The moral barrier effect: Real and imagined barriers can reduce cheating

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This research presents a nudge-based approach to promoting honest behavior. Specifically, we introduce the moral barrier hypothesis, which posits that moral violations can be inhibited by the introduction of spatial boundaries, including ones that do not physically impede the act of transgressing. We found that, as compared to a no barrier condition, children cheated significantly less often when a barrier was strategically placed to divide the space where children were seated from a place that was associated with cheating. This effect was seen both when the barrier took a physical form and when it was purely symbolic. However, the mere presence of a barrier did not reduce cheating: if it failed to separate children from a space that was associated with cheating, children cheated as much as when there was no barrier at all. Taken together, these findings support the moral barrier hypothesis and show that even seemingly unremarkable features of children's environments can nudge them to act honestly.

cheating | nudge | moral behavior | barriers | young children

One fundamental psychological insight is that seemingly unremarkable features of the environment, commonly referred to as nudges, can influence behavior (1). This insight is powerful because it suggests that subtle interventions can be used to engineer desired behavioral outcomes, as well as help researchers to understand the psychological processes that drive behavioral decision making (2, 3). Here we investigate the application of this insight to the problem of dishonesty, which erodes the trust that underlies strong relationships and institutions (4, 5). We address this issue by examining whether environmental cues have the potential to reduce children's dishonest behavior in the absence of any overt social cues. Specifically, we introduce the moral barrier hypothesis, which posits that moral violations can be inhibited by the introduction of spatial boundaries, including ones that do not physically impede the act of transgressing. This hypothesis is based on the assumption that introducing dividers between the self and a location associated with a transgression can provide environmental support for moral behavior.

We used academic cheating as a test case for the moral barrier hypothesis. Specifically, we examined whether introducing a nonoccluding barrier that divided the space between where children sat and an answer key to a test they were taking would lead to a reduction in cheating. Such an approach differs significantly from prior interventions that have been overtly social in nature. One such intervention involves asking adults to write down the Ten Commandments (6). A range of approaches have been found to be effective for children as well. These include eliciting a verbal commitment to not cheat (7, 8), as well as reputation-based manipulations, such as telling children they have a reputation for being good (9), or assigning someone to observe their behavior (10–12). In contrast to these prior interventions, the present study seeks to determine whether it is possible to prevent cheating in a more subtle way, by manipulating features of the physical environment only.

We conducted four preregistered experiments to evaluate the moral barrier hypothesis among a group of 5- to 6-y-olds. In all experiments, children were seen individually and took a timed counting test comprised of four easy problems followed by a fifth problem that was so difficult it could not be completed within the allotted time. After introducing the task, the experimenter left the room, thereby giving children an opportunity to peek at an answer key on a nearby table without leaving their seat. Before leaving, the experimenter told children not to peek at the answer key.

In experiment 1, each child was assigned to one of three conditions (see Fig. 1 for a photo illustration of all conditions). In the no frame control condition (Fig. 1*A*), no barrier was present, and the goal was to establish a baseline cheating rate. In the frame with transparent film condition (Fig. 1*B*), a barrier in the form of a metal frame covered by a transparent plastic sheet was located between where the child sat and where the answer key was located. This barrier served to divide the space between the child and the answer key, but without reducing its visibility. Our aim was to determine whether such a barrier is sufficient to reduce cheating. The frame condition (Fig. 1*C*) was identical to the frame with transparent film condition except that we removed the transparent plastic sheet, leaving only the metal frame, to see whether an even weaker physical barrier could reduce cheating. The moral barrier hypothesis predicts that children will cheat less in both of these frame conditions than in the no frame control

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Significance

Dishonest behavior undermines the trust that is required for strong relationships and institutions. The present study offers an approach to discouraging dishonesty that involves a subtle environmental intervention. Specifically, we test the moral barrier hypothesis, which posits that moral violations can be inhibited by the introduction of spatial boundaries, including ones that do not physically impede the act of transgressing. We found that both real and imagined barriers, when placed strategically, were able to reduce cheating among 5- to 6-y-olds. These findings link spatial cognition to moral behavior and show that even seemingly unremarkable features of children's environments can nudge them to act honestly.

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Data deposition: Data from experiments 1–4 are available at https://osf.io/298BD/.

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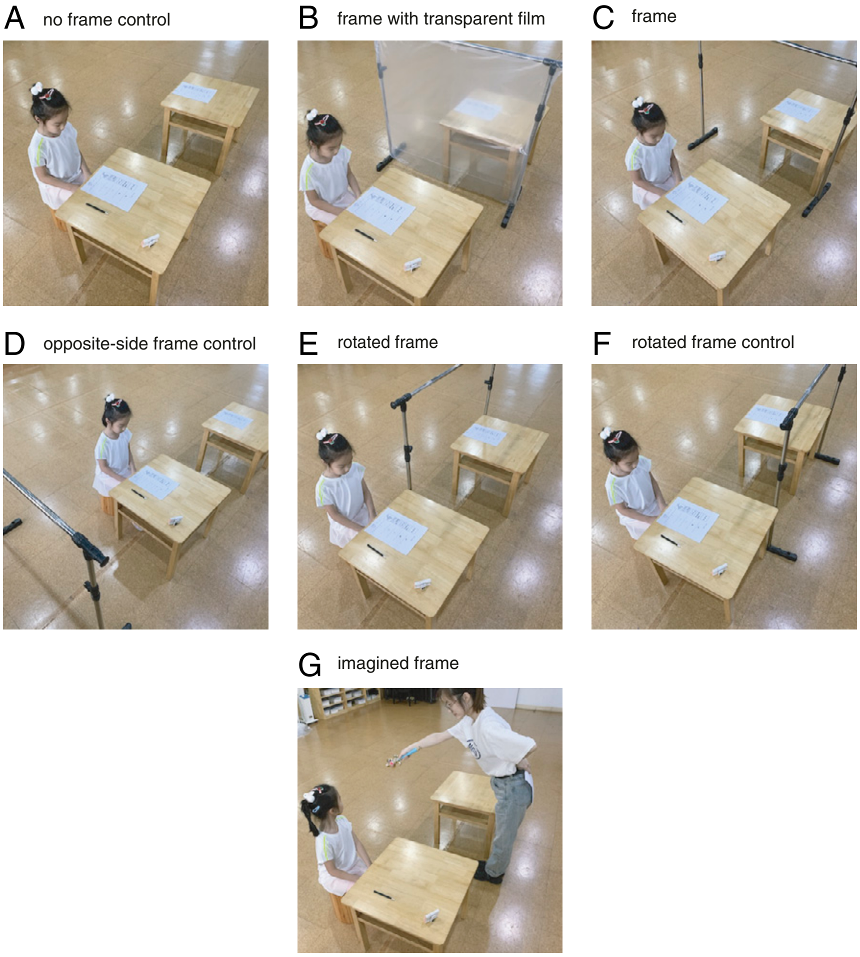

Fig. 1. A child model demonstrates (*A*–*C*) the three conditions of experiment 1, (*D*) the one condition of experiment 2, (*E* and *F*) the two conditions of experiment 3, and (*G*) the one condition of experiment 4. *G* also shows an adult experimenter demonstrating the magic wand procedure.

condition because the frame imposes a boundary between the child's space and the space where he or she is not allowed to transgress.

Experiment 2 included a single condition, the opposite-side frame control condition (Fig. 1*D*). In this condition we placed an empty frame next to the table where the child sat, at the same distance from the child as in the frame condition in experiment 1, but on the child's right side rather than on the left. In contrast to the frame condition, in the opposite-side frame control condition the frame did not divide the space between the child and the answer key. If the moral barrier hypothesis is correct, then the cheating rate in the opposite-side frame control condition should be similar to the rate in the no frame control condition but higher than the rate in the frame condition. In contrast, if the frame in the opposite-side frame control condition is able to reduce cheating by its mere presence, then the cheating rate should be similar to the rate in the frame condition but lower than the rate in the no frame control condition.

In experiment 3 we added two new conditions in which an empty frame was rotated 90° relative to how it was oriented in the frame condition in experiment 1 (Fig. 1 *E* and *F*; see Fig. 2 for a schematic overview of all conditions). In both of these new conditions the frame was placed against one edge of the table with the answer key, with one end extending to a corner on the left side of the child's table. In the rotated frame condition (Figs. 1*E* and 2*E*), the frame extended to the corner of the table that was the closest to the child, and in the rotated frame control condition (Figs. 1*F* and 2*F*), the frame extended to the corner that was the furthest away. These two ways of positioning the frame appear similar, but they had different implications for dividing the space between the child and the answer key. In the rotated frame condition the frame was no longer directly interposed between the child and the answer key, but it remained in the child's direct line of sight if he or she chose to peek. As a result, the frame still divided the space between the child and the answer key, but in a more subtle way than it did in the frame condition. In contrast, in the rotated frame control condition the frame was neither interposed between the child and the answer key nor in the child's direct line of sight. If the moral barrier hypothesis is correct then the cheating rate in the rotated frame condition should be lower than the rate in the rotated frame control condition because only in the rotated frame condition did the frame divide the space between the child and the answer key. Alternatively, if the mere presence of a physical barrier anywhere in children's immediate environment is sufficient to nudge them away from cheating, then the cheating rates in both of these two rotated frame conditions should be lower than in the no frame control condition of experiment 1.

Finally, in experiment 4 we added a condition in which we removed the physical frame altogether. In this imagined frame condition (Fig. 1*G*), before leaving the room the experimenter used a toy magic wand to outline what she said was an invisible frame. (Note that this was the only condition in which the experimenter referred to the frame or drew children's attention to it in any way.) The imagined frame had the same size and position

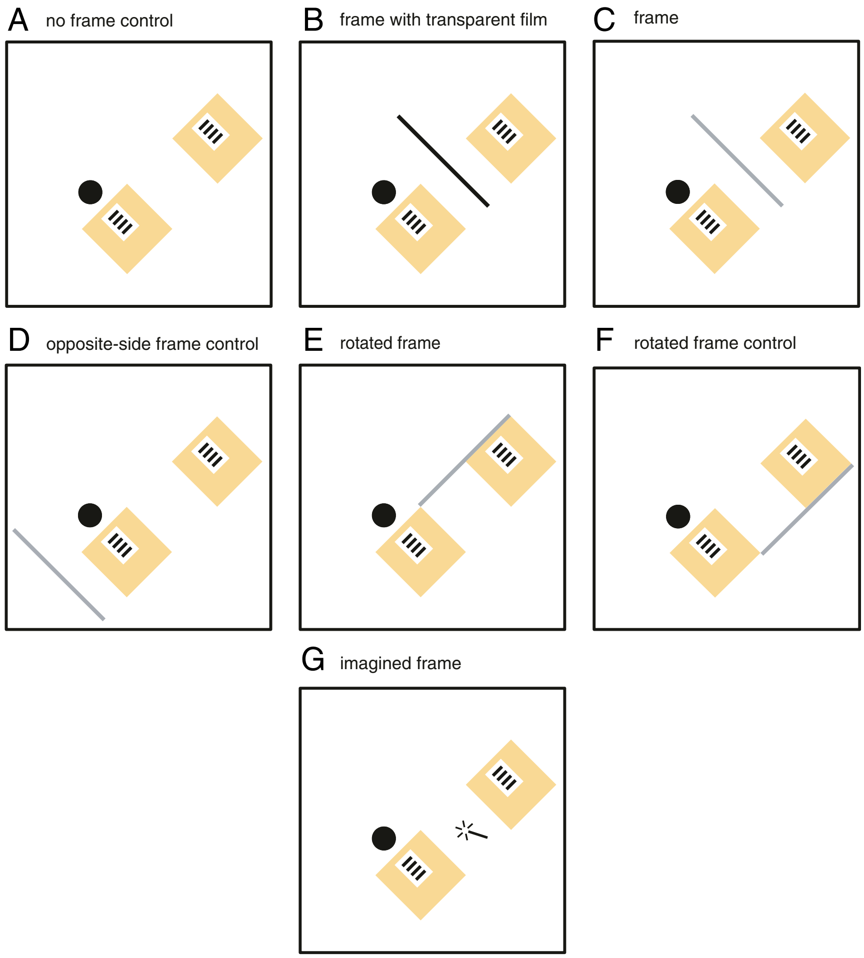

Fig. 2. A schematic overview of all conditions with a black circle representing the child and yellow squares representing the two tables (*A*–*G*), a straight line representing the location of the frame (*B*–*F*), and a magic wand indicating where the experimenter drew the imagined frame (*G*).

as the physical frame in the frame condition in experiment 1, and the experimenter conveyed its presence by using a toy magic wand to trace an outline in the air without saying anything about its purpose. The notion that children of this age would find the experimenter's assertion of an invisible frame believable is supported by evidence that young children's beliefs about imaginary beings can affect their moral behavior and that they will readily accept claims about imaginary beings that are made by adults (12–15). The purpose of adding this condition was to provide a test of a stronger version of the moral barrier hypothesis: that a nudge does not even have to be in a physical form to promote honesty.

In all experiments, a hidden camera recorded the child's behavior while the experimenter was away. The resulting video recordings were used to code for cheating, which was defined as both peeking and copying from the answer key. Coding was done by two research assistants who worked independently and who were blind to the study hypotheses. All instances of cheating were further confirmed by making sure that the child's answer to the exceptionally difficult problem matched the corresponding answer on the answer key.

Results

Fig. 3 shows the cheating rate for each condition across the four experiments. To test our hypotheses we ran a hierarchical binary logistic regression analysis for each experiment with whether the child cheated as the predicted variable (0 = no cheating, 1 = cheating). In each analysis, we entered the condition and the child's age in months in the first block as predictors and the two-way interaction of the predictors in the second block to determine the best fit and most parsimonious model for the data (16).

Experiment 1. The best fit model included condition and age without their interaction as predictors of cheating behavior, χ^2 (3, n = 150) = 23.51, $P < 0.001$, Nagelkerke $R^2 = 0.20$ (*SI Appendix*, Table S1). The main effect of age was significant: with increased age (in months), children were more inclined to cheat, regardless of condition ($\beta = 0.09$, SE $\beta = 0.03$, *Wald* = 6.20, $df = 1$, $P = 0.013$, *odds ratio* = 1.09, 95% CI = 1.02–1.16). The main effect of condition was also significant (*Wald* = 15.00, $df = 2$, $P < 0.001$). A priori comparisons with the no frame control condition as reference showed that the cheating rates in the frame with transparent film condition and the frame condition were both significantly lower than the rate in the no frame control condition (16%, 28%, and 54%, respectively; $\beta = -1.84$ and -1.04, SE $\beta = 0.49$ and 0.43, *Wald* = 14.01 and 5.72, $df = 1$ and 1, $P < 0.001$ and $P = 0.017$, *odds ratio* = 0.16 and 0.35, 95% CI = 0.06–0.42 and 0.15–0.83, for comparisons of the frame with transparent film and the frame conditions with the no frame control condition, respectively). In contrast, a post hoc comparison showed that cheating rates did not differ between the frame with transparent film condition and the frame condition ($\beta = -0.80$, SE $\beta = 0.51$, *Wald* = 2.43, $df = 1$, $P = 0.119$, *odds ratio* = 0.45, 95% CI = 0.17–1.23). Thus, placing a physical barrier between the child and the answer key led to a significant reduction in cheating.

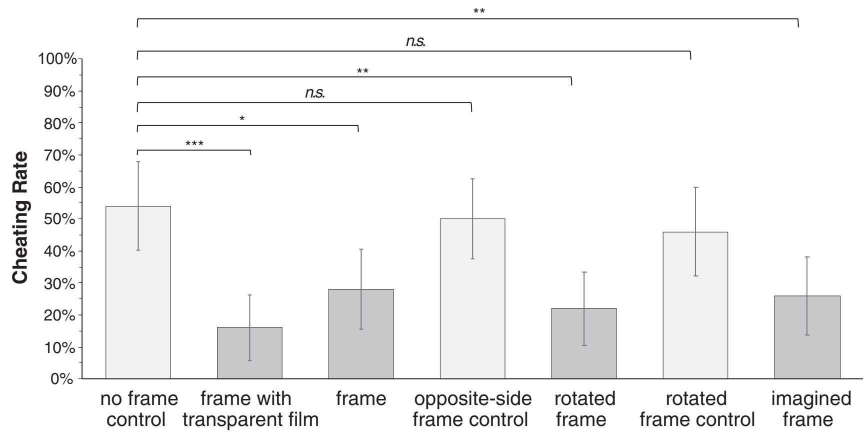

Fig. 3. The cheating rate in each of the seven conditions (error bars: 95% CI; $*P < 0.05$; $**P < 0.01$; $***P < 0.001$).

Experiment 2. The regression model compared the cheating rate in the opposite-side frame control condition in experiment 2 with those of the frame condition and the no frame control condition in experiment 1. The best fit model included condition and age without their interaction as predictors of cheating, χ^2 (3, n = 150) = 17.71, P = 0.001, Nagelkerke R^2 = 0.15 (*SI Appendix*, Table S1). The main effect of age was significant: children's tendency to cheat increased with age (in months) regardless of condition (β = 0.11, SE β = 0.04, *Wald* = 9.20, *df* = 1, P = 0.002, *odds ratio* = 1.12, 95% CI = 1.04–1.20). The main effect of condition was also significant (*Wald* = 6.16, *df* = 2, P = 0.046). A priori comparisons with the opposite-side frame control condition as reference showed that the cheating rate in the frame condition was significantly lower than the rate in the opposite-side frame control condition (28% vs. 50%; β = −0.87, SE β = 0.44, *Wald* = 4.00, *df* = 1, P = 0.046, *odds ratio* = 0.42, 95% CI = 0.18–0.98). However, the cheating rate in the no frame control condition was not significantly different from the rate in the opposite-side frame control condition (54% vs. 50%, β =0.16, SE β = 0.41, *Wald* = 0.15, *df* = 1, P = 0.700, *odds ratio* = 1.17, 95% CI = 0.52–2.63). These results indicate that to reduce the cheating rate, the frame needed to be strategically placed to divide the space between the child and the answer key and that its mere presence was not sufficient.

Experiment 3. The regression model compared cheating rates in the rotated frame and the rotated frame control conditions of experiment 3 with the rate in the no frame control condition in experiment 1. The best fit model included condition and age without their interaction as predictors of cheating, χ^2 (3, n = 150) = 17.76, P < 0.001, Nagelkerke R^2 = 0.15 (*SI Appendix*, Table S1). The main effect of age was significant: children's tendency to cheat increased with age (in months) regardless of condition (β = 0.10, SE β = 0.04, *Wald* = 5.55, *df* = 1, P = 0.018, *odds ratio* = 1.11, 95% CI = 1.02–1.21). The main effect of condition was also significant (*Wald* = 12.95, *df* = 2, P = 0.002). A priori comparisons with the no frame control condition in experiment 1 as reference showed that the cheating rate in the rotated frame condition was significantly lower than the rate in the no frame control condition (22% vs. 54%, β = −1.43, SE β = 0.45, *Wald* = 9.96, *df* = 1, P = 0.002, *odds ratio* = 0.24, 95% CI = 0.10–0.58), whereas the cheating rates in the rotated frame control and the no frame control conditions did not significantly differ from each other (46% vs. 54%, β = 0.16, SE β = 0.46, *Wald* = 0.12, *df* = 1, P = 0.733, *odds ratio* = 1.17, 95% CI = 0.48–2.86). These results suggest that the frame reduced cheating even when it served to divide the space between the child and the answer key in a more subtle way.

Experiment 4. The regression model compared the cheating rate in the imagined frame condition in experiment 4 to that of the no frame control condition in experiment 1. The best fit model included condition and age without their interaction as predictors of cheating, χ^2 (2, n = 100) = 12.46, P = 0.002, Nagelkerke R^2 = 0.16 (*SI Appendix*, Table S1). The age effect was significant: with increased age (in months), children became more inclined to cheat (β = 0.07, SE β = 0.04, *Wald* = 4.09, *df* = 1, P = 0.043, *odds ratio* = 1.08, 95% CI = 1.00–1.16). The main effect of condition was also significant, with a significantly lower cheating rate in the imagined frame condition than in the no frame control condition (26% vs. 54%, β = −1.21, SE β = 0.44, *Wald* = 7.57, *df* = 1, P = 0.006, *odds ratio* = 0.30, 95% CI = 0.13–0.71). Thus, placing an imagined barrier between the child and the answer key also significantly reduced cheating, which suggests that a barrier does not need to take a physical form to be effective.

In each of the experiments we found a significant effect of children's age. Because there were no significant differences in cheating rates across the four experimental conditions, or across the three control conditions, we combined the data from these two types of conditions to examine the age effect further. We performed a hierarchical binary logistic regression analysis with cheating as the predicted variable, age (in months) and type of condition (experimental vs. control) as predictors in the first block, and their interaction in the second block. The best fit model included age and condition type without their interaction as predictors of cheating behavior, χ^2 (2, n = 350) = 37.48, P < 0.001, Nagelkerke R^2 = 0.14 (*SI Appendix*, Table S2). As expected, both the main effects of age and type of condition were significant (β = 0.072, SE β = 0.02, *Wald* = 9.77, *df* = 1, P = 0.002, *odds ratio* = 1.08, 95% CI = 1.03–1.13, for age; β = −1.31, SE β = 0.24, *Wald* = 29.23, *df* = 1, P < 0.001, *odds ratio* = 0.27, 95% CI = 0.17–0.44, for type of condition). Using the logistic regression equation, we derived the probabilities of cheating with increased age for the experimental conditions and the control conditions separately. As shown in Fig. 4, the likelihood of cheating increased significantly with age, but the condition effect did not differ with age.

Discussion

In four experiments we tested the moral barrier hypothesis, which posits that moral transgressions can be reduced by strategically introducing certain spatial boundaries. Specifically, we investigated whether placing a nonoccluding frame between an answer key and where children sat while taking a test would reduce the likelihood that they would cheat by peeking at the answer key and copying from it. We found that the frame that divided the space between the child and the answer key led to a

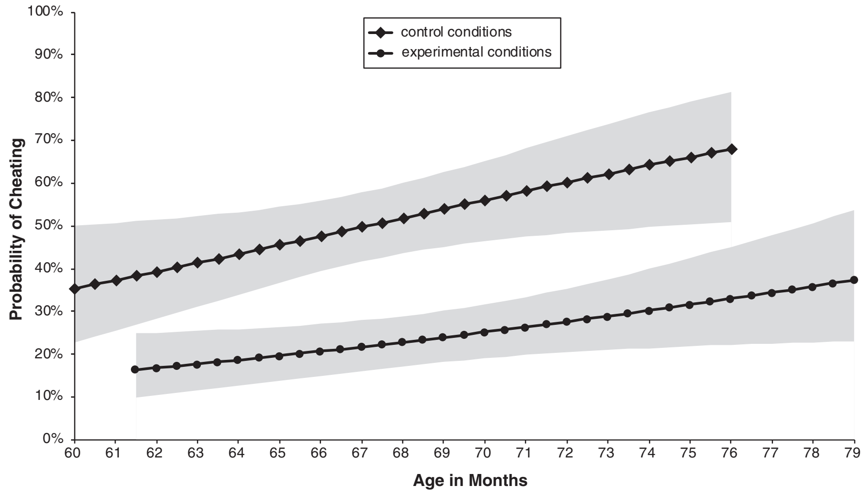

Fig. 4. The probability of cheating as predicted by age in months, with the upper line representing a combination of the control conditions (no frame control, opposite-side frame control, and rotated frame control) and the lower line representing a combination of the experimental conditions (frame with transparent film, frame, rotated frame, and imagined frame). The shaded regions indicate the 95% confidence interval.

significant reduction in cheating. This was true even though it did not impede the child's view of the answer key in any way, and the experimenter did not draw attention to it. However, the frame needed to be strategically placed in the child's line of sight to produce the moral barrier effect, as shown by a pair of control conditions in which the mere presence of a frame in the child's environment failed to produce a significant reduction in cheating.

The results of experiment 4 show that the frame does not even need to take a physical form to function as a moral barrier. In the imagined frame condition the experimenter outlined an invisible frame between the child and the answer key to create an imagined barrier. This suggests that the moral barrier effect does not even require a real barrier and that other ways of eliciting mental representations of barriers can also be effective.

It should be noted that age did not interact with condition in any of these analyses, which suggests that the moral barrier effect is relatively stable across age. However, we did find that cheating tended to increase with age (Fig. 4). It may be that as children get older they increasingly recognize the importance of performing well on examinations or become more confident in their ability to cheat without being caught (see ref. 17).

Why were the strategically placed barriers able to nudge children to act more honestly? One possibility is that from a very young age, children are socialized to use environmental cues such as landmarks to learn about which areas they are allowed to explore and which they are not. Children may do so not only for prudential reasons (e.g., that it is okay to play on a playground but not okay to play in the street) but also for social reasons (e.g., that it is okay to play on a soccer field but not on someone's fenced-in lawn). Children's ability to pick up on these environmental cues could be a consequence of explicit teaching (e.g., how to respond to street crossing and "no trespassing" signs) or implicit learning (e.g., how close to strangers one should stand).

It is possible that children generalized what they had previously learned about environmental cues to the current situation, and viewed the strategically placed barriers as dividers between the permissible space (where they were seated) and the impermissible space (where the answer key was located). If this interpretation is correct, then other spatial dividers between children and an answer key, such as walls, fences, and chains, might also be able to serve as moral barriers. Empty space might even serve a similar function. If so, it could help to explain why the cheating rate in our three control conditions was around 50%, as compared to around 75% in the baseline conditions of several related studies that used comparable experimental procedures (7–9). One way to test this possibility would be to compare a condition in which the child sits at one end of a long table with the answer key at a fixed distance at the other end, to a condition in which the child sits at the same distance from the answer key but at a different table, such that there is a gap between the tables.

In addition to functioning as a divider of space, the frame may also serve as a reminder that reinforces the experimenter's injunction to not cheat. Specifically, its presence might have led children to stop and think about what the experimenter had said. If this explanation is correct then perhaps the effectiveness of the frame's reminding function depends on where it is placed, and to be effective it must be strategically placed directly in the line of sight between the child and the space they were instructed to not transgress into.

More work will be needed to identify the specific mechanisms that underlie the present findings. Future studies could investigate whether the space divider account or the reminder account best explains the moral barrier effect. Future work could also investigate whether the effect is specific to barriers, or is also seen in relation to other types of cues in the physical environment, such as strategically-placed sticky notes. In addition, although the barriers we used were not overtly social cues, it is important to acknowledge that they are artifacts (or representations of artifacts, in the case of the imagined frame condition) that are positioned by people. Thus, children might draw inferences about the intentions of whoever placed the barrier in that particular location. If this is the case, then it is possible that the effects we observed are fundamentally social in nature, even though we did not introduce any overt social cues. To examine this possibility, future work could assess the effects of naturally-occurring barriers, such as streams or fallen tree branches, which are not as easily attributable to human intentions.

The way the barrier functioned in the present study is likely to have parallels outside of the moral domain, such as when traffic cones are used to alert drivers to reconfigured lanes, rope lines are used at airport security check points to guide passengers to line up in an orderly way, or marks are drawn on pavement to facilitate social distancing for public health reasons. This raises the possibility that the moral barrier effect reflects more general psychological phenomena that underpin social behaviors. Investigating the causes of the moral barrier effect and how it generalizes could lead to a deeper understanding of the relation between spatial cognition and human behavior (18, 19) and provide insights into how environments can be structured so as to promote desirable outcomes.

In summary, the present findings provide strong support for the moral barrier hypothesis by showing that both real and imagined barriers, when placed strategically, can promote honest behavior. These findings illustrate the power of nudges (1), in which seemingly unremarkable features of the physical and social environment can guide people's thinking and behavior in a particular direction.

Materials and Methods

Parents or legal guardians gave informed consent to allow their children to participate, and children gave their oral assent prior to participating. We received ethical approval from the Scientific Research Ethics Committee of Hangzhou Normal University, China (IRB 2019-010). See https://osf.io/298BD/ for all data and code.

Participants. The sample size of 50 for each condition in experiment 1 was predetermined based on existing studies (20, 21). The same sample size was then used in the other experiments after verifying its appropriateness with power analyses. Each of the conditions was preregistered (see https://aspredicted.org/es235.pdf for the no frame control, frame with transparent film, and frame conditions in experiment 1, https://aspredicted.org/wb5a4.pdf for the opposite-side frame control condition in experiment 2, https://aspredicted.org/p9np3.pdf and https://aspredicted.org/k8ba4.pdf for the rotated frame and rotated frame control conditions in experiment 3, and https://aspredicted.org/pg2cd.pdf for the imagined frame condition in experiment 4).

A total of 350 5- to 6-y-old children were recruited, with 50 assigned to each of the seven conditions: the no frame control condition (mean age = 68.79 mo, SD = 5.17 mo, range = 60.56–75.58 mo; 24 boys), the frame with transparent film condition (mean age = 67.97 mo, SD = 5.69 mo, range = 62.04–78.00 mo; 25 boys), and the frame condition (mean age = 67.45 mo, SD = 5.40 mo, range = 61.92–78.00 mo; 25 boys) in experiment 1; the opposite-side frame control condition (mean age = 68.38 mo, SD = 3.70 mo, range = 63.65–75.22 mo; 25 boys) in experiment 2; the rotated frame condition (mean age = 68.68 mo, SD = 3.39 mo, range = 63.32–74.89 mo; 24 boys) and the rotated frame control condition (mean age = 64.00 mo, SD = 3.23 mo, range = 60.07–68.65 mo; 25 boys) in experiment 3; and the imagined frame control condition (mean age = 68.03 mo, SD = 6.65 mo, range = 61.78–78.87 mo; 23 boys) in experiment 4. The participants in all conditions were Han Chinese, from middle class backgrounds, and attended the same preschool in eastern China. Each child was able to pass the comprehension check questions, so there were no exclusions in any of the conditions.

Testing Room. The room where children were tested contained two identical tables measuring 0.6 m long by 0.6 m wide. Children sat at one of the tables, which had a digital countdown timer on it. The second table, which held the answer key, was located to the child's left. The two tables were placed 0.6 m apart, a distance that, according to the results of pilot testing, made it easy for children to peek at the answer key quickly and reliably without leaving their seat. The room contained a hidden camera that was used to record children's progress on the test, as well as any peeking behavior.

Experiment 1. In the no frame control condition (Fig. 1*A*), no frame was present. In the frame with transparent film condition (Fig. 1*B*) and the frame condition (Fig. 1*C*), a metal frame on a stand that measured 1.1 m tall by 1.2 m wide was located between the tables such that it would be centered within the child's line of sight if he or she attempted to look at the answer key while seated. In the frame with transparent film condition only, the frame was covered by a transparent plastic sheet that did not impede the visibility of the answer key.

Experiment 2. The opposite-side frame control condition (Fig. 1*D*) was identical to the frame condition in experiment 1 except that the empty frame was placed to the right of the child's table rather than to the left. The distance from the frame to the child's table was the same as in the frame condition.

Experiment 3. In both the rotated frame condition (Figs. 1*E* and 2*E*) and the rotated frame control condition (Figs. 1*F* and 2*F*), the empty frame was rotated 90° relative to where it had been in the frame condition in experiment 1. It was then placed along the side of the table with the answer key, with one end extending to a left-side corner of the table where the child sat. In the rotated frame condition the frame extended to the left-side corner of the table that was closest to the child, and in the rotated frame control condition it extended to the left-side corner that was furthest away.

Experiment 4. In the imagined frame condition (Fig. 1*G*) no physical frame was present. Instead, near the beginning of the session the experimenter used a toy magic wand to outline what she said was an invisible frame. This imagined frame had the same dimensions and positioning as the physical frame in the frame with transparent film and frame conditions in experiment 1.

Test Materials. A test sheet was created that contained a series of five counting problems. Each problem required the child to count all of the shapes of a certain type and circle the correct answer from a set of nine response options. The first four problems were trivially easy for children of this age, but the final problem was exceptionally difficult due to the number of shapes to be counted and the way they were arranged, and this made it effectively impossible for children to finish the entire test within the 5-min time limit. The answer key was identical to the test sheet except that the correct answer for each problem had been circled (Fig. 5).

Procedure. Participants were tested by a female experimenter in one-on-one sessions, and the entire procedure was conducted in Chinese. The experimenter began by explaining that the child would be taking a test that was designed to assess whether he or she was good at solving math problems and thus able to answer all five problems correctly in a limited amount of time. The experimenter then conducted a practice session to introduce the

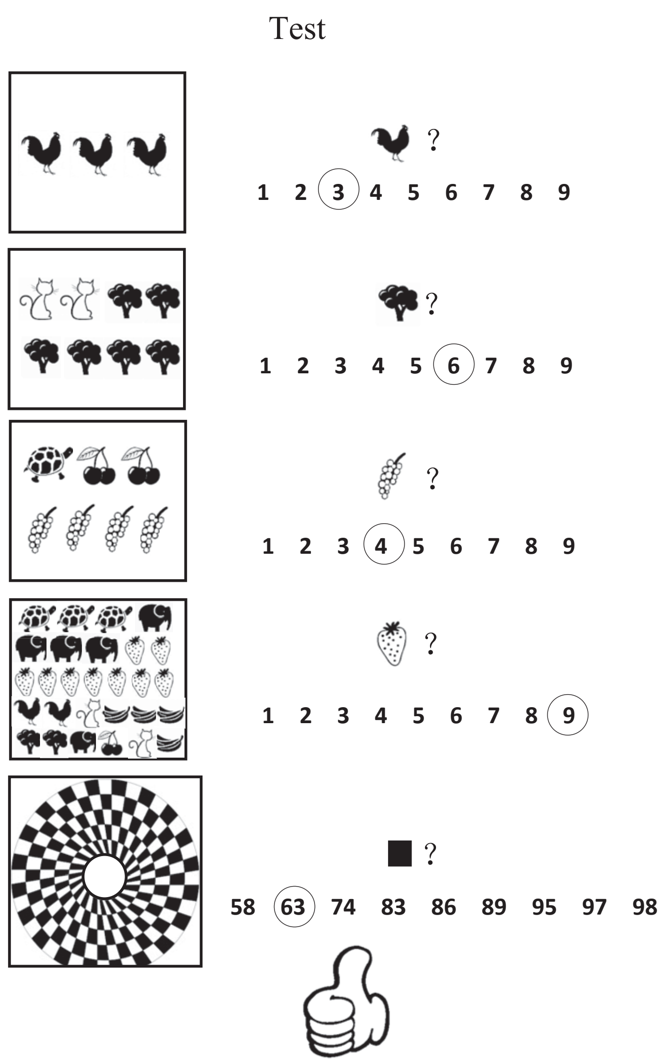

Fig. 5. The answer key that the experimenter placed on the second table.

test and to verify that the child had the counting skills needed to solve the first four problems.

Next, the experimenter gave the child the test sheet and explained, "You will have up to 5 min to finish the test. Here is a clock (indicating the countdown clock) that will show 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 completing these instructions the experimenter said, "Sorry, I just remembered that I need to go to a nearby room to deal with an emergency. I will not be able to come back for 5 min. While I am away you should try to solve the problems by yourself. When you are done you should leave the test sheet on your table and find me in the room next door. Please make sure that you finish the test before the time runs out." The experimenter also said, "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 answered all of the problems correctly. Remember, don't peek at the answer key. Okay?" The experimenter 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 5 min? As noted above, all participants answered these questions correctly.

For children in the frame with transparent film condition and the four conditions involving the empty frame (i.e., the frame, opposite-side frame control, rotated frame, and rotated frame control conditions), the experimenter never made reference to the frame or did anything to draw attention to it. For children in the imagined frame condition, just before placing the answer key on the second table the experimenter used a toy magic wand to outline a path through space that corresponded to the size and position of the frame in the frame condition of experiment 1. She told the participant, "Look, I have a magic wand. Now I am going to do some magic. I am outlining a frame here. It is invisible and no one can see it. It stands between your table and the other table. Remember, although you cannot see it, it will always be here." As she said this, she used a battery-powered toy magic wand to outline the imaginary frame. The magic wand produced one light and sound effect combination when she switched it on prior to outlining the frame, and a second light and sound effect combination each time she pressed a button to indicate the location of each corner of the frame.

After finishing the test and retrieving the experimenter from the nearby room as they were instructed to do, children were debriefed and sent back to their classroom. Each child received a prize for participating after data collection for all children was completed.

Dependent Measure. In all experiments, whether the child cheated by peeking at the answer key and copying an answer from it served as the dependent measure. Two research assistants who were blind to the study hypotheses independently coded children's cheating behavior based on video recordings taken by a hidden camera. All instances of cheating were further confirmed by making sure that the child's answer to the exceptionally difficult problem matched the corresponding answer on the answer key. There was 100% intercoder reliability.

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1. R. H. Thaler, C. R. Sunstein, *Nudge: Improving Decisions about Health, Wealth, and Happiness*, (Yale University Press, New Haven, 2008).
2. E. J. Johnson *et al*., Beyond nudges: Tools of a choice architecture. *Mark. Lett.* **23**, 487–504 (2012).
3. G. M. Walton, The new science of wise psychological interventions. *Curr. Dir. Psychol. Sci.* **23**, 73–82 (2014).
4. S. Bok, *Lying: Moral Choice in Public and Private Life*, (Pantheon Books, New York, 1978).
5. M. E. Schweitzer, J. C. Hershey, E. T. Bradlow, Promises and lies: Restoring violated trust. *Organ. Behav. Hum. Decis. Process.* **101**, 1–19 (2006).
6. N. Mazar, O. Amir, D. Ariely, The dishonesty of honest people: A theory of self-concept maintenance. *J. Mark. Res.* **45**, 633–644 (2008).
7. G. D. Heyman, G. Fu, J. Lin, M. K. Qian, K. Lee, Eliciting promises from children reduces cheating. *J. Exp. Child Psychol.* **139**, 242–248 (2015).
8. A. D. Evans, A. M. O'Connor, K. Lee, Verbalizing a commitment reduces cheating in young children. *Soc. Dev.* **27**, 87–94 (2018).
9. G. Fu, G. D. Heyman, M. Qian, T. Guo, K. Lee, Young children with a positive reputation to maintain are less likely to cheat. *Dev. Sci.* **19**, 275–283 (2016).
10. G. Fu, A. D. Evans, F. Xu, K. Lee, Young children can tell strategic lies after committing a transgression. *J. Exp. Child Psychol.* **113**, 147–158 (2012).
11. J. M. Engelmann, E. Herrmann, M. Tomasello, Five-year olds, but not chimpanzees, attempt to manage their reputations. *PLoS One* **7**, e48433 (2012).
12. J. Piazza, J. M. Bering, G. Ingram, "Princess Alice is watching you": Children's belief in an invisible person inhibits cheating. *J. Exp. Child Psychol.* **109**, 311–320 (2011).
13. J. S. DeLoache, K. F. Miller, K. S. Rosengren, The credible shrinking room: Very young children's performance with symbolic and nonsymbolic relations. *Psychol. Sci.* **8**, 308–313 (1997).
14. J. D. Lane, P. L. Harris, Confronting, representing, and believing counterintuitive concepts: Navigating the natural and the supernatural. *Perspect. Psychol. Sci.* **9**, 144–160 (2014).
15. J. D. Woolley, E. A. Boerger, A. B. Markman, A visit from the candy witch: Factors influencing young children's belief in a novel fantastical being. *Dev. Sci.* **7**, 456–468 (2004).
16. S. Menard, *Applied Logistic Regression Analysis*, (Sage University Paper Series on Quantitative Applications in Social Science, series no. 07-106, Sage, Thousand Oaks, CA, ed. 2, 2001).
17. H. Hartshorne, M. S. May, *Studies in the Nature of Character: Studies in Deceit*, (Macmillan, New York, 1928).
18. G. Lakoff, *Moral Politics: How Liberals and Conservatives Think*, (University of Chicago Press, Chicago, 1996).
19. N. Yu, T. Wang, Y. He, Spatial subsystem of moral metaphors: A cognitive semantic study. *Metaphor Symb.* **31**, 195–211 (2016).
20. L. Zhao, G. D. Heyman, L. Chen, K. Lee, Telling young children they have a reputation for being smart promotes cheating. *Dev. Sci.* **21**, e12585 (2018).
21. L. Zhao *et al*., Young children are more likely to cheat after overhearing that a classmate is smart. *Dev. Sci.*, e12930 (2019).