Fu[1] | Gail D. Heyman[2] | Kang Lee[3]

[1] Department of Psychology, Hangzhou Normal University, Hangzhou, China

[2] Department of Psychology, University of California, San Diego, USA

[3] Dr Eric Jackman Institute of Child Study, University of Toronto, Toronto, Canada

[4] School of Psychological and Cognitive Sciences and Beijing Key Laboratory of Behavior and Mental Health, Peking University, Beijing, China

[5] Peking-Tsinghua Center for Life Sciences, Peking University, Beijing, China

[6] IDG/McGovern Institute for Brain Research, Peking University, Beijing, China

**Correspondence**
Li Zhao, Department of Psychology, Hangzhou Normal University, No. 2318 Yuhangtang Rd, Yuhang District, Hangzhou 311121, PR China (email: zhaoli@hznu.edu.cn), Fang Fang, School of Psychological and Cognitive Sciences and Beijing Key Laboratory of Behavior and Mental Health, Peking University, No.5 Yiheyuan Rd, Haidian District, Beijing 100871, PR China (email: ffang@pku.edu.cn), or Kang Lee, Dr. Eric Jackman Institute of Child Study, University of Toronto, 45 Walmer Rd., Toronto, Ontario M5R 2X2, Canada (email: kang.lee@utoronto.ca).

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## Abstract

Cheating is a common human behavior but few studies have examined its emergence during early childhood. In three preregistered studies, a challenging math test was administered to 5- to 6-year-old children (total $N$ = 500; 255 girls). An answer key was present as children completed the test, but they were instructed to not peek at it. In Study 1, many children cheated, but manipulations that reduced the answer key's accessibility in terms of proximity and visibility led to less cheating. Two follow-up studies showed that the answer key's visibility played a more significant role than its proximity. These findings suggest that subtle and seemingly insignificant alterations of the physical environment can effectively nudge young children away from acting dishonestly.

KEYWORDS
accessibility, cheating, nudge, proximity, visibility, young children

## 1 | SUBTLE ALTERATIONS OF THE PHYSICAL ENVIRONMENT CAN NUDGE YOUNG CHILDREN TO CHEAT LESS

Cheating is a ubiquitous human behavior. It occurs in all spheres of human life, including politics, commerce, relationships, and education. It can have pernicious consequences at the individual, institutional, and societal levels. Understanding the developmental origins of cheating behavior in early childhood could shed light on the nature of children's moral decision-making, and it could be used to inform interventions aimed at preventing cheating in early childhood, before this behavior is normalized. The present study addresses this issue by investigating how seemingly insignificant physical environmental cues can influence young children's decisions to cheat.

  

### 1.1 | Research on cheating

The earliest scientific studies on cheating (e.g., Hartshorne & May, 1928; Voelker, 1921) were motivated by theoretical work positing that honesty is a function of the individual's moral character; therefore children who are dishonest can be expected to cheat consistently across situations (Darley, 1992; Hall, 1904, 1921; Nucci & Narvaez, 2008; see Tsang, 2002). However, evidence of the predicted cross-situational consistency in moral behavior never materialized, and interventions such as moral preaching that are based on this work are largely ineffective (see Cizek, 1999; McCabe et al., 2001). This failure led to a Doctrine of Specificity Theory (Hartshorne & May, 1928; see Burton, 1963), which describes dishonesty as primarily driven by situational factors. However, because the early proponents of this theory did not clearly identify the situational factors that influence dishonesty, it has had little influence on the subsequent empirical research on the development of cheating and has had minimal impact on interventions to reduce cheating.

**E EA C**

- We examined how subtle physical environmental cues, in the absence of overtly social cues, can influence young children's cheating in a test-taking context.
- Children took a challenging math test and were instructed to not peek at an answer key that was present as they completed the test.
- Manipulations reducing the answer key's accessibility in terms of proximity and visibility led to less cheating, and visibility played a more significant role than proximity.
- Seemingly insignificant physical environmental cues can have a significant impact on children's cheating, and subtly altering the physical environment can nudge them to act honestly.

### 1.2 | Nudges and accessibility

Recent advances in behavioral economics inspired by nudge theory (Thaler & Sunstein, 2008) offer a theoretical and methodological basis for identifying situational factors that can either foster or discourage honest behavior. Nudge research with adults has revealed that subtle and seemingly insignificant changes in the environment can influence behavior in a predictable manner that still maintains freedom of choice. As compared to traditional behavioral interventions, nudges tend to require less effort and cost, and can have longer-lasting effects (Thaler & Sunstein, 2008).

Accessibility, which refers to the ease with which the target of a nudge can be accessed in the environment, has been found to be one of the most important situational cues to engender behavioral changes (Cole et al., 2021; Rozin et al., 2011; Wansink et al., 2006). Targets of nudges can be made less accessible by decreasing their proximity or visibility. In a study of candy consumption among university staff members, Wansink et al. (2006) manipulated proximity by placing candies directly on the participant's desk or two meters away from the desk, and manipulated visibility by placing them in a covered bowl that was either transparent or opaque. Reducing either type of accessibility, proximity or visibility, led to reduced candy consumption. Similar accessibility nudges have been found to influence a wide range of behaviors, including those relating to personal health, financial decisions, and political participation (Coucke et al., 2019; Eves et al., 2009; Painter et al., 2002; Rozin et al., 2011; Vandenbroele et al., 2021; Winkler et al., 2018; see Kremers et al., 2012). However, very little is known about the effectiveness of accessibility nudges in childhood.

### 1.3 | The present research

The present research examined the impact of accessibility nudges on children's cheating, across three preregistered studies. We used a test-taking paradigm (see Zhao et al., 2020, 2021) in which 5- to 6-year-old children were tested individually on a challenging math test (Figure 1). Participants were tempted to use a nearby answer key to cheat when the experimenter was out of the room . Whether the child cheated, which was recorded by a hidden camera, served as the primary dependent measure.

We systematically manipulated accessibility to determine its effects on cheating. In Study 1, we altered the distance between the table where the child sat and the table that held the answer key (Figure 2). We expected to observe an accessibility nudge effect in which the cheating rate would decrease with increased inter-table distance due to the reduction in children's proximity to the answer key, and the visibility of the answers. In each of two follow-up studies we separately examined the unique effects of proximity and visibility.

## 2 | STUDY 1

### 2.1 | Method

The research was approved by the Scientific Research Ethics Committee of Hangzhou Normal University. Informed consent was obtained for all children's participation from their parents or legal guardians.

#### 2.1.1 | Participants

This study was preregistered (https://aspredicted.org/c6rb6.pdf). We predetermined the sample size per condition based on Zhao et al. (2020), which used a related methodology. Power analyses with an estimated cheating rate of 54% for the baseline condition and 26% for each experimental condition suggested that a sample size of 47 would be sufficient for detecting a condition effect, with a power of 0.80, an alpha at 0.05, and an enrolment ratio of 1. Based on this analysis, we

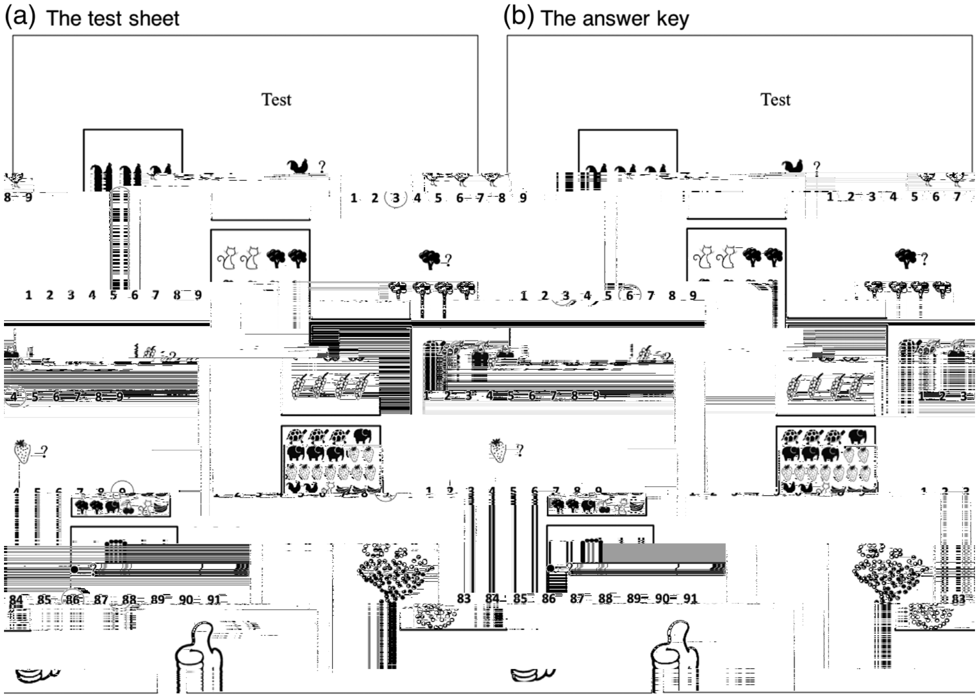


**FIGURE 1** The test sheet that children completed (a), and the answer key (b). The test sheet consisted of five problems, each of which required the child to report the number of a target item (e.g., roosters) by circling the correct answer from a set of nine possible response options. The answer key was identical to the test sheet except that the correct response to each problem had been circled

**FIGURE 2** A child model demonstrates the four conditions of Study 1, the two conditions of Study 2a, and the two conditions of Study 2b. In Study 1, the answer key was the same size as the child's test sheet, and the inter-table distance was 0.6 m, 1 m, 2 m, and 3 m in the four conditions, respectively. In Study 2a the answer key was enlarged to 200% of its original size, and in Study 2b it was reduced to 25% of its original size. In Studies 2a and 2b, the inter-table distance was either 0.6 m or 1 m

decided to use a sample size of 50 per condition, considering the possible subject attribution.

We tested a total of 200 5- to 6-year-olds, with 50 in the 0.6 m condition (mean age = 70.92 months, *SD* = 3.32 months, range = 64.77–77.23; 25 boys), 50 in the 1 m condition (mean age = 70.72 months, *SD* = 3.13 months, range = 65.42–77.36; 25 boys), 50 in the 2 m condition (mean age = 71.16 months, *SD* = 3.22 months, range = 66.31–77.39; 25 boys), and 50 in the 3 m condition (mean age = 70.95 months, *SD* = 3.72 months, range = 64.31–76.24; 25 boys).

Participants were recruited from two kindergartens located in Eastern China and all were Han Chinese. They were from middle class families with almost all children's parents having at least a high school education. Typical parental professions were civil servants, teachers, merchants, and employees of local technology companies. Children attended kindergartens that were designed to prepare them to transition to the formal educational system after 6 years of age. In these kindergartens they receive training in academics, and also engage in play-based learning.

All children passed a set of three comprehension checks (see below), and thus none were excluded.

#### 2.1.2 | Testing room and materials

Children were seen individually in a quiet room in their kindergarten. The room contained two identical tables measuring 0.6 meters long by 0.6 meters wide. Children took a math test while seated at a table that had a digital countdown timer on it (see Figure 2). A second table was placed to the child's left, and it held the answer key.

The distance between the two tables served as the key independent variable (see Figure 2). The names of the four conditions, *0.6 m, 1 m, 2 m*, and *3 m*, specify the inter-table distance.

According to pilot testing ($N = 25$), when children were seated, they were able to easily see the correct answers on the answer key at an inter-table distance 0.6 meters, without having to leave their seat. However, at an inter-table distance of 1 meter they had difficulty seeing the answers.

The math test was modeled after a naturalistic paradigm that was designed to elicit spontaneous cheating. This paradigm has been used in many studies with older children and adults (e.g., Hartshorne & May, 1928; see Cizek, 1999), and it has recently been successfully adapted for use with young children (Zhao et al., 2020, 2021). It should be noted that it is common for teachers in China to leave an answer key near where children are taking tests because they often use it to grade completed tests whilst other students are still finishing.

The math test consisted of five problems involving counting, each accompanied by a set of shapes. The task was to count all the shapes of a target type and circle the correct answer from a set of nine possible response options (see Figure 1a). The tests used in the study were designed to be highly similar to the kinds of tests children see in their classroom, and the four easy problems were designed in consultation with teachers to be ones that all participants would be able to correctly answer with ease. It should be noted that the children in our sample were routinely tested on multiple academic skills. This is because these kindergartens, like others in China, are mandated to prepare children for a smooth transition to elementary school. One of the skills children are taught and tested on is counting. As expected, all children who were pilot tested had no difficulty completing the four easy problems correctly, and the ease of these problems was further confirmed by the fact that all children participating in the formal study answered these four questions correctly without cheating within the allotted time limit. This contrasts with the final problem, which was designed to be very difficult, and which none of the children who were pilot tested answered correctly.

The answer key was identical to the test sheet except that the correct response to each problem had been circled (see Figure 1b).

#### 2.1.3 | Procedure

Each child was tested individually by a female experimenter. The entire session was video recorded using a hidden camera. At the beginning of the session, the experimenter told children that they would be taking a test with five problems that they should try to solve in a limited amount of time, and that she would like to see whether they could solve all of them correctly. The experimenter first gave children three practice problems as an introduction to the types of problems they would be seeing during the test. The practice problems were also used to verify that all children had the necessary counting skills to complete the four simple problems. No child failed this task.

In the next phase, the experimenter presented the test sheet and explained, "Now it's time for you to take the test. You will have up to five minutes to finish it. Here is a clock [indicating the countdown clock] that will show you how much time is left for you to work on the test. It will sound an alarm when the time runs out. Your test cannot be scored if you don't finish on time." After giving these instructions, she made an excuse to leave the room and said, "Sorry, I just remembered that I need go to a nearby room to deal with an emergency. I will not be able to come back for five minutes. While I am away, you should try to solve the problems by yourself. When you are done, you should leave your test sheet on your table and find me in the nearby room. Make sure that you finish the test before the time runs out. Please come to the next room to get me when the five minutes are up." She also added, "I am putting an answer key on this table. There is someone who will come here later, after you leave, to score your test and see if you have answered all the problems correctly. Remember: don't peek at the answer key."

The experimenter then placed the answer key on the second table and left the room. Before she left, she asked the following questions as comprehension checks: (1) *How much time do you have to finish the test?* (2) *When you are done what should you do?* (3) *What will happen if you don't finish the test within five minutes?* All children answered these questions correctly.

The experimenter started the timer and exited the room. As instructed, each child finished the test within the allotted 5-min period and then retrieved the experimenter from the nearby room. Next, the children were taken back to their classrooms. All children were debriefed after the completion of the study.

#### 2.1.4 | Dependent measures

In accordance with the preregistration of Study 1, the categorical variable *cheating occurrence* served as the primary dependent measure. It was operationally defined as children acting against the experimenter's instruction not to look at the answer key by peeking at it and copying the answer from it during the experimenter's absence. Two research assistants who were blind to the study hypothesis independently coded cheating occurrence based on the video recordings taken by the hidden camera. All instances of apparent cheating were further confirmed by ensuring that the child's answer to the exceptionally difficult problem

 

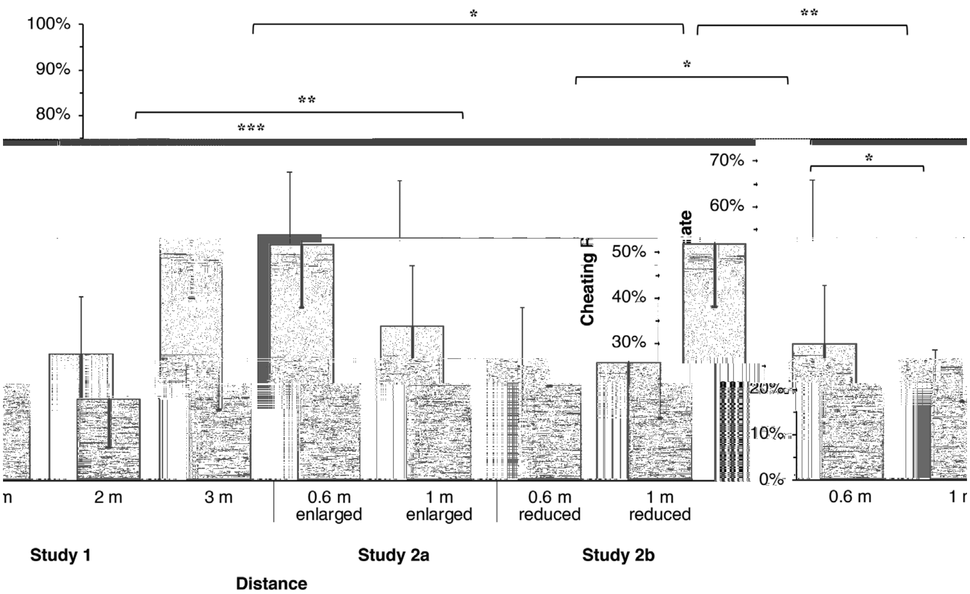


FIGURE 3 Cheating rates in Studies 1, 2a, and 2b. Note: *$p < 0.05$; **$p < 0.01$; ***$p < 0.001$; error bars: 95% CI

matched the corresponding answer on the answer key. The inter-coder reliability was 100%.

A review of the videos indicated differences between conditions in the way children carried out the act of cheating. To capture this difference, we also coded for a second categorical variable, *cheating behavior*. Specifically, for the children who cheated, the two research assistants also coded how they cheated into two categories: *cheating while sitting* (i.e., peeking at the answer key while sitting down), and *cheating while standing* (i.e., standing up and/or stepping towards the answer key to peek at it). The inter-coder reliability was also 100% for this measure. (See the online supplemental materials for additional methodological details and analyses from Study 1.)

## 2.2 | Results

Preliminary analyses of the data from this study and the subsequent studies yielded no significant main effects or interactions involving age (measured in months) or gender (all *ps* > 0.10), so the data was combined for these two factors for all subsequent analyses.

### 2.2.1 | Cheating occurrence

There was a marked difference in cheating rates when the inter-table distance increased from 0.6 meters to 1 meter and beyond. As shown in Figure 3, the cheating rate was 52% in the 0.6 m condition, as compared to 30% in the 1 m condition, 18% in the 2 m condition, and 28% in the 3 m condition. To confirm this effect, we conducted a binary logistic regression analysis (SPSS Version 25), with cheating occurrence (0 = no cheating, 1 = cheating) as the predicted variable, and condition as the predictor (0 = 0.6 m, 1 = 1 m, 2 = 2 m, 3 = 3 m). The model was significant, $\chi^2$ (3, $N$ = 200) = 13.99, $p$ = 0.003, Nagelkerke $R^2$ = 0.10, and the condition effect was also significant (*Wald* = 13.34, *df* = 3, $p = 0.004$).

A priori comparisons using the 0.6 m condition as reference revealed that the cheating rates in the 1 m, 2 m, 3 m conditions were all significantly lower than the rate in the 0.6 m condition (52%, 30%, 18% and 28%, for the 0.6 m, 1 m, 2 m, and 3 m conditions, respectively; $\beta = -0.93$, $-1.60$, and $-1.03$, SE $\beta$ = 0.42, 0.46, and 0.42, *Wald* = 4.90, 11.82, and 5.85, *df* = 1, 1, and 1, $p$ = 0.027, 0.001, and 0.016, *odds ratio* = 0.40, 0.20, and 0.36, 95% *CI* = 0.17 to 0.90, 0.08 to 0.50, and 0.16 to 0.82, for comparisons of the 1 m, 2 m and 3 m conditions with the 0.6 m condition, respectively). Follow-up comparisons showed that there were no significant differences in cheating rates between any two of the 1 m, 2 m and 3 m conditions (*ps* > 0.10).

These results showed that the cheating rate increased significantly from the 0.6 m condition to the 1 m condition, but it did not differ significantly at greater distances. This finding not only supports our hypothesis that reducing the accessibility of the answer key can reduce cheating, but it also suggests that the relation between the distance and that the cheating rate is not linear.

### 2.2.2 | Cheating behavior

As shown in Figure 4, 69.2% of the children who cheated in the 0.6 m condition were classified as *cheating while standing*, and this rate was 80% in the 1 m condition, and 100% in the 2 m and 3 m conditions. Because a logistic model failed to converge, we conducted a chi-squared analysis and found a significant condition effect, $\chi^2$ (3, $N$ = 64) = 8.23, $p$ = 0.042), suggesting that children were more likely to cheat by standing up and/or stepping towards the answer key when the inter-table distance was 1 meter or more.

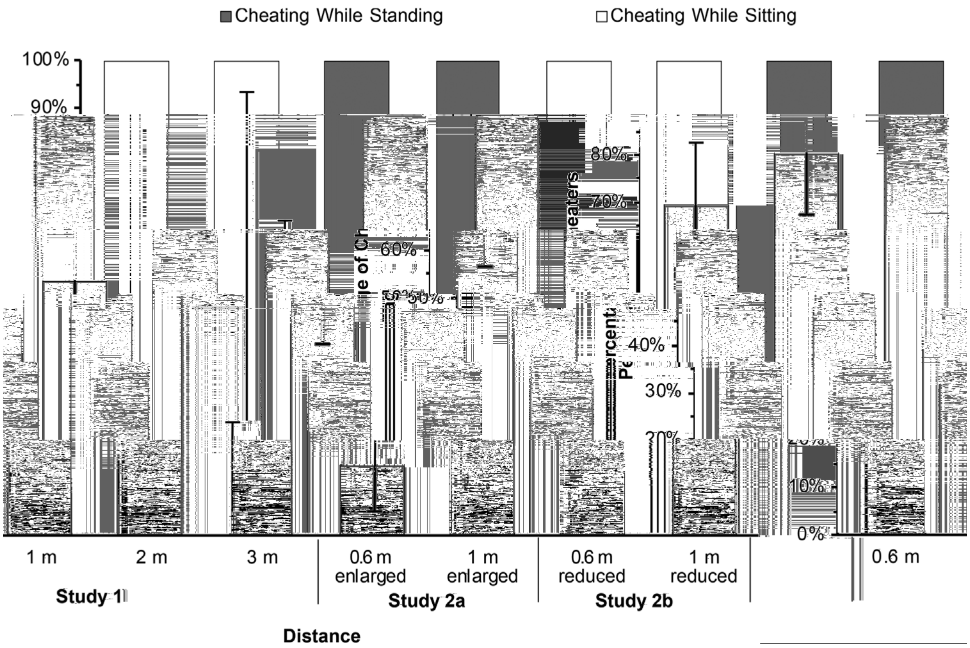


FIGURE 4 The percentage of cheaters in each condition of Studies 1, 2a, and 2b who were classified as cheating while standing, or cheating while sitting. Error bars: 95% CI.

## 2.3 | Study 1 discussion

Study 1 revealed a significant accessibility nudge effect. Further, the cheating rate seemed to drop off abruptly after 0.6 meters. This drop may be because children could not see the answer key while sitting down at inter-table distances of 1 meter or more. This visibility hypothesis was partially supported by how children cheated: when the inter-table distance was 0.6 meters, 69.2% cheated by standing up and/or stepping towards the answer key to peek at it, compared to 80–100% when it was 1 meter or more.

To test this visibility hypothesis, the following two preregistered studies were designed to disentangle the effects of proximity and visibility. In Study 2, we included two proximity conditions (the answer key being either 0.6 meters or 1 meter away) while keeping the answer key either highly visible (Study 2a) or difficult to see (Study 2b). This allowed us to examine the effects of proximity while holding the answer key's visibility constant. In Study 3, we tested the effects of the answer key visibility while holding its proximity constant.

# 3 | STUDY 2A

In Study 2a, we increased the visibility of the answer key by enlarging it to 200% of its original size so that children could easily see the correct answers without leaving their seat in both a 0.6 m condition and a 1 m condition (Figure 2). We hypothesized that if the proximity of the answer key was responsible for the accessibility nudge effect in Study 1, children should cheat more in the 0.6 m condition than in the 1 m condition. In contrast, according to the visibility hypothesis there should be no significant differences in cheating rates between these conditions because the answer key is readily visible in both conditions.

## 3.1 | Method

### 3.1.1 | Participants

Study 2a was preregistered. As in Study 1, we predetermined a sample size of 50 for each of the two conditions. Following the preregistration (https://aspredicted.org/n6r8v.pdf), we tested a new sample of 100 5- to 6-year-olds, with 50 in the 0.6 m enlarged condition (mean age = 69.96 months, SD = 4.84 months, range = 62.76–78.18; 25 boys) and 50 in the 1 m enlarged condition (mean age = 69.55 months, *SD* = 5.26 months, range = 62.60–81.30; 25 boys). Children were recruited from the same kindergartens, and none had previously participated in Study 1. All children were Han Chinese with a socioeco-

We also used an enlarged version of the answer key for both conditions, with the answer key increased to 200% of the original size. This size was determined following pilot testing with 22 5- to 6-year-old children who did not participate in Study 2a. We instructed these children to look at the enlarged answer key when the inter-table distance was 1 meter. We found that by enlarging the answer key to 200% of its original size, all children were able to clearly identify the answers on the answer key without having to leave their seats.

#### 3.1.3 | Procedure

The procedure was identical to that of Study 1, with the exception of an additional post-experimental session the next day. This session served as a manipulation check to ensure that children could clearly see the correct answer to the final question on the enlarged answer key from a distance of 1 meter without leaving their seat. In this post-experimental test, children were again seen individually in the testing room. They sat at the same table where they had taken the test, and an enlarged answer key was placed on the second table, 1 meter away. This key was the answer key for a different test that also consisted of five questions, and it was of the same size as the one used during the experimental session. The children were asked to read out the correct answers on the answer key, which all participants were able to do.

#### 3.1.4 | Dependent measures

The dependent measures were identical to those of Study 1. The same two research assistants who were blind to the study hypotheses independently coded the two dependent variables. The inter-coder reliability for both measures was 100%.

### 3.2 | Results

#### 3.2.1 | Cheating occurrence

As shown in Figure 3, 54% of the children cheated in the 0.6 m enlarged condition, as compared to 52% of children in the 1 m enlarged condition. Because a logistic model failed to converge, we conducted a chi-squared analysis to test the condition effect. As is consistent with our hypothesis, the cheating rates in the two enlarged conditions did not differ from each other ($\chi^2$ (1, $N$ = 100) = 0.04, $p$ = 0.841). This result supports the interpretation that the visibility of the answer key was driving the accessibility nudge effect observed in Study 1.

#### 3.2.2 | Cheating behavior

Figure 4 shows that 14.8% of children who cheated left their seat and stepped towards the answer key in the 0.6 m enlarged condition, as compared to 53.8% in the 1 m enlarged condition. A binary logistic regression analysis, with cheating behavior (0 = cheating while sitting, 1 = cheating while standing) as the predicted variable and condition as the predictor (0 = 0.6 m enlarged, 1 = 1 m enlarged) revealed a significant condition effect, $\chi^2$ (1, $N$ = 53) = 9.38, $p$ = 0.002, Nagelkerke $R^2$ = 0.23 ($\beta$ = 1.90, SE $\beta$ = 0.67, *Wald* = 8.08, *df* = 1, $p$ = 0.004, *odds ratio* = 6.71, 95% *CI* = 1.81 to 24.92). Thus, even though the answer key was readily visible to children in both conditions, they cheated in different ways: they were significantly more likely to stand up and/or step towards the answer key to peek at it in the 1 m enlarged condition than in the 0.6 m enlarged condition. They did so in order to get closer to the answer key to verify the answers, even though the post-experimental test revealed that no child had difficulty reading the answers from the answer key while remaining seated. This finding was not consistent with the visibility hypothesis.

## 4 | STUDY 2B

In Study 2b, we reduced the answer key to 25% of its original size such that it was not possible for children to see the correct answers from their seat in either a 0.6 m reduced condition or a 1 m reduced condition (Figure 2). We hypothesized that if proximity was responsible for the accessibility nudge effect in Study 1, children should cheat more in the 0.6 m condition than in the 1 m condition. However, if the visibility hypothesis were true, they should cheat in the two conditions equally.

### 4.1 | Method

#### 4.1.1 | Participants

This study was preregistered with a sample size of 50 for each condition as predetermined for Studies 1 and 2. Following the preregistration (https://aspredicted.org/up9av.pdf for the 0.6 m reduced condition and https://aspredicted.org/ij3i3.pdf for the 1 m reduced condition), we tested a new sample of 100 5- to 6-year-olds, with 50 in the 0.6 m reduced condition (mean age = 67.32 months, $SD$ = 4.27 months, range = 61.51–78.25; 22 boys) and 50 in the 1 m reduced condition (mean age = 67.60 months, $SD$ = 2.70 months, range = 62.43–72.43; 25 boys). Children were recruited from the same kindergartens, and none had participated in the previous studies. All participants were Han Chinese with a socioeconomic status of middle class. All passed the comprehension check questions, and thus there were no exclusions.

#### 4.1.2 | Materials

The materials for Study 2b were identical to those of Study 2a except that in each condition we used an answer key that was only 25% of the size in Study 1. As in Study 2a, the size of the reduced answer key was determined following the results of pilot testing, which was conducted with a group 26 5- to 6-year-old children who did not participate in any of the other studies reported here. They were instructed to look

## 5.2 | Results

### 5.2.1 | Cheating occurrence

We found that 22% of children cheated in the 2 m enlarged table condition, compared to 54% in the 2 m enlarged floor condition. We conducted a logistic regression analysis with cheating occurrence entered as the predicted variable, and condition as the only predictor. The model was significant, $\chi^2$ (1, $N$ = 100) = 11.13, $p$ = 0.001, Nagelkerke $R^2$ = 0.14. The condition effect was also significant ($\beta$ = 1.43, SE $\beta$ = 0.44, *Wald* = 10.32, *df* = 1, $p$ = 0.001, *odds ratio* = 4.16, 95% *CI* = 1.74–9.94). Thus, when we held the inter-table distance constant, keeping the proximity of the answer key to the child constant, children were more likely to cheat in the 2 m enlarged floor condition than in the 2 m enlarged table condition, which supports the visibility hypothesis.

### 5.2.2 | Cheating behavior

We found that 100% of the cheaters stood up and/or stepped towards the answer key to peek at it in the 2 m enlarged table condition, as compared to 29.6% in the 2 m enlarged floor condition. Because the logistic regression model failed to converge, we conducted a chi-squared analysis. It revealed a significant condition effect ($\chi^2$ (1, $N$ = 38) = 12.80, $p < 0.001$, with Yates' correction), which supports the visibility hypothesis.

## 5.3 | Study 3 discussion

The results of Study 3 support the visibility hypothesis that the answer key visibility significantly affected children's decision to cheat as well as the manner in which they cheated.

# 6 | GENERAL DISCUSSION

In the present research, we investigated whether subtle environmental nudges are able to influence young children's cheating behavior by systematically manipulating the accessibility of a target of cheating in terms of its visibility and proximity.

Study 1 documented an accessibility nudge effect, in which cheating significantly decreased as the inter-table distance increased from 0.6 meters to 1 meter or greater. Follow-up studies revealed that the visibility of the answer key played a greater role than proximity in explaining the effect. This was the case in Studies 2a and 2b in which we varied proximity while controlling for visibility, and in Study 3 in which we varied visibility while keeping proximity constant. Visibility also played a more important role than proximity in influencing how children cheated: children were more likely to cheat while remaining seated when visibility was high.

Why did the visibility of the answer key affect children's decision to cheat? One possibility is that the salience of a highly visible answer key leads to increased temptation. Another is that it makes cheating less effortful. A third possibility is that children may infer that they have a low probability of being caught when they can cheat while remaining seated. Future research will be needed to assess the specific roles of temptation, effort, and perceived likelihood of being caught in children's decision-making about cheating.

The current findings build on previous evidence that various forms of nudges can influence moral behavior (e.g., Bryan et al., 2014; Evans et al., 2018; Fu et al., 2016; Heyman et al., 2015; Lee et al., 2014; Zhao et al., 2017, 2018). Most of the approaches used in prior research have been explicit and overtly social. Even the physical environmental nudges that were tested by Zhao et al. (2020, 2021), such as having an adult place a conspicuous physical or symbolic barrier between the child and the target of cheating, are likely to be viewed as social signaling. The present research shows that subtle physical environmental manipulations alone can also function as effective honesty nudges, even in the absence of any social communicative cues.

Our findings, as well as those of other studies of nudges (e.g., Fu et al., 2016; Heyman et al., 2015), support Hartshorne and May's (1928) Doctrine of Specificity Theory by documenting the influence of external situational factors on children's cheating decisions. Indeed, when such factors are conducive to cheating, cheating rates can be as high as 90% (e.g., Fu et al., 2016), but when they are not conductive to cheating, cheating rates can be as low as 20% (e.g., the present research; Zhao et al., 2020). Furthermore, this body of work has delineated exactly which situational factors encourage cheating (e.g., the presence of a physical reward, Kotaman, 2016; ability praise, Zhao et al., 2017), and which situational factors discourage it (e.g., physical or symbolic barriers, Zhao et al., 2020, 2021; low visibility of the target of cheating, in the present research). These discoveries provide important theoretical insights about the development of dishonesty, and lay an empirical foundation for developing effective interventions to prevent cheating in early childhood.

The present research has several limitations. First, in Study 3, to test our hypotheses, we increased the answer sheet size by 800%, and this large size might have made the situation seem odd to children. Future studies with more naturalistic designs are thus needed. Second, the present studies only tested 5- to 6-year-olds, and it is important to use cross-sectional or longitudinal designs with younger and older children to test for age-related changes in these tendencies. Third, the present studies did not assess children's moral judgments, motivations to cheat, social-cognitive abilities or math ability (e.g., O'Connor & Evans, 2019). Assessment of these variables are critical for understanding the mechanisms underlying the effects we observed.

In summary, cheating is a widespread problem, and it is of great theoretical and practical importance to delineate the factors that influence its emergence during childhood. Across three studies, we found that accessibility nudges can systematically affect cheating behavior, and that visibility as an accessibility nudge plays a more important role than proximity. These findings suggest that subtle and seemingly insignificant physical environmental cues can significantly influence children's cheating, and that altering these cues is a promising strategy to nudge children to act honestly.