Aversion to Playing God and Moral Condemnation of Technology and Science

This research provides the first systematic empirical investigation of people's aversion to *playing God*. Seven studies validate this construct and show its association with negative moral judgments of science and technology. Motivated by three nationally representative archival datasets that demonstrate this relationship, Studies 1-2 demonstrate that people condemn scientific procedures they perceive to involve playing God. Studies 3-5 demonstrate that dispositional aversion to playing God corresponds to decreased willingness to fund the National Science Foundation and lower donations to organizations that support novel scientific procedures. Studies 6a-6b demonstrate that people judge a novel (versus established) scientific practice to involve more playing God and to be more morally unacceptable. Finally, Study 7 demonstrates that reminding people of an existing incident of playing God reduces concerns toward scientific practices. Together, these findings provide novel evidence for the impact of people's aversion to playing God on science and policy-related decision-making.

In Mary Shelley's *Frankenstein*, the eponymous Victor Frankenstein animates a human-like creature through scientific experimentation, stating, "A new species would bless me as its creator and source; many happy and excellent natures would owe their being to me" ([1], p. 101). Yet, by the story's end, the experiment has gone horribly wrong, and the creature, a monster, turns against Frankenstein. Many have read *Frankenstein* as a critique of humans' desire to play God, a romantic indictment of the Enlightenment's scientific advancements.

This critique of playing God pervades people's opposition toward science and technology. Sunstein ([2], p. 539) describes aversion to playing God as a heuristic [3] that guides[1] moral disapproval of human intervention in the domains of sex, reproduction, and nature: "'Do not play God' is the general heuristic here, with different societies specifying what falls in that category and with significant changes over time." Despite its apparent importance, though, behavioral science has largely ignored the principle "Do not play God" as a topic of study, work emerging in the fields of genetic engineering [4], nature conservation [5], and medicine [6] instead. The current work addresses this gap within behavioral science.

Scholars have put forth several definitions of playing God, with varying specificity. Most broadly, playing God involves what science scholar, Philip Ball [7], refers to as, "Mankind assuming powers beyond our station or our ability to control." The current work adapts this general definition and focuses on a single domain that typifies aversion to playing God— people's responses to human intervention in science and technology.

Aversion to playing God, and its basis in aversion to human interference in the natural order (supported empirically in Studies 6a-6b), resembles other related but conceptually distinct

---

[1] Although we assume the causal pathway from aversion to playing God to moral judgment and explicitly support this pathway empirically in Study 7, we also acknowledge that people may use assessment of playing God to justify moral judgment post-hoc.

constructs. Moral Foundations Theory [8-11], for example, specifies one moral foundation related to aversion to playing God: *purity/sanctity*. This foundation has theoretical roots in the moral code of *purity/divinity*, detailed as follows ([12], p. 576, *italics added*): "A person disrespects the sacredness of God, or causes impurity or degradation to himself/herself, or to others. To decide if an action is wrong, you think about things like sin, the *natural order of things*, sanctity, and the protection of the soul or the world from degradation and spiritual defilement." The link between impurity and violating the "natural order of things" is critical to the code of purity/divinity and yet has gone largely unexplored. We believe understanding aversion to playing God can illuminate this link.

Closest to this topic is work on naturalness bias—people's preference for natural processes and products rather than those that originate from human-imposed agency on the natural order of things [13,14]. Rozin ([15], p. 31) notes, "Human intervention seems to be an amplifier in judgments on food riskiness and contamination," and Sunstein ([2], p. 539) notes that secular societies endorse a version of the "Do not play God" principle in the form of "Do not tamper with nature." Extensive work reveals people's preference for foods and medicines produced naturally and without human intervention [16,17].

More recent work suggests that naturalness bias might be linked to moral aversion to taboo trade-offs, a social transaction that places a monetary price on a value that people perceive to be sacred [18,19]. Work examining people's aversion to genetically modified food suggests it elicits dislike not only for its "unnaturalness," but also elicits moral emotional responses (e.g., disgust) similar to canonical taboo tradeoffs [20].

Despite the resemblance between people's naturalness bias (and related constructs) and people's aversion to playing God, these constructs are nevertheless distinct. A pilot study

(electronic supplementary material) reveals several practices that people perceive to involve tampering with nature but not playing God (e.g., emitting carbon monoxide while driving) as well as practices perceived to involve playing God but not tampering with nature (e.g., airline CEOs' conspiring to fix prices). In addition, Study 2 presents one case largely unrelated to nature (drone warfare) and establishes a link between aversion to playing God and moral judgment.

The link between principles regarding God and principles regarding nature and the natural order also aligns with extensive work on intuitive theism—people's implicit belief that a supernatural deity has intelligently designed nature itself [21-23]. Importantly, we take aversion to playing God to be distinct from religious cognition in three ways. First, our pilot study (electronic supplementary material) distinguishes playing God from judgments of religious violations. Second, across studies we show religiosity does not explain the relationship between aversion to playing God and moral judgment. Third, we demonstrate that aversion to playing God need not involve any consideration of God as the source of action per se and that aversion to playing God is distinct from religious conviction.

The present research characterizes the relationship between aversion to playing God and moral attitudes primarily in the domains of science and technology. Scientific procedures frequently involve human intervention in nature and sacred aspects of human experience [18]. Our overarching hypothesis is that aversion to playing God corresponds to negative attitudes toward science and technology across diverse contexts. Three archival nationally representative datasets provide initial support for this relationship (electronic supplementary material) and motivate the present empirical work.

Overview of Studies

Studies 1 and 2 provide initial support that people morally condemn practices to the degree that they see them as involving playing God. Studies 3-5 extend these findings by showing that aversion to playing God corresponds to behavioral intentions and behaviors including willingness to fund the National Science foundation, and real monetary donations to organizations supporting stem cell research and genetically modified rice. Given that this is the first systematic psychological examination of aversion to playing God, we also examine an important moderator—novelty. Studies 6a-6b present a case in which the relationship between aversion to playing God and moral condemnation is modulated by the novel versus established nature of the act. Study 7 extends these findings by demonstrating that reminders of existing acts of playing God (i.e., reducing the perceived novelty of playing God) improve attitudes toward scientific practices.

Study 1

Study 1 tests whether perceptions of playing God correspond to condemnation of scientific procedures.

Methods

One hundred sixty-four United States residents (93 male, 65 female, 6 unreported, M_{age}=33.51) participated for a small payment via Amazon.com's Mechanical Turk (MTurk) [24]. For this study and all subsequent studies, sample size was determined based on prior similar studies, data collection stopped only when predetermined samples were attained, and participants were included in primary analyses only if they completed the study items in full (but see Study 7 for specific pre-registered exclusion criteria).

As a conservative test our hypothesis, one group of participants evaluated whether several scientific procedures involve playing God, and a different group of participants evaluated

the moral acceptability of these procedures. Participants were randomly assigned to one of these two conditions, both of which involved evaluating 19 scientific procedures drawn from the survey items in Archival Studies 1a, 1b, and 1c (e.g., "genetic testing during pregnancy to find out whether the baby will have desirable characteristics…," "cloning humans") (electronic supplementary material).

In the moral judgment condition, 82 participants evaluated the moral status of each procedure on a 7-point scale (1=*Completely morally unacceptable*, 7=*Completely morally acceptable*). We computed a moral judgment score for each of the 19 items, as the unit of analysis, by computing an average over all participants. In the playing God condition, 82 participants evaluated each procedure in terms of "whether you consider each practice to be "Playing God" on a 7-point scale (1=*Not at all*, 7=*Yes definitely*). To concisely capture this construct that we describe in the introduction, we defined playing God for participants as "taking on the role of some higher, metaphysical power to intervene in natural or human affairs." We calculated a "playing God score" for each of the 19 items by computing an average over all participants. We employed this between-subjects design to avoid artificially inflating the correlation between moral acceptability ratings and playing God ratings; this design choice precluded subject-wise analyses of the relationship between these constructs.

Finally, participants completed several demographic questions including three questions relevant to the construct of playing God: (1) political ideology ("Using the scale below please describe your political beliefs" 1=*Extremely Liberal*, 7=*Extremely conservative*), (2) religiosity ("How religious are you?" 1=*Not at all religious*, 7=*Very religious*), and (3) belief in God ("Do you believe in God?" 1=*Not at all*, 7=*Very much*). We examine these variables in this study and all subsequent studies.

Results

Our primary analysis involved computing moral acceptability and playing God scores for each scientific procedure (both αs>.90). As hypothesized, these scores were highly correlated, $r(17)=-.50$, $p=.028$. Procedures seen as involving playing God by one group of participants were also judged as less morally acceptable by a different group of participants. Supplemental analyses reveal political ideology, religiosity, and belief in God cannot account for these effects and the primary effects of Studies 2, 6a, 6b, and 7 (electronic supplementary material).

Study 2

Study 2 examines specific practices related to science and technology policies using a within-subjects design such that the same participants deliver moral acceptability judgments and playing God judgments for specific practices.

Methods

Three hundred sixty-five United States residents (209 male, 153 female, 3 unreported, $M_{age}=32.49$) participated online as in Study 1.

At the outset of the study, participants answered demographic questions including questions about belief in God, religiosity, and political ideology as in Study 1. All participants then evaluated four issues:

- The use of **drones in warfare**--unmanned aerial vehicles that operate autonomously to fire missiles on enemy targets.
- The production of **genetically modified organisms** including food such as fruits and vegetables.
- The injection of **vaccines** into children in order to protect against disease.
- Humans' use of technologies and energy sources that contribute to **climate change and global warming**.

First, participants evaluated each issue on the extent to which it involved playing God (1=*Not at all*, 7=*Yes definitely*), defined as, "To aspire or pretend to omnipotence or deity; to attempt to control people or events; to interfere in matters regarded as beyond the (appropriate) sphere of

human influence." Here, we used an expanded definition, taken from the Oxford English Dictionary definition, which is consistent with the definition used in Study 1. While Study 1 relies on our organically generated definition, this study enables us to test whether the same relationship between aversion to playing God and moral condemnation persists, given a more formal definition of playing God. Next, participants evaluated each issue on moral acceptability (1=*Completely morally unacceptable*, 7=*Completely morally acceptable*).

Results

Perceptions of playing God correlated negatively with moral acceptability for each practice (Drones, $r(363)=-.25$, $p<.001$; Genetically Modified Organisms (GMOs), $r(363)=-.45$, $p<.001$; Vaccination, $r(363)=-.43$, $p<.001$; Global Warming, $r(363)=-.17$, $p=.001$). Again, perceptions of playing God were related to reduced moral acceptability.

Study 3

Study 3 develops a measure of individual differences in aversion to playing God (the APG scale) and examines the predictive validity of the APG scale for decisions about funding the National Science Foundation. Given the theoretical basis for the construct of aversion to playing God, we use aversion to playing God as the predictor variable in this study and Studies 4 and 5, but we also acknowledge that causality can run in the reverse direction as well.

Methods

Three hundred and four United States residents (200 male, 103 female, 1 unreported, $M_{age}=29.47$) participated online as in Study 1.

Participants first completed a 7-item measure of APG (the APG scale), responding to each of the following items using a 6-point scale (Strongly Disagree=1, Moderately Disagree=2, Slightly Disagree=3, Slightly Agree=4, Moderately Agree=5, Strongly Agree=6):

1. It bothers me when humans try to take on the role of God

2. Playing God is morally wrong
3. There are some situations where control is best left to a higher power, rather than humans
4. Humans should be free to intervene in all matters, even those in which God plays a role (reverse scored)
5. Decisions about life and death are better left to God than to humans
6. Some domains should be governed by a nonhuman authority rather than by humans
7. There are some matters in the world that are beyond the sphere of human influence

Although some items mentioned God explicitly, whereas others did not, these items were highly reliable (α=.91); thus, we averaged the items to compute an APG score for each participant.

Participants then answered demographic questions as in Study 1, and completed a task asking for decisions about funding different government agencies (electronic supplementary material). Given the proposed negative relationship between aversion to playing God and favorable attitudes toward science, we hypothesized that people's dispositional aversion to playing God would predict reduced funding to the National Science Foundation (NSF).

Results

As hypothesized, APG predicted reduced funding to the NSF, β=-.30, $t(302)$=5.48, p<.001. APG did not predict funding decisions for the Department of Labor, Patent and Trademark Office, Library of Congress, Agency for International Development, agency for Housing and Urban Development, or Securities and Exchange Commission (βs<[.08], ps>.21). Unexpectedly, APG positively predicted funding toward the Department of Defense (β=.21, $t(302)$=3.79, p<.001) and Federal Prison System (β=.12, $t(302)$=2.01, p=.045), suggesting that high levels of APG do not simply indicate high levels of moral disapproval for all policies and practices. We also found that political ideology, religiosity, and belief in God cannot account for the relationship between APG and funding decisions for the NSF, but do affect funding decisions for the Department of Defense and Federal Prison System (electronic supplementary material).

Finally, the correlation between APG and NSF funding differs significantly from the correlations between APG and funding for all other agencies (zs>3.07, ps≤.002). Overall, these

findings suggest that aversion to playing God uniquely predicts decisions to reduce funding for science, specifically.

Study 4

Study 4 establishes APG as a reliable and valid construct and demonstrates the predictive validity of the APG scale in an actual behavioral context involving monetary donation.

Methods

Two hundred and seventy-five United States residents (164 male, 109 female, 2 unreported, $M_{age}=29.35$) participated online as in Study 1.

Participants completed the APG measure ($\alpha=.91$), followed by demographic items as in Study 1. Participants were then presented with an opportunity to allocate any portion of a 30-cent bonus to one of two charities (one supporting stem cell research, one called Cure Violence supporting gun violence reduction), or to themselves (electronic supplementary material). Participants made their donations, which we distributed and donated to the two charities according to participants' allocations.

Results

APG negatively predicted donations to stem cell research, as predicted, $\beta=-.13$, $t(273)=2.17$, $p=.031$[2]. We also found that political ideology, religiosity, and belief in God cannot account for the relationship between APG and stem cell research donations (electronic

---

[2] Our data contained eleven people who made donations outside of 3 *SD* either for Cure Violence or for the National Stem Cell foundation, and whose exclusion alters the significance of these findings. Given our a priori decision not to exclude outliers and given the bounded nature of this measure, we chose to include these participants in our analyses as they represent meaningful data points of people who feel strongly about donating to one charity or the other. Furthermore, regressing donations transformed by square root (such that they no longer represent values outside of 3 *SD*) on APG, reveals the same significant results reported in the primary analyses.

supplementary material); political ideology and APG both account partially for stem cell research donations, but do not robustly account for donations over and above each other.

Unexpectedly, APG positively predicted donations to an alternate cause (charity, Cure Violence), $ß$=.18, $t(273)$=2.95, p=.003, though this finding became non-significant (ps>.10) when controlling simultaneously for belief in God, religiosity, and political ideology or when controlling for belief in God or religiosity separately (electronic supplementary material). Controlling separately for political ideology did not eliminate the significant association between APG and donation to Cure Violence, $ß$=.19, $t(272)$=3.08, p=.002. In addition, APG did not significantly predict donations to oneself ($ß$=-.01, p=.87). We found that 53.4% of our sample allocated all 30 cents to themselves and examining only people who donated some non-zero amount to one of the two charities yielded the same pattern of results. APG negatively predicted donations to stem cell research, $ß$=-.27, $t(128)$=3.22, p=.002, positively predicted donations to Cure Violence, $ß$=.36, $t(128)$=4.34, p<.001, and did not significantly predict donations to oneself ($ß$=-.03, p=.71).

Study 5

Study 5 again tests whether the APG scale predicted actual monetary donations, this time in a zero-sum context—two oppositional charities were offered, with no opportunity for participants to donate to themselves.

Methods

Three hundred six United States residents (158 male, 147 female, 1 unreported, M_{age}=34.60) participated online as in Study 1.

Participants completed the APG measure (α=.92), followed by demographic items as in Study 1. Participants were then presented with an opportunity to divide up 30 cents in donations

two charities to reduce Vitamin A deficiency (VAD), one of which produces "Golden Rice" through genetic modification practices (electronic supplementary material). Notably, we indicated that the Golden Rice solution was the superior strategy for reducing VAD and endorsed by Nobel Laureates; we hypothesized that nonetheless APG would predict donating more to Helen Keller International compared to the International Rice Research Institute. Participants made their donations, which we distributed to the two charities per their allocations.

Results

APG negatively predicted the difference score of money donated to the International Rice Research Institute (IRRI) (that promotes genetically modified "golden rice" as a solution to VAD) and money donated to Helen Keller International (HKI) (that promotes an alternate VAD solution), β=-.13, $t(304)$=2.32, p=.021. Controlling for political ideology, religiosity, and belief in God reduces this relationship to non-significance but cannot account for the relationship between APG and this donation difference because ideology and religiosity are not correlated with this donation difference (electronic supplementary material). These analyses also show that belief in God significantly predicted donation difference but not over and above APG.

Examining only people who produced a non-zero difference in donations between the two causes revealed the same result, β=-.19, $t(146)$=2.35, p=.02. Notably, APG predicted preferential donations to HKI over IRRI even though we explicitly indicated that IRRI's genetically modified golden rice solution is a preferred solution to VAD.

Study 6a

Study 6a tests for a factor that amplifies perceptions of playing God: the extent to which a scientific practice is either novel or established. Given that we conceptualize playing God as "assuming powers beyond our station or our ability to control", novel practices should be viewed

as inherently more representative of this construct because they represent practices where humans have not yet exhibited agency or ability to act. Established processes, on the other hand, should be viewed as practices that humans have demonstrated they can enact. Furthermore, our pilot study (electronic supplemental materials) supports the role of novelty, showing that aversion to playing God reflects perceptions of human agency exerted in domains governed by established nonhuman systems of authority.

In addition, to address the alternative explanation that aversion to playing God simply amounts to aversion to risk or uncertainty, the existing practice is described as riskier, with the novel practice improving on those risks.

Methods

Four hundred ninety-four United States residents (312 male, 180 female, 2 unreported, $M_{age}=29.47$) participated online as in Study 1.

Participants completed the APG measure ($\alpha=.90$), followed by demographic items as in Study 1, and read about two scientific procedures (electronic supplementary material)

We purposely provided minimal detail about the two procedures. We did this to avoid triggering preexisting biases regarding existing practices (e.g., cloning), and to match the two procedures as closely as possible on content while ensuring they differed only on the established vs. novel dimension. Critically, we described Practice A as having known risks, whereas we described Practice B as mitigating those risks. Nonetheless, we predicted that because Practice B was described as a novel intervention while a process (Practice A) is already in place participants would view Practice B as higher in playing God and also higher in immorality. Participants answered (in order) the extent to each practice is novel/established (1=*very established*, 7=*very novel*) (as a manipulation check), involves playing God (1=*does not at all involve playing God*,

7=*very much involves playing God*), and is morally unacceptable/acceptable (1=*completely morally unacceptable*, 7=*completely morally acceptable*).

Results

Confirming the validity of our manipulation, participants perceived the novel practice as more novel (*M*=5.74, *SD*=1.31) than the established practice (*M*=2.12, *SD*=1.54), *t*(493)=33.46, *p*<.001, *d*=2.13. Participants believed the novel practice (*M*=3.36, *SD*=2.04) involved playing God to a greater extent than the established practice (*M*=3.09, *SD*=1.91), *t*(493)=6.55, *p*<.001, *d*=0.42, and that the novel practice (*M*=5.08, *SD*=1.67) was less morally acceptable than the established practice (*M*=5.26, *SD*=1.60), *t*(493)=5.01, *p*<.001, *d*=0.32. Thus, as predicted, people view a practice that improves on an established, standard practice as higher in playing God than the established practice and more morally unacceptable. Mediation analyses (electronic supplementary material) also showed that perceptions of playing God partially mediated the effect of practice on moral acceptability.

Next, we examined the predictive validity of the APG scale and found that APG predicted lower moral acceptability of the established practice, *ß*=-.48, *t*(492)=12.28, *p*<.001, and the novel practice, *ß*=-.48, *t*(492)=12.21, *p*<.001.

Study 6b

Study 6b replicated and extended Study 6a by examining the effects of novelty on perceptions of playing God and moral acceptability in the domains of both science and the law

Importantly, we do not mean to suggest that aversion to playing God represents mere resistance to change or a preference for the status quo. We believe that novelty enhances perceptions of playing God particularly in domains (i.e., science) that people believe are governed by higher, non-human forces. Therefore, in this study we replicated and extended

Study 6a by examining the effects of novelty on perceptions of playing God and moral acceptability in the domain of science and also in the domain of the law, where clear *human* authority exists, and where human intervention is more common.

Study 6b also measured and examined participants' belief that there is a natural order of things that should not be violated.

Methods

Nine hundred three United States residents (513 male, 386 female, 4 unreported, M_{age}=34.42) participated online as in Study 1.

Participants first completed the same 7-item APG scale (α=.91) as in the previous study and answered demographic questions as in Study 1, as well as one additional item asking, "Please state the extent to which you agree or disagree with the following statement: There is a natural order of things in the world that should not be violated" (1=*strongly disagree, 7=strongly agree*). We included this item to explore the idea, presented in our introduction, that aversion to playing God may be rooted in a belief in a natural order, which was borne out in the results (electronic supplementary materials).

Participants were then randomly assigned to one of two conditions: the science condition or the law condition. The science condition was identical to the procedure in Study 6a in which participants read about a novel and established scientific procedure, and answered questions about the novelty, degree of playing God, and moral acceptability of the procedures.

Participants also answered two additional questions about the "general practice of manipulating cellular processes within the human body"—"To what extent is this practice important" and "To what extent does this practice have significant consequences" (1=*not at all*,

7=*very much*). We included these two questions about importance and significance to assess whether the two conditions were approximately equivalent in gravity.

In the law condition, participants read about two practices, one established and one novel, to sentence drug offenders (electronic supplementary material). Next, they answered identical questions to the science condition, with the last two questions about importance and significance regarding, "the general practice of sentencing drug offenders." Per Zhou and Fishbach [25], we examined, by condition, frequency of participants dropping out just prior to the experimental manipulation and found that 1.75% (8/457) and 0.87% (4/458) dropped out in the science and law conditions, respectively, a non-significant difference, χ^2=1.36, p=.24, φ=.038.

Results

Our primary analyses were mixed 2 (condition: legal vs. science) X 2 (practice: established vs. novel) ANOVAs for ratings of novelty, playing God, and moral acceptability. Analyses for novelty revealed no significant interaction (p=.73), but two significant main effects. A main effect of practice emerged, $F(1, 901)$=2246.63, p<.001, η_p^2=.71, such that participants indeed rated the novel practice (M=5.89, SD=1.36) as more novel than the established practice (M=1.94, SD=1.48). In addition, an unexpected main effect of condition emerged, $F(1, 901)$=10.37, p=.001, η_p^2=.01, such that participants viewed practices in the science condition (M=3.99, SD=0.69) to be more novel than practices in the law condition (M=3.85, SD=0.65). Despite this overall main effect, the critical pattern we explore below is the interaction between domain (science or law) and whether the practice is novel or established.

The mixed ANOVA for perceptions of playing God revealed a main effect for practice, $F(1, 901)$=10.10, p=.002, η_p^2=.01 (novel practice: M=3.20, SD=1.96 vs. established practice: M=3.08, SD=1.92), a main effect for condition, $F(1, 901)$=69.21, p<.001, η_p^2=.07 (science

condition: M=3.64, SD=1.92 vs. law condition: M=2.65, SD=1.65), qualified by a predicted

interaction, $F(1, 901)$=12.82, p<.001, η_p^2=.01. Decomposing this interaction revealed that

participants rated practices to involve more playing God in the science condition than in the law

condition both for the established practice (M=3.51, SD=1.98 vs. M=2.66, SD=1.77; $t(901)$=6.84,

p<.001, d=0.46) and the novel practice (M=3.77, SD=2.04 vs. M=2.64, SD=1.72; $t(901)$=9.00,

p<.001, d=0.60). Most important, people rated the novel practice to involve more playing God

than the established condition in the science condition, $t(448)$=4.75, p<.001, d=0.32, but

perceived virtually no difference between the novel and established practice on playing God in

the law condition, t=0.29, p=.77 (this finding also suggests that novelty alone and related

constructs (i.e., uncertainty) does not drive perceptions of playing God). In sum, the enhanced

perception of playing God for novel versus established practices is not simply a status quo bias

but applies specifically to some domains (e.g., science), as we had predicted, more than others.

The mixed ANOVA for moral acceptability revealed no predicted main effect for practice

(p=.71), and a main effect for condition, $F(1, 901)$=7.64, p=.006, η_p^2=.01 (science condition:

M=5.09, SD=1.54 vs. law condition: M=4.83, SD=1.34) qualified by the predicted interaction,

$F(1, 901)$=28.26, p<.001, η_p^2=.05. Decomposing this interaction revealed the following:

Participants rated the established practice as more morally acceptable in the science condition

than in the law condition (M=5.21, SD=1.58 vs. M=4.70, SD=1.54; $t(901)$=4.97, p<.001,

d=0.33), but no difference emerged for the novel practice between the science and law condition

(M=4.98, SD=1.66 vs. M=4.96, SD=1.43; t=0.15, p=.88). More interestingly, as predicted, people

rated the novel practice versus the established practice to be more morally unacceptable in the

science condition (as in Study 6a), $t(448)$=5.01, p<.001, d=.33, yet perceived the novel practice

to be more morally *acceptable* in the law condition, $t(453)$=4.38, p<.001, d=.29. These results

suggest that the enhanced perception of higher playing God and reduced moral acceptability for novel versus established events is more pertinent to the domain of science, compared to law. Mediation analyses (electronic supplementary material) reveal at least a marginal mediating effect of perceptions of playing God.

We also examined the APG scale, which again predicted lower moral acceptability of the established practice in the science condition, $\beta=-.43$, $t(447)=10.12$, $p<.001$, but not in the law condition, $\beta=-.01$, $p=.88$. We also found, somewhat unexpectedly, that APG predicted lower moral acceptability for the novel practice in both the science condition, $\beta=-.47$, $t(447)=10.12$, $p<.001$, and law condition, $\beta=-.14$, $t(452)=2.94$, $p=.003$.

We also examined participants' perceived importance and significance of the science domain and law domain (across condition). Independent t-tests demonstrated that significance did not differ across conditions ($t=.88$, $p=.38$), but importance did, $t(901)=3.81$, $p<.001$. Because of this effect for importance, we investigated the relationship between importance and both moral acceptability and playing God. Interestingly, importance was *positively* correlated with moral acceptability for both practices (rs>.39, $p<.001$) and *negatively* correlated with perceived playing God for both practices (rs<-.18, $p<.001$). Thus, differences in perceptions of playing God and moral acceptability for the science domain versus the legal domain do not appear to result from differences in perceived importance.

Study 7

Studies 6a-6b suggest the relationship between aversion to playing God and opposition to scientific practices is rooted in perceived novelty. Therefore, our final study examined whether reducing novelty and establishing the normalcy of playing God could improve attitudes toward scientific practices. We examined whether prompting people to recall an instance of themselves

playing God (Self-playing-God) or others playing God (Other-playing-God) would improve

attitudes toward scientific practices compared to a control condition.

Methods

Eight hundred ninety United States residents (93 male, 65 female, 6 unreported,

M_{age}=36.42) participated via Prolific Academic [26] for a small payment and completed the

study using Qualtrics software.

We pre-registered our hypotheses and analytic plan (see

http://aspredicted.org/blind.php?x=j99ys9). We randomly assigned people to write about an

instance of themselves playing God, an instance of another person playing God, or—in a control

condition—a time they made a meal. We then asked them to evaluate the same 19 scientific

practices from Study 1 on a 7-point scale (1=*Completely morally unacceptable*, 7=*Completely*

morally acceptable). At the outset of the study, participants answered demographic questions

including questions about belief in God, religiosity, and political ideology as in Study 1. In our

pregistration plan, we proposed two alternative hypotheses:

> Hypothesis 1a: Considering an instance of oneself playing God increases
> perceptions of scientific practices as morally acceptable.

> Hypothesis 1b: Considering an instance of anyone (self or other) playing God
> increases perceptions of scientific practices as morally acceptable.

We randomly assigned participants to one of our three conditions. In the you-playing-

God condition, participants were told:

> Please describe a time that you played God in some way. Please describe what you did that
> involved playing God. Please do your best to write about at least one case where you were doing
> something that involved playing God. We would like you to please spend at least a few minutes
> writing instead of just jotting down a word or two quickly.

After this prompt, participants responded "Yes" or "No" to the question, "In the previous

section, were you able to write an example of you playing God?"

In the others-playing-God condition, participants were told:

> Please describe a time that you heard about or observed someone you know or have met playing God in some way. Please describe what they did that involved playing God. Please do your best to write about at least one case where you heard about or observed someone you know or have met doing something that involved playing God. We would like you to please spend at least a few minutes writing instead of just jotting down a word or two quickly.

After this prompt, participants responded "Yes" or "No" to the question, "In the previous section, were you able to write an example of someone you know or have met playing God?"

In the control condition, participants were told:

> Please describe a time that you made a meal in some way. Please describe what you did that involved preparing food and making a meal. Please do your best to write about at least one time that you made a meal. We would like you to please spend at least a few minutes writing instead of just jotting down a word or two quickly.

After this prompt, participants responded "Yes" or "No" to the question, "In the previous section, were you able to write an example of a time you made a meal?"

After the essay prompt and manipulation check question, all participants rated the 19 scientific practices on moral acceptability. As stated in our preregistration plan, we excluded from analyses participants who responded "No" to the question asking whether they completed the writing task, by condition, leaving 743 participants (Self-playing-God=217, Other-playing-God=208, and Control=318). Given these counts are unbalanced by condition, we examine them in supplemental analyses (electronic supplementary material) and find that the difference does not account for effects on our dependent variable.

Results

As specified in our preregistration plan, we conducted a one-way ANOVA using condition as an independent variable and moral acceptability ratings of scientific practices as an outcome variable (averaged, α=.92), and examined the following contrasts:

> **Contrast to test Hypothesis 1a**: Self-playing-God (2) vs Other-playing-God (-1) vs Control (-1).

Contrast to test Hypothesis 1b: Self-playing-God (1) vs Other-playing-God (1) vs Control (-2).

The significant ANOVA, $F(2, 740)=3.71$, $p=.025$, $\eta_p^2=.01$ suggests that moral acceptability varied by condition. The contrast testing Hypothesis 1a was non-significant, $p=.17$, whereas the contrast testing Hypothesis 1b was significant, $t(740)=2.72$, $p=.007$, $d=.20$. Participants in the Self-playing-God ($M=4.06$, $SD=1.10$) and Other-playing-God ($M=4.04$, $SD=1.16$) conditions rated scientific practices as more morally acceptable than those in the Control condition ($M=3.82$, $SD=1.17$). Thus, considering either oneself or others playing God increases moral acceptability judgments of scientific practices.

We also conducted secondary analyses per our preregistration plan, examining contrasts to test whether specific conditions differ on moral acceptability ratings of scientific practices:

Contrast 1: Self-playing-God (1) vs Other-playing-God (-1) vs Control (0)
Contrast 2: Self-playing-God (1) vs Other-playing-God (0) vs Control (-1)
Contrast 3: Self-playing-God (0) vs Other-playing-God (1) vs Control (-1)

Contrast 1 was non-significant ($p=.88$), but Contrasts 2 and 3 were both significant, $t(740)=2.38$, $p=.018$, $d=.17$ and $t(740)=2.18$, $p=.03$, $d=.16$. Thus, both playing God conditions produced higher moral acceptability for scientific practices than the control condition.

In sum, the findings suggest that recalling someone (self or other) playing God may lead people to see playing God as less novel or risky and therefore scientific practices as less immoral. Furthermore, participants generated their own examples of playing God (by themselves or others) provide some insight into how lay people conceptualize this construct. Although several people provided examples involving science and technology (e.g., "The closest to playing God I've seen is the Gene-editing technology CRISPR"), several others provided examples pertaining to involvement in life and death decisions (e.g., "I used to catch bugs in the garden when I was little. Some of them I would kill and others I wouldn't," "the last time i

played god was when i gave birth to my daughter, i really felt like a goddess giving life to this amazing creature") or more mundane situations involving having outsized control (e.g., "Running a small business felt a bit like 'playing God' sometimes"). A coder blind to hypotheses identified that, for participants included in the primary analysis, 18.9% of the responses in the Self-playing-God involved science and 15.7% involved technology, and 22.1% of the responses in the Others-playing-God involved science and 11.5% involved technology. Although the present work focuses on science and technology, these findings suggest that aversion to playing God is not merely reducible to an aversion to science and technology.

We acknowledge that these examples might be specific to our American sample, and a non-Western population might not perceive them to constitute playing God. As we describe further in our discussion, the universal aspect of aversion to playing God is the perception that human intervention should left to a higher or metaphysical agent, which in some cases is God explicitly and in other cases constitutes another entity altogether.

Discussion

These studies establish, for the first time, aversion to playing God as a valid psychological construct relevant to judgments of science and technology including robotics (drones), GMOs, vaccinations, and stem cell research. Importantly, our findings provide critical evidence for the association between aversion to playing God and moral condemnation of novel scientific practices, even when these practices benefit human well-being [27].

Given that this research represents the first systematic examination of aversion to playing God, several key questions emerge. One is the degree to which aversion to playing God causally influences moral judgment toward science and technology. Although we acknowledge the plausibility of a bidirectional relationship between these constructs, Study 7 in particular

supports a causal pathway from aversion to playing God to moral judgment. Future research can examine this pathway as well, for example, testing whether people condemn a chemical change in an organism that results from human intervention more than one that results from randomness, and whether perceptions of playing God drive any difference. Given that existing work shows that people view human-caused harm as worse than naturally arising harm and harm caused by acts worse than harm by omission [28], and that people prefer natural products and processes (that are chemically identical) to human-made ones [29], we believe these effects are likely.

Another key question is whether aversion to playing God simply reflects general moral condemnation. The present research suggests this is not the case. First, Study 5 shows that aversion to playing God *positively* correlates with support for the Cure Violence charity, and Study 6b shows aversion to playing God is unrelated to the moral acceptability of an established practice in the legal domain. In other words, the relationship between aversion to playing God and moral judgment is not consistent across contexts. Second, the inconsistent relationship between aversion to playing God and political ideology suggests this construct does not merely reflect a particular political profile associated with a particular set of moral foundations [9,10]. Archival Studies 1b and 1c (electronic supplementary material) also show little association between ideology and aversion to playing God. Thus, aversion to playing God reflects a specific moral concern that emerges amongst liberals and conservatives alike.

A related question is whether aversion to playing God simply reflects religious conviction. The present research suggests aversion to playing God represents a distinct construct from religiosity or belief in God. First, across studies, measures of religiosity and belief in God do not account for the association between aversion to playing God and disapproval of science and technology. Aversion to playing God predicts moral condemnation above and beyond

religious constructs. Second, the pilot study (electronic supplementary material) and Study 2 showed no association between measures of religiosity or belief in God and aversion to playing God. The inconsistent relationship between religiosity and aversion to playing God across studies may stem from opposing influences of religious belief on perceptions of playing God. As documented here, when a relationship between religious belief and aversion to playing God emerges, it is typically positive. That is, believers deliver harsher moral judgments than non-believers. This pattern likely stems from an explicit code within many Judeo-Christian traditions that calls for respecting God's authority as sole creator [30,31]; thus, intervening in matters such as reproduction is incompatible with respect for God as ultimate agent. Yet, some Judeo-Christian sects, such as Lutheranism, teach adherents to carry out the will of God through their actions [32]. Therefore, followers may view certain interventions as essential to their religion. Because no comparisons among religions are offered here, future work is needed to assess whether aversion to playing God is attenuated for religions that explicitly instruct people to be secondary agents for God's plans.

As it stands, one of the current limitations of this work is its generalizability to adherents of non-Judeo-Christian religions, which as of now is an open question. For example, a strict interpretation of the Islamic idea of *Tawhid* (one should not worship other Gods nor take on Godhead for oneself) would prohibit acts of playing God, yet the Islamic spiritual tradition of Sufism also allows people to take divine traits so that God can act "through them" [33, p. 417]. Other scholars suggest that playing God in the case of cloning is less of a concern for Hinduism and Buddhism because it fits with the idea of reincarnation [30] although these religions' views about the creation and destruction of life complicate this question [34]. Ultimately, future research can test the strength of aversion to playing God in other religions.

Given the prevalence of atheism [35], future research may also examine whether even atheists demonstrate an aversion to playing God at an implicit level. Although our work demonstrates a relationship between increased religiosity and aversion to playing God, aversion to playing God is present across the religious spectrum in all of the present studies. Atheists may therefore demonstrate their aversion at an implicit level, similar to other aspects of religious cognition that emerge even amongst those who explicitly disavow religious belief [22,36]; indeed, recent studies have shown that religious primes affect moral behavior and public self-awareness even among atheists [37,38]. At an explicit level, atheists might express their aversion in non-religious terms, such as, "Do not tamper with nature," as noted by Sunstein [2, p. 539].

Overall, our work suggests that most people believe (implicitly or explicitly) that, in the domains of science and technology, human intervention should be avoided and instead left to a more metaphysical source of action—for theists that source might be God, and for atheists or others that source might be fate [39], nature, or some other agentic practice already in place. In other words, aversion to playing God may not necessarily reflect an aversion to humans' taking on the role of a religious spirit or creator, but rather an aversion to human agency in a domain in which another agent is thought to be responsible.

Given that playing God is not reducible to religiosity or belief in God, other related beliefs about secular preexisting systems or agents governing science might similarly affect moral judgments of science and scientific progress. For example, belief in the infallible capacity of nature might impede views on scientific innovation as well. Take, for example, the hotly contested debate over GMOs. Spitznagel and Taleb [40] argue against genetically modified food by stating, "The statistical mechanism by which a tomato was built by nature is bottom-up, by tinkering in small steps…In nature, errors stay confined and, critically, isolated." This belief in

nature's near-perfect ability may stifle innovation in food production and farming [41], inspiring beliefs (akin to aversion to playing God) that humans should not interfere in these domains. Study 6b hints at the contribution of belief in a natural order to these attitudes.

In sum, aversion to playing God, which may result from ideas about deference to God or some higher organizing power as the ultimate agent, can increase inertia in moral and scientific domains. Given rapid advances in reproductive technology, pharmaceuticals, and robotics and artificial intelligence, and the novelty of these advancements, we expect aversion to playing God to continue to influence public opposition toward these developments. Particularly in the domain of social robotics, as scientists and developers become increasingly Frankensteinian in engineering of humanlike agents, the present work suggests the importance of understanding where negative attitudes toward these agents originate and how to mollify them, in efforts to facilitate scientific progress.

Ethics

Informed consent was obtained from all participants and institutional review board approval was obtained for all studies we conducted. For the GSS, used in Archival Study 1a, informed consent was obtained from participants and this survey was approved by the institutional review board at NORC at University of Chicago. The survey used in Archival Study 1b was approved by the institutional review board at Johns Hopkins University that granted exempt status for consent. For the polls used in Archival Study 1c, they were conducted within the CASRO standards for research and all participants received informed consent before participating.

Data Accessibility

The data supporting this article have been uploaded at

https://drive.google.com/open?id=1EWuVIJBgugtbTFVZ4QBq4oAo8vXOOVew

Authors' Contributions

Both authors designed the studies, analyzed the data, drafted the paper and approved the final submission

Competing Interests

We have no competing interests.

References

1. Shelley M. 1818 *Frankenstein or, the modern Prometheus* (1985 ed.). London: Penguin Books.

2. Sunstein CR. 2005 Moral heuristics. *Behav. Brain. Sci.* **28**, 531-541.

3. Gilovich T, Griffin D, Kahneman D. 2002 *Heuristics and biases: The psychology of intuitive judgment*. Cambridge, UK: Cambridge University Press.

4. Evans JH. 2002 *Playing God?: Human genetic engineering and the rationalization of public bioethical debate*. Chicago, IL: University of Chicago Press.

5. Chase A. 1987 *Playing God in Yellowstone: The destruction of America's first national park*. New York, NY: Harcourt Brace Jovanovich.

6. LaCombe MA. 1992 Playing God. *Ann. Intern. Med.* **116**,161-162.

7. Ball P. 2010 https://www.prospectmagazine.co.uk/science-and-technology/playing-god-is-a-meaningless-dangerous-cliche

8. Haidt J, Joseph C. 2004 Intuitive ethics: How innately prepared intuitions generate culturally variable virtues. *Daedalus* **133**, 55-66.

9. Graham J, Haidt J, Nosek BA. 2009 Liberals and conservatives rely on different sets of moral foundations. *J. Pers. Soc. Psychol.* **96**, 1029-1046.

10. Graham J, Nosek BA, Haidt, J, Iyer, R, Koleva S, Ditto PH. 2011 Mapping the moral domain. *J. Pers. Soc. Psychol.* **101**, 366-385.

11. Moralfoundations.org. 2015 http://moralfoundations.org/.

12. Rozin P, Lowery L, Imada S, Haidt J. 1999 The CAD triad hypothesis: a mapping between three moral emotions (contempt, anger, disgust) and three moral codes (community, autonomy, divinity). *J. Pers. Soc. Psychol.* **76**, 574-586.

13. Rozin P. 2005 The meaning of "Natural" process more important than content. *Psychol. Sci*. **16**, 652-658.

14. Rozin P. 2006 Naturalness judgments by lay Americans: Process dominates content in judgments of food or water acceptability and naturalness. *Judgm. Decis. Making* **1**, 91-97.

15. Rozin P. 2001 Technological stigma: Some perspectives from the study of contagion. *Risk, media, and stigma: Understanding public challenges to modern science and technology* (eds Flynn J, Slovic P), pp 31-40. Kunreuther H. London: Earthscan Publications.

16. Rozin P, Spranca M, Krieger Z, Neuhaus R, Surillo D, Swerdlin A, Wood K. 2004 Preference for natural: instrumental and ideational/moral motivations, and the contrast between foods and medicines. *Appetite* **43**, 147-154.

17. Rozin P, Fischler C, Shields-Argelès C. 2009 Additivity dominance: Additives are more potent and more often lexicalized across languages than are "subtractives". *Judgm. Decis. Making* **4**, 475-478.

18. Tetlock PE, Kristel OV, Elson SB, Green MC, Lerner JS. 2000 The psychology of the unthinkable: taboo trade-offs, forbidden base rates, and heretical counterfactuals. *J. Pers. Soc. Psychol.* **78**, 853-870.

19. Tetlock PE. 2003 Thinking the unthinkable: Sacred values and taboo cognitions. *Trends. Cogn. Sci.* **7**, 320-324.

20. Scott SS, Inbar Y, Rozin P. 2016 Evidence for absolute moral opposition to genetically modified food in the United States. *Perspect. Psychol. Sci.* **11**, 315-324

21. Kelemen D. 2004 Are children "intuitive theists"? Reasoning about purpose and design in nature. *Psychol. Sci.* **15**, 295-301.

22. Kelemen D, Rosset E. 2009 The human function compunction: Teleological explanation in adults. *Cognition* **111**, 138-143.

23. Kelemen D, Rottman J, Seston R. 2013 Professional physical scientists display tenacious teleological tendencies: Purpose-based reasoning as a cognitive default. *J. Exp. Psychol. Gen.* **142**, 1074-1083.

24. Buhrmester M, Kwang T, Gosling SD 2011 Amazon's Mechanical Turk a new source of inexpensive, yet high-quality, data?. *Perspect. Psychol. Sci.* **6**, 3-5.

25. Zhou H, & Fishbach A. 2016 The pitfall of experimenting on the web: How unattended selective attrition leads to surprising (yet false) research conclusions. *J. Pers. Soc. Psychol.* **111**, 493-504.

26. Peer E, Brandimarte L, Samat S, Acquisti A. 2017 Beyond the Turk: Alternative platforms for crowdsourcing behavioral research. *J. Exp. Soc. Psychol.* **70**, 153-163.

27. Pinker S. 2015 https://www.bostonglobe.com/opinion/2015/07/31/the-moral-imperative-for-bioethics/JmEkoyzlTAu9oQV76JrK9N/story.html.

28. Baron J, & Ritov, I. 1993 Intuitions about penalties and compensation in the context of tort. *J. Risk Uncertain.* **7**, 17-33.

29. Rozin P, Spranca M, Krieger Z, Neuhaus R, Surillo D, Swerdlin A, Wood K. 2004 Preference for natural: instrumental and ideational/moral motivations, and the contrast between foods and medicines. *Appetite*, **43**, 147-154.

30. Tierney J. 2007 http://www.nytimes.com/2007/11/20/science/20tier.html.

31. Dabrock P. 2009 Playing God? Synthetic biology as a theological and ethical challenge. *Syst. Synth. Biol.* **3**, 47-54.

32. Bornkamm H. 1966 *Luther's Doctrine of the Two Kingdoms in the Context of His Theology*. Philadelphia, PA: Fortress Press.

33. Shahzad Q. 2007 Playing God and the ethics of divine names: An Islamic paradigm for biomedical ethics. *Bioethics* **21**, 413-418.

34. Reichhardt T, Cyranoski D, Schiermeier Q. 2004 Religion and science: studies of faith. *Nature* **432**, 666-669.

35. Gervais W, Najle MB. 2018 How many atheists are there?. *Soc. Psychol. Personal. Sci.* **9**, 3-10.

36. Bloom P. 2005 Is God an accident? *Atl. Mon.* **296**, 105.

37. Gervais W, Norenzayan A. 2012 Like a camera in the sky? Thinking about God increases public self-awareness and socially desirable responding. *J. Exp. Soc. Psychol.* **48**, 298-302.

38. Ariely D, Jones S. 2012 *The (honest) truth about dishonesty: How we lie to everyone--especially ourselves*. New York, NY: HarperCollins.

39. Morris MW, Menon T, Ames DR. 2001 Culturally conferred conceptions of agency: A key to social perception of persons, groups, and other actors. *Pers. Soc. Psychol. Rev.* **5**, 169-182.

40. Spitznagel M, Taleb NN. 2015 http://www.nytimes.com/2015/07/14/business/dealbook/another-too-big-to-fail-system-in-gmos.html.

41. Bailey R. 2016 http://reason.com/archives/2016/02/19/gmo-alarmist-nassim-taleb-backs-out-of-d/.

Electronic Supplementary Material

Pilot Study 1

This initial study seeks to accomplish three key goals: (i) to demonstrate aversion to playing God as a principle governing moral judgments, (ii) to distinguish aversion to playing God from related constructs: aversion to tampering with nature and aversion to violating religious principles, and (iii) to support our conceptualization of aversion to playing God as aversion to the exertion of human agency in domains expected to be governed by preexisting non-human sources of authority. Importantly, this first study aims to distinguish aversion to playing God from related constructs *outside* the realm of science and technology, in contrast to all subsequent studies.

Method

Participants. One hundred seventy-two United States residents (97 male, 74 female, 1 unreported, M_{age}=36.26) participated via Amazon.com's Mechanical Turk (MTurk) for a small payment and completed the study using Qualtrics software. For this study, sample size was determined separately for each study based on prior similar studies, and data collection stopped only when predetermined samples were attained.

Procedure. At the outset of the study, participants completed a series of demographic questions including three questions relevant to the construct of playing God: (1) political ideology ("Using the scale below please describe your political beliefs" 1=*Extremely Liberal*, 7=*Extremely conservative*), (2) religiosity ("How religious are you?" 1=*Not at all religious*, 7=*Very religious*), and (3) belief in God ("Do you believe in God?" 1=*Not at all*, 7=*Very much*).

Participants then evaluated nine different practices on six different characteristics. Practices were of three basic types: (1) three actions involving tampering with nature (nature

practices), (2) three involving religious violations (religion practices) (3) and three expected to

elicit judgments of playing God, involving human interference in matters regarded as beyond the

appropriate sphere of human influence (Playing God practices). The practices were as follows:

> Playing God practice 1. High-frequency trading (HFT) is the use of sophisticated computers to trade large amounts of stock at extremely high rates of speed. HFT critics say the practice is used (or misused) to skim billions of dollars in profits out of the markets that would otherwise go into the retirement accounts of average mom and pop investors.

> Playing God practice 2. In major league baseball, the use of human growth hormone (HGH) is prohibited. HGH builds muscle mass, increases bone density, and speeds recovery time from injury. Some athletes have used HGH after getting injured to speed up their recovery rather than rely on their bodies to heal.

> Playing God practice 3. Card counting is a casino card game strategy used primarily in blackjack to determine whether the next hand is favorable to the player or to the dealer. Many casinos try to ban the practice because card counting allows players to bet more with less risk and to alter playing decisions based on the remaining cards.

> Nature practice 1. Apple picking is an activity found at apple farms where people pick apples off the trees. Apple orchards may be opened to the public, allowing consumers to pick their own apples or purchase pre-picked apples.

> Nature practice 2. A campfire is a fire at a campsite that provides light and warmth, and heat for cooking. It can also serve as a beacon, and an insect and predator deterrent. Campfires are a popular feature of camping, but they can also pose a danger to the surrounding woods.

> Nature practice 3. Shelling is a practice that involves going to the beach, searching for seashells, and selecting interesting or unique seashells and taking them home as keepsakes.

> Religion practice 1. Shabbat is the Jewish day of rest and the seventh day of the week. Observant Jews typically do not work on this day of the week and even minor work such as driving a car is technically prohibited. Nonetheless, some observant Jews do work on this day.

> Religion practice 2. In Islam, it is customary that the eating of pork is prohibited. This is noted in the Quran and the act of eating pork is considered unholy, particularly in religious places. Nonetheless, some observant Muslims do eat pork.

> Religion practice 3. In Hinduism, it is customary to wash one's hands and feet before and after eating. There are many reasons for this including promoting general hygiene and ensuring that disease is not spread to others. It is also considered an important part of religious purification although not all Hindus wash before eating at all times.

Participants rated each practice on the extent to which it involved playing God, involved

tampering with nature, involved a religious violation, involved a "human acting agentically with

intentional purpose," whether the outcome of the practice is typically determined by a

preexisting order or system, and whether the practice was morally acceptable or unacceptable. In

the case of the campfire participants evaluated letting the campfire set fire to a tree, and for the

religion practices, participants evaluated *failure* to observe the practice. Items were as follows:

Tampering with Nature

1. To what extent does a trader using HFT to profit involve tampering with nature?
2. To what extent does a player using HGH to recover quickly from injury involve tampering with nature?
3. To what extent does a gambler using card counting to win involve tampering with nature?
4. To what extent does a person picking apples to bring them home for eating involve tampering with nature?
5. To what extent does a person letting a campfire burn too long and setting fire to a tree involve tampering with nature?
6. To what extent does a person shelling to take seashells home involve tampering with nature?
7. To what extent does an observant Jew working on Shabbat involve tampering with nature?
8. To what extent does an observant Muslim eating pork inside a mosque involve tampering with nature?
9. To what extent does an observant Hindu eating without washing involve tampering with nature?

Religious violation

1. To what extent does a trader using HFT to profit involve a religious violation?
2. To what extent does a player using HGH to recover quickly from injury involve a religious violation?
3. To what extent does a gambler using card counting to win involve a religious violation?
4. To what extent does a person picking apples to bring them home for eating involve a religious violation?
5. To what extent does a person letting a campfire burn too long and setting fire to a tree involve a religious violation?
6. To what extent does a person shelling to take seashells home involve a religious violation?
7. To what extent does an observant Jew working on Shabbat involve a religious violation?
8. To what extent does an observant Muslim eating pork inside a mosque involve a religious violation?
9. To what extent does an observant Hindu eating without washing involve a religious violation?

Playing God

1. To what extent does a trader using HFT to profit involve playing God?
2. To what extent does a player using HGH to recover quickly from injury involve playing God?
3. To what extent does a gambler using card counting to win involve playing God?
4. To what extent does a person picking apples to bring them home for eating involve playing God?
5. To what extent does a person letting a campfire burn too long and setting fire to a tree involve playing God?
6. To what extent does a person shelling to take seashells home involve playing God?
7. To what extent does an observant Jew working on Shabbat involve playing God?
8. To what extent does an observant Muslim eating pork inside a mosque involve playing God?
9. To what extent does an observant Hindu eating without washing involve playing God?

Morality

1. To what extent is a trader using HFT to profit morally unacceptable/acceptable?
2. To what extent is a player using HGH to recover quickly from injury morally unacceptable/acceptable?
3. To what extent is a gambler using card counting to win morally unacceptable/acceptable?
4. To what extent is a person picking apples to bring them home for eating morally unacceptable/acceptable?
5. To what extent is a person letting a campfire burn too long and setting fire to a tree morally unacceptable/acceptable?
6. To what extent is a person shelling to take seashells home morally unacceptable/acceptable?
7. To what extent is an observant Jew working on Shabbat morally unacceptable/acceptable?
8. To what extent is an observant Muslim eating pork inside a mosque morally unacceptable/acceptable?
9. To what extent is an observant Hindu eating without washing morally unacceptable/acceptable?

Agency

1. To what extent is a trader using HFT to profit acting agentically with intentional purpose?
2. To what extent is a player using HGH to recover quickly from injury acting agentically with intentional purpose?
3. To what extent is a gambler using card counting to win acting agentically with intentional purpose?
4. To what extent is a person picking apples to bring them home for eating acting agentically with intentional purpose?
5. To what extent is a person letting a campfire burn too long and setting fire to a tree acting agentically with intentional purpose?
6. To what extent is a person shelling to take seashells home acting agentically with intentional purpose?
7. To what extent is an observant Jew working on Shabbat acting agentically with intentional purpose?
8. To what extent is an observant Muslim eating pork inside a mosque acting agentically with intentional purpose?
9. To what extent is an observant Hindu eating without washing acting agentically with intentional purpose?

System

1. Independent of this action, to what extent is there a preexisting order or system that determines the outcome of stock trading?
2. To what extent is there a preexisting order or system that determines the outcome of injury recovery?
3. To what extent is there a preexisting order or system that determines the outcome of casino card games?
4. Independent of this action, to what extent is there a preexisting order or system that determines the outcome of picking apples?
5. Independent of this action, to what extent is there a preexisting order or system that determines the outcome of how fire spreads?
6. To what extent is there a preexisting order or system that determines the outcome of removing seashells from the beach?
7. To what extent is there a preexisting order or system that determines the outcome of whether an observant Jew works on Shabbat?
8. To what extent is there a preexisting order or system that determines the outcome of whether an observant Muslim eats pork in the mosque?
9. To what extent is there a preexisting order or system that determines the outcome of whether an observant Hindu eats without washing?

All items were evaluated on 7-point scales and each characteristic was evaluated in a block, with order of practices randomized within block. We computed a composite score for each characteristic for each practice type to compare these constructs. All composites had reasonable reliability (αs>.63) except three: tampering with nature evaluations for the Playing God practices, and moral judgments and agency evaluations for the Nature practices. Conducting analyses below using individual practices from these composites reveals equivalent results, except where noted below.

Results

Validating our categorization scheme, we found the following patterns: People perceived Nature practices (*M*=4.28, *SD*=1.46) to involve more tampering with nature than Playing God practices (*M*=2.97, *SD*=1.27), *t*(171)=9.34, *p*<.001, *d*=1.01[3], or Religion practices (*M*=1.73, *SD*=1.07), *t*(171)=19.53, *p*<.001, *d*=2.14. People perceived Religion practices (*M*=5.86, *SD*=1.45) to involve more religious violation than Playing God practices (*M*=2.29, *SD*=1.61), *t*(171)=21.95, *p*<.001, *d*=2.37, or Nature practices (*M*=1.57, *SD*=1.08), *t*(171)=28.69, *p*<.001, *d*=3.11. People perceived Playing God practices (*M*=2.76, *SD*=1.68) to involve more playing God than Nature practices (*M*=1.78, *SD*=1.13), *t*(171)=8.72, *p*<.001, *d*=0.99, or Religion practices (*M*=2.01, *SD*=1.46), *t*(171)=5.46, *p*<.001, *d*=0.59.

We examined the relationship between perceptions of playing God and belief in God, religiosity, and political ideology. Belief in God was correlated with perceptions of playing God for Playing God practices (*r*(170)=.20, *p*<.01) and Religion practices, (*r*(170)=.29, *p*<.001) but not for Nature practices (*r*=.12, *p*=.11). Religiosity was correlated with playing God for Religion practices (*r*(170)=.24, *p*<.001), but not Playing God or Nature practices (*r*s<.13, *p*s>.11). Similarly, political conservatism was correlated with playing God for Religion practices (*r*(170)=.24, *p*=.002), but not Playing God or Nature practices (*r*s<.10, *p*s>.19). Thus, perceptions of playing God do not reduce simply to political or religious beliefs, and the largest effects of religious and political beliefs are in the domain of religion. We explore links between perceptions of playing God, belief in God, religiosity, and political ideology more thoroughly in subsequent studies.

People judged Playing God practices (*M*=3.33, *SD*=1.44) to be less morally acceptable

---

[3] However, participants rated a baseball player using HGH as involving playing God (*M*=4.99, *SD*=1.94) more than the Nature practices (as a composite), *t*(171)=4.23, *p*<.001, *d*=0.46, likely because it involved scientific intervention in the human body.

than Nature practices (M=5.23, SD=0.86), t(171)=15.28, p<.001, d=1.72[4], or Religion practices (M=4.38, SD=1.76), t(171)=6.74, p<.0001, d=0.74. Thus, the actions that people judged to involve playing God—not tampering with nature or violating religious principles—to the greatest extent were the actions that they judged to be the most morally wrong.

Interestingly, separate correlations for each practice type between playing God and moral acceptability revealed significant negative associations for Playing God practices and Nature practices (rs<-.16, ps≤.028)[5] but not for Religion practices (r=-.11, p=.15). For Religion practices, perceptions of a religious violation were significantly negatively correlated with moral acceptability (r(170)=-.18, p=.016) as was the case for Nature actions (r(172)=-.27, p<.001)[6], but not for Playing God actions (r=-.06, p=.46). Tampering with nature was associated negatively with moral acceptability for all practice types (rs<-.16, ps≤.035)[7]. Thus, for some domains playing God will play less of a role in moral judgment compared to other factors, a phenomenon we explore further in Study 8. Overall, however, these findings clearly link moral judgment to aversion to playing God.

Finally, to examine the link between playing God and the exercise of human agency perceived to be governed by a preexisting system or order, we compared across practice type the two variables examining perceptions of human agency and perceptions of a preexisting system.

---

[4] However, participants rated letting a campfire spread to the woods as less morally acceptable (M=2.89, SD=1.75) more than the Playing God practices (as a composite), t(171)=2.85, p=.005, d=0.30.

[5] However, the relationship between perceived playing God (as a composite) and moral judgment for the campfire scenario was non-significant, r=.02, p=.83.

[6] However, the relationship between perceived religions violation (as a composite) and moral judgment for the campfire scenario was non-significant, r=.12, p=.13.

[7] For the Nature practices, the relationship between perceived tampering with nature (as a composite) and moral judgment for the apple-picking scenario was non-significant, r=.10, p=.18. For the playing God practices, the relationship between the HGH item and moral judgment (as a composite) was marginally significant, r(170)=-.15, p=.053.

Importantly, people perceived Playing God practices (*M*=5.98, *SD*=1.39) to involve more human agency than Nature practices (*M*=4.98, *SD*=1.34), *t*(171)=12.09, *p*<.001, *d*=1.30, or Religion practices (*M*=5.27, *SD*=1.46), *t*(171)=7.78, *p*<.001, *d*=0.85. People also perceived outcomes of Playing God practices (*M*=4.50, *SD*=1.65) to be determined by preexisting systems more than the outcomes of Nature practices (*M*=3.33, *SD*=1.77), *t*(171)=9.41, *p*<.001, *d*=1.02, or Religion practices (*M*=3.88, *SD*=2.12), *t*(171)=3.41, *p*=.001, *d*=0.37. We also multiplied these two variables (human agency * preexisting system) for each practice type to compute a measure of perceived human agency *in* a domain governed by a preexisting system (αs>.71) and showed that this interaction measure is correlated with perceptions of playing God for Playing God practices (*r*(170)=.15, *p*=.043) and for Nature practices (*r*(170)=.18, *p*=.019) (but not for Religion practices, *r*=.09, *p*=.25). These results support our conceptualization of playing God as a perception of the exertion of human agency in a sphere deemed to be governed by a preexisting system or order.

In sum, this study supported the following three assertions: (1) Perceptions of playing God are distinct from perceptions of tampering with nature or religious violations. (2) Perceptions of playing God are linked to judgments of moral unacceptability. (3) Perceptions of playing God are linked to the perception of a practice involving human agency in a domain governed by a preexisting system or order.

Archival Study 1a

Archival Study 1a uses the 1993 (Sample A) and 1994 (Sample B) versions of General

Social Survey (GSS) [1] that included a question related to aversion to playing God and a set of

questions assessing attitudes toward science, and thus provide preliminary data on the

phenomenon in a large, nationally representative sample.

Method

Participants. Participants in the 1993 subsample (Sample A) consisted of 685 men and

921 women (N=1,606; M_{age}=46.05). Participants in the 1994 subsample (Sample B) consisted of

1,290 men and 1,702 women (N=2,992; M_{age}=45.97). Sample sizes for this study and Studies 1b

and 1c employed all available participants in the survey. For this study and Archival Studies 1b

and 1c, we analyzed data from all available survey participants.

Procedure. Data were drawn from the 1993 and 1994 GSS, a survey that uses

questionnaire items, with yearly variation in questions, downloaded from a public access

website: http://www3.norc.org/gss+website/. The item we used to measure aversion to playing

God was a single item included only in the years 1993 and 1994. This item consisted of a

statement, "Human beings should respect nature because it was created by God," presented with

five response options: 1=*strongly agree*, 2=*agree*, 3=*neither agree nor disagree*, 4=*disagree*,

5=*strongly disagree*. We identify this item as the aversion to playing God (APG) item.

Participants who, according to the GSS codebook, did not respond to the APG item on this five-

point scale (N=125 for Sample A, N=1672 for Sample B) were excluded, leaving 1,481

participants in Sample A and 1,320 participants in Sample B. These participants constitute our

samples in this study. Because some participants did not provide responses to additional specific

items, degrees of freedom differ across subsequent analyses. This was true for subsequent studies

as well. All dependent variables or measures that were analyzed for this article's target research question are reported in the methods section for this study and all subsequent studies.

In addition to the APG item, participants answered a series of questions about their negative attitudes and beliefs toward science (first two items below are reverse-scored):

> "How much confidence do you have in the scientific community?"
> (1=*A great deal*, 2=*Only some*, 3=*Hardly any*)

> "Modern science will solve our environmental problems with little change to our way of life"
> "We believe too often in science, and not enough in feelings and faith"
> "Overall, modern science does more harm than good"
> "Nature would be at peace and in harmony if only human beings would leave it alone"
> "Any change humans cause in nature - no matter how scientific - is likely to make things worse"
> (1=*strongly agree*, 5=*strongly disagree*)

> "All radioactivity is made by humans"
> "All man-made chemicals can cause cancer if you eat enough of them"
> "Human beings are the main cause of plant and animal species dying out"
> (1=*definitely true*, 4=*definitely not true*)

An exploratory factor analysis of these items in Sample A revealed that only one item ("Modern science will solve our environmental problems with little change to our way of life") loaded negatively onto the first factor that emerged (-.28) (in Sample B the same item emerged as the only item with a negative loading on the first factor=-.05). Standardizing and averaging all nine items produced a reliability of α=.56, but this value increased to α=.64 when eliminating the outlying item. We thus generated a composite score for negative attitudes toward science by averaging the remaining eight items (including the outlying item produced the same results). A more negative score indicates greater support for science (overall Sample A: *M*=-0.01, *SD*=0.57; overall Sample B: *M*=-0.009, *SD*=0.57).

Results

Sample A. First, to assess the prevalence of aversion to playing God, we examined frequencies of responses on the item measuring aversion to playing God (the APG item). A

significant majority of participants (76.6%) responded, "Strongly Agree" or "Agree" to the APG item, $z=20.42$, $p<.001$.

Second, we assessed whether aversion to playing God predicted attitudes toward science, by examining the correlation between the scientific attitudes composite and aversion to playing God, $r(1478)=.32$, $p<.001$ (see Table S1 for correlations with individual items from this Sample and Sample B; all were at least marginally significant). This positive correlation suggests that, as hypothesized, aversion to playing God is linked to unfavorable attitudes toward science.

Sample B. Using the same analyses as in Sample A, we found a significant majority (77.7%) responded, "Strongly agree" or "Agree" to the APG item, $z=20.07$, $p<.001$. Aversion to playing God correlated with the same composite of negative attitudes toward science as in Sample A ($\alpha=.69$), $r(1318)=.36$, $p<.001$.

To ensure that scientific attitudes were predicted by aversion to playing God, as measured by the APG item, over and above political ideology or belief in God, we assessed both of these variables. We assessed political ideology using an item asking participants where they would place themselves on a 7-point scale: 1=*Extremely liberal*, 2=*Liberal*, 3=*Slightly liberal*, 4=*Moderate, middle of the road*, 5=*Slightly conservative*, 6=*Conservative*, 7=*Extremely conservative*. Participants who, according to the GSS guidebook, did not provide a response on this 7-point scale (3.2% in Sample A, 3.3% in Sample B) could not be analyzed.

We assessed belief in God using a 6-point measure: 1=*I don't believe in God*, 2=*I don't know whether there is a God and I don't believe there is any way to find out*, 3=*I don't believe in a personal God, but I do believe in a Higher Power of some kind*, 4=*I find myself believing in God some of the times, but not at others*, 5=*While I have doubts, I feel that I do believe in God*, 6=*I know God really exists and I have no doubts about it*. Participants who, according to the GSS

guidebook did not provide a response on this 6-point scale (3.1% in Sample A, 3.3% in Sample B) could not be analyzed.

We also assessed religiosity using an item asking, "What is your religious preference," with response options: Protestant, Catholic, Jewish, None, and Other. Religious affiliation data for participants in the "Other" category were not included in the GSS dataset and cannot be identified by the GSS (GSS office, personal communication, February 4, 2013). Less than 1 % of respondents in Samples A and B provided a "don't know" response or did not answer and were excluded from analyses using this item.

Sample A Results. We assessed the relationship between aversion to playing God and two demographic variables: political ideology as well as belief in God. First, political views correlated with responses to the APG item: conservatism was associated with greater aversion to playing God, $r(1432)=-.15$, $p<.001$. Despite this association, correlations between aversion to playing God and the composite reflecting scientific attitudes remained significant, when controlling for political views, $r(1429)=.33$, $p<.001$.

Second, similar correlational analyses indicated belief in God and responses to the APG item were highly correlated, $r(1433)=-.43$, $p<.001$, such that the more people believed in God, the more they expressed an aversion to playing God. We also conducted the same correlational analyses between aversion to playing God and the scientific attitude composite, controlling for belief in God and the association remained significant, $r(1429)=.27$, $p<.001$.

Finally, we conducted exploratory analyses assessing aversion to playing God across different levels of belief in God and across different religious affiliations. We first examined aversion to playing God (as above, coded "1" for some or strong agreement; otherwise "0") at all response levels of the GSS item assessing "belief in God" by conducting binomial tests.

Proportions of the sample that scored "1", "2", "3", "4", "5", and "6" on the belief in God measure were, respectively, 2.9%, 3.9%, 8.1%, 3.2%, 14.2%, and 64.6%. Significantly more than half of respondents who scored a "4" (66%), "5" (65%), or "6" (88%) on belief in God expressed some or strong agreement with the APG item ($z=2.04$, $p<.05$; $z=4.27$, $p<.001$; $z=23.45$, $p<.001$, respectively). About half of respondents who scored a "1" (49%, $p=1$) and respondents who scored a "3" (48%, $p=.78$) on belief in God expressed some or strong agreement with the APG item. Significantly more than half of respondents who indicated a "2" (78%) on belief in God expressed *no* aversion to playing God, $z=4.07$, $p<.001$. These results indicate that at least some people who express weak or no belief in God nevertheless report being averse to playing God. Using religious affiliation as a measure of religiosity, we coded people who indicated Protestant (64.0% of sample), Catholic (22.1% of sample), "Other" (2.4% of sample), or Jewish (2.1% of sample), as religious and participants who answered "None" (9.0% of sample) as nonreligious (again, excluding participants who reported "don't know" or no answer). T-tests on the APG item and the scientific attitude composite revealed significant differences. Religious participants reported significantly less favorable attitudes toward science than non-religious participants ($M=-0.02$, $SD=0.56$ vs. $M=0.09$, $SD=0.60$), $t(1472)=2.12$, $p=.034$, $d=0.11$, and also reported more aversion to playing God as well, ($M=2.00$, $SD=0.86$ vs. $M=2.84$, $SD=1.21$; lower scores indicate greater aversion), $t(1472)=10.33$, $p<.001$, $d=0.54$. These results suggest a role for religion in aversion to playing God, but also demonstrate that even amongst non-religious people, aversion to playing God is present. Non-religious people's responses on the APG item were lower than the mid-point of the scale, "3," indicating more agreement than disagreement with aversion to playing God.

Sample B Results. Aversion to playing God was correlated with political ideology, $r(1274)=-.09$, $p<.01$, such that greater conservatism was again associated with greater aversion to playing God. Importantly, the correlation between aversion to playing God and the composite of scientific attitudes remained significant when controlling for political views, $r(1271)=.36$, $p<.001$. Aversion to playing God was correlated with belief in God, $r(1274)=-.40$, $p<.001$), as in Sample A. Nonetheless, the correlation between aversion to playing God and the composite of scientific attitudes remained significant when controlling for belief in God, $r(1271)=.32$, $p<.001$.

As with Sample A, we conducted binomial tests at different levels of strength of belief in God. Proportions of the sample that scored "1", "2", "3", "4", "5", and "6" on the belief in God measure were, respectively, 2.3%, 2.8%, 9.2%, 3.6%, 15.8%, and 62.9%. Significantly more than half of respondents who scored a "5" (66%) or "6" (89%), expressed some or strong agreement with the APG item ($z=4.51$, $p<.001$; $z=22.39$, $p<.001$, respectively). Approximately half of respondents who scored a "1," "2," "3," or "4" (35%, $p=.15$; 49%, $p=1$; 48%, $p=.79$; 60%, $p=.19$, respectively) expressed some or strong agreement with the APG item. Thus, sample B, like sample A, provides evidence that aversion to playing God exists in some proportion of non-believers.

As in Sample A, using religious affiliation as a measure of religiosity, we coded people who indicated Protestant (59.4% of sample), Catholic (25.1% of sample), "Other" (3.6% of sample), or Jewish (8.9% of sample), as religious and participants who answered "None" (9.0% of sample) as nonreligious (again, excluding participants who reported "don't know" or no answer). T-tests on the APG item and the scientific attitude composite revealed similar results to Sample A. Religious participants reported significantly less favorable attitudes toward science than non-religious participants ($M=-0.02$, $SD=0.57$ vs. $M=0.13$, $SD=0.63$), $t(1315)=2.74$, $p=.006$,

d=0.14, and reported more aversion to playing God as well, (*M*=1.99, *SD*=0.88 vs. *M*=2.65, *SD*=1.18), *t*(1315)=7.48, *p*<.001, *d*=0.41. As with Sample A, these results suggest a role for religion in aversion to playing God, but also demonstrate that even amongst non-religious people, aversion to playing God is not absent. Again, non-religious people's responses on the APG item were lower than the mid-point of the scale, "3," indicating more agreement than disagreement with aversion to playing God, and their responses differed significantly from this mid-point, *t*(116)=3.22, *p*=.002, *d*=0.30.

Archival Study 1b

Archival Study 1b assessed data from 1997 (Sample A) and 2001 (Sample B) CNN/Time Magazine polls [2-3] administered to a representative sample of Americans that focused on cloning and other topics. These polls included two items in 1997 and one in 2001 that assessed aversion to cloning for reasons related to aversion to playing God as well as items reflecting attitudes toward cloning more generally.

Method

Participants. Participants in Sample A included 500 men and 505 women with the following age distribution (age was assessed categorically): 18-24 (10.0%), 25-29 (11.0%), 30-34 (12.2%), 35-39 (12.2%), 40-49 (19.9%), 50-64 (18.9%), 65+ (13.6%), and 2.1% who refused to respond. Participants in Sample B included 508 men and 507 women with the following age distribution: 18-24 (12.2%), 25-29 (9.0%), 30-34 (9.5%), 35-39 (10.7%), 40-49 (20.0%), 50-64 (20.7%), 65+ (16.0%), and 2.0% who refused to respond.

Procedure. We assessed aversion to playing God through two items in Sample A, one asking, "Do you think it is against God's will to clone animals such as sheep, or don't you feel

that way?" and one asking, "Do you think it is against God's will to clone human beings, or don't you feel this way?" Response options for both items were "Yes" (coded as 1), "No" (coded as 0), and "Not Sure" (excluded from analysis), and thus our sample for analysis consisted of 966 people who responded "Yes" or "No" to at least one of these questions. For each participant, to produce a composite score of aversion to playing God we averaged their two responses, which were correlated with each other $r(890)=.45$, $p<.001$ (correlation reflects only participants who had responses to both items, but analyses include participants who only had responses to one item). For Sample B, only the second item was administered, and this constituted our measure of aversion to playing God.

To assess general attitudes toward cloning in Sample A, we standardized and averaged the following 12 items ($\alpha=.84$) to produce a composite (response options and our coding of these options follows each item):

"In general, do you think is a good or a bad idea to clone animals such as sheep?" (1=*Good idea*, 0=*Bad idea*, Excluded: *Not sure*)

"Do you think that it is morally acceptable to clone animals such as sheep, or don't you feel that way?" (1=*Yes*, 0=*No*, Excluded: *Not sure*)

"As you may know, scientists might one day be able to identify animals such as sheep, chickens, cows, and pigs which grow the fastest on the least amount of food and clone them in order to create large flocks of genetically identical animals, which would be less expensive for farmers to raise. Would you consider this a positive or a negative discovery?" (2=*Positive Discovery*, 0=*Negative Discovery*, 1=*Some of Both*, 1=*Neither*, Excluded: *Not sure*)

"Do you think you would or would not eat vegetables and fruits that are clones?" (1=*Would eat*, 0=*Would not eat*, Excluded=*Not sure*)

"Do you think you would or would not eat meat from animals that are clones?" (1=Would eat, 0=Would not eat, Excluded=*Don't Eat Meat, Not sure*)

"Which do you think is more likely--that the new cloning techniques will help solve some of the problems that the world faces, or that cloning will create more problems than it solves?" (1=*Will solve problems*, 0=*Will create more problems than it solves*, Excluded=*Not sure*)

"In general, do you think it is a good idea or a bad idea to clone human beings?" (1=*Good thing*, 0=*Bad thing*, Excluded: *Not sure*)
"Do you think that it is morally acceptable to clone human beings, or don't you feel this way?" (1=*Yes*, 0=*No*, Excluded: *Not sure*)

"In general, would you consider it a good idea or a bad idea to clone not whole human beings, but body parts or vital organs for transplants that are needed as a result of accidents or disease?" (1=*Good thing*, 0=*Bad thing*, Excluded: *Not sure*)

"Do you think you would or would not take part in a demonstration against the cloning of human beings?" (1=*Would not*, 0=*Would*, Excluded: *Not sure*)

"In general, does the prospect of cloning human beings scare you, or not?" (1=*Does not scare*, 0=*Scares*, Excluded: *Not sure*)

"If you had the chance, would you clone yourself, or, wouldn't you do that?" (1=*Would clone*, 0=*Wouldn't do that*, Excluded: *Not sure*)

To assess general attitudes toward cloning in Sample B, we standardized and averaged

the following 17 items (α=.84) to produce a composite (response options and our coding of these

options follows each item):

"Do you think is a good or a bad idea to clone animals such as sheep?"
"In general, do you think it is a good idea or a bad idea to clone human beings?"
(1=*Good idea*, 0=*Bad idea*, Excluded: *Not sure*)

"Do you think each of the following justifies creating a human clone or don't you think so?
    …To save the life of the person who is being cloned?"
    …To help infertile couples to have children without having to adopt"
    …To produce copies of humans whose vital organs can be used to save the lives of others"
    …To create genetically superior human beings"
    …To allow parents to have a twin child at a later date if they wanted to"
    …To allow parents who have lost a child to create a clone of the child they lost"
    …To allow gay couples to have children using only their own genes"
(1=*Justifies*, 0=*Does not justify*, Excluded: *Not sure*)

"Do you think scientists should be allowed to clone human beings or don't you think so?"
(1=*Should be allowed*, 0=*Should not be allowed*, Excluded: *Not sure*)

"If scientists could clone the following people, do you think they should do so?
    …Albert Einstein
    …Michael Jordan
    …Beethoven
    …Abraham Lincoln
    …Isaac Newton
    …Humphrey Bogart
(1=*Yes*, 0=*No*, Excluded: *Not Sure*)

"If you had the chance, would you clone yourself, or, wouldn't you do that?" (1=*Would*, 0=*Would not*, Excluded: *Not sure*)

A more positive score on these composites reflects more favorable attitudes toward cloning

(overall Sample A: *M*=0.007, *SD*=0.60; overall Sample B: *M*=0.007, *SD*=0.66).

Results

Sample A. As predicted, a negative association emerged between aversion to playing God in the context of cloning and favorable attitudes toward cloning, $r(964)=-.56$, $p<.001$, and aversion to playing God in cloning was negatively correlated with each item individually (rs<-.13, ps<.001; See Table S2 for individual correlations), including those items that did not specifically pertain to animals or humans. Critically, we also examined below the relationships among aversion to playing God, religious affiliation, political party, and religiosity, demonstrating that religion and political affiliation did not fully account for these results.

Sample B. As in Sample A, a negative association emerged between aversion to playing God in the context of cloning and favorable attitudes toward cloning, $r(930)=-.34$, $p<.001$. Also, as in Sample A, aversion to playing God was correlated with each item individually (rs<-.13, ps<.001; See Table S3 for correlations with individual items).

To assess the impact of religion in Sample A, we inspected two items. One asked people to indicate their religious affiliation; only 47 of the 967 people who responded to this item indicated no religion. We thus turned to a more fine-grained measure of religiosity, a question asking people, "How often do you attend church or synagogue?" with response options (1) Never at all, (2) A few times a year, (3) Once or twice a month, (4) Every week/nearly every week (participants who indicated "Not sure" were excluded from this analysis). Aversion to playing God and religious attendance were not significantly correlated ($r=-.03$, $p=.31$), suggesting that degree of religiosity did not necessarily account for the pattern of that emerged. No significant association emerged between religious attendance and support for cloning either ($r=.02$, $p=.59$). The survey for Sample B did not include items pertaining to religion.

To assess the influence of political ideology in Samples A and B, we relied on two items. The first was a question asking people, "Are you Democrat, Republican, or Independent?" Using a t-test to examine only participants who indicated Democrat or Republican (as in the previous study), we found no significant effect of party on aversion to playing God in Sample A (t=1.12, p=.26). However, a significant difference emerged for cloning such that Republicans expressed more support overall than Democrats, $t(601)$=1.96, p=.051, d=0.16. In Sample B, Republicans (M=0.79, SD=0.41) reported significantly greater aversion to playing God than Democrats (M=0.70, SD=0.46), $t(575)$=2.37, p=.018, d=.20. Interestingly, unlike Sample A, Republicans in Sample B (M=-0.06, SD=0.60) reported marginally *less* support for cloning than Democrats (M=0.03, SD=0.67), $t(629)$=1.80, p=.072, d=0.14.

The second item was a question asking people who had indicated their party as Independent on the previous question, "Do you feel closer to the Democratic Party or the Republican Party?" (we excluded participants from this analysis who indicated "Neither Party," "Other," or "Not Sure"). A t-test comparing aversion to playing God between Democrats and Republicans on this measure revealed no significant difference in Sample A (t=0.10, p=.92) or Sample B (t=1.59, p=.11). A comparable t-test comparing support for cloning between Democrats and Republicans on this measure revealed no significant difference in Sample A (t=0.83, p=.40) or Sample B (t=0.41, p=.69). These findings indicate that political ideology is not necessarily driving the association between aversion to playing God and negative attitudes toward cloning despite some tendency for Republicans in Sample B to express greater aversion.

Archival Study 1c

Archival Study 1c examined data from the 2002 Public Awareness and Attitudes about Reproductive Genetic Technology Survey, administered by the Genetics and Public Policy Center [4]. This survey, administered to a representative sample of Americans, assessed attitudes toward genetic technology broadly and included a question narrowly targeting concern about this technology as a form of playing God.

Method

Participants. Participants in this sample included 570 men and 641 women (M_{age}=47.07).

Procedure. The key item participants read was, "When you think about these topics [concerning reproductive genetic technology], which of the following, if any, WORRIES you the MOST," with single-response options: (1) That using these technologies is too much like playing GOD, (2) That the technologies are too new to be used SAFELY, (3) That most people will not be able to AFFORD these technologies, (4) That the technologies can easily be used for the wrong PURPOSES, (5) Or, don't you worry about any of these? (capitalization was in the survey). We transformed this item into a categorical variable by classifying respondents who indicated that technology is too much like playing God as our *APG participants* and respondents who indicated reasons 2-4 as *other-worry participants*. We excluded people who stated they do not worry about any of these or indicated "it depends," "don't know," or a refusal to answer (*N*=189). Our final sample then comprised 1,022 individuals—399 APG participants, and 623 other-worry participants. This approach allowed us to conduct a conservative test of whether aversion to playing God predicts general negative attitudes toward genetic science and technology; in particular, we predicted that those who worry about playing God in particular would report more negative attitudes than those with other worries.

To assess negative attitudes toward genetic science and technology, we used twelve items that assessed participants' basic approval/disapproval toward different practices. We did not include additional items in the survey that assessed attitudes toward governmental regulation because these items could have reflected attitudes toward the government rather than science and technology per se. Items, each containing response options "Approve" (coded 1), "Disapprove" (coded 0), Don't know (excluded), or Refused (excluded), were as follows:

"In general, do you approve or disapprove of the use of genetic testing during pregnancy to find out whether the baby will develop a serious genetic disease?"
"Do you approve or disapprove of the use of genetic testing during pregnancy to find out whether the baby will have desirable characteristics such as strength or high intelligence?"
"In general, do you approve or disapprove of the use of in vitro fertilization?"
"Would you approve or disapprove if parents were offered a way to use P-G-D [preimplantation genetic diagnosis] to…
        …Choose the sex of their child."
        … Make sure their baby does NOT have a serious genetic disease."
        … Make sure their baby has desirable characteristics such as high intelligence and strength."
        … Make sure their baby does NOT have a tendency to develop a disease like cancer when he or she is an adult."
        … Make sure their baby would be a good match to donate his or her blood or tissue to a brother or sister who is sick and needs a transplant."
"Would you approve or disapprove if parents were offered a way to change their OWN genes in order to have children who would be smarter, stronger, or better looking?"
"Would you approve or disapprove if parents were offered a way to change their OWN genes in order to prevent their children from having a genetic disease?"
"Do you approve or disapprove of scientists working on ways to clone animals?"
"Do you approve or disapprove of scientists working on ways to clone humans?"

These items were averaged to constitute a composite score of approval of genetic technology (α=.83). Positive scores suggest greater approval (overall sample: M=0.48, SD=0.26).

Results

We again observed that many people reported an aversion to playing God. Thirty-nine percent of people reported this concern, rendering it the second-most reported concern and statistically indistinguishable from the most-reported concern (44.4% of people stated "that these technologies can be used for the wrong purposes," 8.8% stated, "That the technologies are too

new to be used SAFELY," 7.7% stated "that most people will not be able to AFFORD these technologies").

Next, we examined the binary categorization of participants as APG participants or other-worry participants. A t-test comparing approval of this technology between APG participants (*M*=.36, *SD*=.24) and other-worry participants (*M*=.55, *SD*=.25) demonstrated that participants who expressed concern over genetic issues because of aversion to playing God indicated significantly less approval of genetic technology than participants who expressed concern for other reasons, $t(1020)=12.20$, $p<.001$, $d=.76$ (see Table S4 for individual t-tests).

Next, we turned to examining religious beliefs and political ideology. The one item about religion asked participants to categorize themselves as Protestant, Catholic, Jewish, Orthodox Christian, Muslim/Islam, Buddhism/Hindu, other religion, or No religion/Atheist/Agnostic. Excluding 14 people who indicated Don't Know/Refused, we categorized people into either non-religious if they responded "No religion/Atheist/Agnostic" or religious if they gave any other response. We first examined whether aversion to playing God differs across religiosity by examining a 2 (participant category: APG participants vs. other-worry participants) X 2 (religiosity: non-religious vs. religious) table using a chi-square analysis. This analysis showed that although religious individuals and non-religious individuals revealed a similar pattern, a greater proportion of religious individuals expressed concern over playing God (41.4%) than non-religious individuals did (17.5%), $\chi^2(1)=22.32$, $p<.001$, $\phi=.15$. Thus, we examined whether religiosity might account for the effect of aversion to playing God on disapproval toward genetic technology. We conducted a 2 (participant category: APG participants vs. other-worry participants) X 2 (religiosity: non-religious vs. religious) ANOVA on concern over genetic issues revealed only two main effects, the effect of participant category that mimicked the t-test

analysis, $F(1, 1004)=31.47$, $p<.001$, $\eta_p^2=.03$, and a smaller effect of religiosity, $F(1, 1004)=3.80$, $p=.052$, $\eta_p^2=.004$, such that religious participants ($M=.46$, $SD=.26$) indicated lower support for genetic technology than non-religious participants ($M=.57$, $SD=.28$). Most important, no interaction emerged ($F=0.015$, $p=.90$), suggesting that aversion to playing God was associated with less approval of genetic technology regardless of religiosity.

To assess whether aversion to playing God varied by political ideology, we examined responses from an item asking participants to indicate their political party (Republican, Democrat, or Independent). Because we were interested in clear liberal-conservative differences in aversion to playing God, we excluded individuals who indicated "Independent" or any other response. A 2 (participant category: APG participants vs. other-worry participants) X 2 (party: Democrat vs. Republican) chi-square analysis revealed no significant difference ($\chi^2(1)=1.94$, $p=.16$), with similar numbers of individuals expressing aversion to playing God amongst Democrats (39.1%) and Republicans (44.6%). Thus, political party does not necessarily seem to be driving these results.

Analyses of religion and politics, Study 1

Political ideology did not predict moral acceptability judgments ($r=-.06$, $p=.57$), but conservatism increased perceptions of playing God, $r(79)=.25$, $p=.024$. Religiosity did not predict perceptions of playing God ($r=.03$, $p=.79$) or moral acceptability ($r=-.13$, $p=.25$). Belief in God did not predict perceptions of playing god ($r=.18$, $p=.12$) but did predict reduced moral acceptability, $r(79)=-.27$, $p=.015$. Thus, these factors do not appear necessarily to account for the relationship between perceptions of playing God and moral judgments.

Scientific practices evaluated, Study 2

- Genetic testing during pregnancy to find out whether the baby will develop a serious genetic disease
- Genetic testing during pregnancy to find out whether the baby will have desirable characteristics such as strength or high intelligence
- In vitro fertilization (combining eggs and sperm outside the body in a laboratory)
- Using P-G-D [preimplantation genetic diagnosis] to choose the sex of one's child
- Using P-G-D [preimplantation genetic diagnosis] to make sure one's baby does not have a genetic disease
- Using P-G-D [preimplantation genetic diagnosis] to make sure one's baby has desirable characteristics such as high intelligence and strength
- Using P-G-D [preimplantation genetic diagnosis] to make sure one's baby does NOT have a tendency to develop a disease like cancer as an adult
- Using P-G-D [preimplantation genetic diagnosis] to make sure one's baby would be a good match to donate his or her blood or tissue to a brother or sister who is sick and needs a transplant
- Parents employing procedures on their OWN genes in order to have children who would be smarter, stronger, or better looking
- Parents employing procedures on their OWN genes in order to prevent their children from having a genetic disease
- Cloning animals such as sheep for scientific purposes
- Cloning humans
- Creating large flocks of genetically identical animals, which would be less expensive for farmers to raise
- Cloning fruits and vegetables
- Cloning specific body parts or vital organs for transplants that are needed as a result of accidents or disease
- Producing meat from cloned animals
- Developing technology that produces radioactive substances
- Producing human-made chemicals such as pesticides, herbicides, and insecticides
- Environmental practices that cause plants and animals to die out

Analyses of religion and politics, Study 2

We examined the relationships among aversion to playing God, moral acceptability, political ideology, religiosity, and belief in God as in Study 2. Both religiosity and belief in God were significantly and positively related to perceptions of playing God for all issues (rs>.12, ps<.02). Both variables were negatively related to moral acceptability of GMOs and vaccines (rs<-.15, ps≤.003), but unrelated to moral acceptability for global warming or drone warfare (ps>.24). Meanwhile, political ideology was significantly related only to perceptions of playing God for GMOs (r(363)=.15, p=.003) and vaccines (r(363)=.18, p<.001) such that conservatism was

related to increased perceptions of playing God for both (other issues, $ps>.34$). Political ideology

was also related to moral judgment of every issue, albeit inconsistently: conservatism was

positively related to moral acceptability for drone warfare ($r(363)=.16$, $p=.002$) and global

warming ($r(363)=.21$, $p<.001$), whereas it was negatively related to moral acceptability for

GMOs ($r(363)=-.17$, $p=.001$) and vaccination ($r(363)=-.13$, $p=.012$). Importantly, all correlations

between playing God and moral unacceptability remained significant ($p\leq.001$) simultaneously or

separately controlling for belief in God, religiosity, and political ideology (see Table S5 for

standardized betas from multiple regressions).

Allocation task, Study 3

We would like you to play the role of a politician tasked with how to divide up 100 billion dollars in the next U.S. budget. Below, are various agencies that you need to divide up the $100 billion between. For each agency, move the slider to indicate how many billions of dollars you want to devote to it. Your choices must sum to 100 (representing $100 billion).

Department of Labor (responsible for occupational safety, wage and hour standards, etc.)
National Science Foundation (supports all research in biological, physical, and other sciences)
Department of Defense (responsible for national security and armed forces)
Federal Prison System (the system handling prisons and prisoners)
Patent and Trademark Office (issues patents and trademarks for intellectual property)
Library of Congress (national library of the U.S.)
United States Agency for International Development (responsible for administering civilian foreign aid)
Housing and Urban Development (develops policies on housing and urban problems)
Securities and Exchange Commission (regulates the financial system)

Analyses of religion and politics, Study 3

APG was again significantly correlated with political conservatism ($r(302)=.46$, $p<.001$),

belief in God ($r(302)=.72$, $p<.001$), and religiosity ($r(302)=.69$, $p<.001$). In addition, belief in

God and religiosity significantly predicted reduced funding toward the NSF ($rs>.17$, $ps\leq.003$),

whereas political ideology did not, $r=-.09$, $p=.13$. Nonetheless, when simultaneously or

separately controlling for belief in God, religiosity, and political ideology, APG continued to

predict NSF funding negatively and significantly (ps<.001) (see Table S5 for standardized betas from multiple regression).

The effect of APG on funding the Department of Defense and on funding the Federal Prison System, however, were reduced to non-significance when controlling for political ideology, belief in God, and religiosity simultaneously (ps>.54) (see Table S5 for standardized betas from multiple regression). Controlling for religiosity and belief in God separately did not reduce the effect of APG on Department of Defense funding (β=.13, $t(301)$=1.71, p=.088; β=.13, $t(301)$=1.71, p=.088), although controlling for political ideology separately did (β=.04, p=.52). Controlling for these variables separately reduced the effect of APG on Federal Prison System funding to non-significance (βs=.10, ps>.13).

Allocation task, Study 4

In this study, we are giving everybody a $.30 bonus, and here we would like to give you the opportunity to allocate that money to various organizations or to yourself. In particular, we would like you to choose whether to allocate any of that money (in cents) to two different organizations, The National Stem Cell Foundation or Cure Violence.

The National Stem Cell Foundation supports peer reviewed biomedical research in the field of adult stem cell transplantation. Adult stem cells have the potential to repair or regenerate damaged tissue and create a paradigm shift in science.

Cure Violence stops the spread of violence in communities by using the methods and strategies associated with disease control – detecting and interrupting conflicts, identifying and treating the highest risk individuals, and changing social norms.

Divide up your 30 cents between these two foundations and yourself however you like. Whatever you allocate to the two organizations we will donate, and whatever you allocate to yourself, we will distribute to you via bonus on MTurk. The sum of your allocations must total 30 cents.

Analyses of religion and politics, Study 4

APG was significantly correlated with political conservatism ($r(273)$=.32, p<.001), belief in God ($r(273)$=.72, p<.001), and religiosity ($r(273)$=.59, p<.001). Belief in God and religiosity

did not significantly predict donations to stem cell research ($ps > .83$) although political ideology

did, $\beta = -.12$, $t(273) = 1.96$, $p = .052$. Importantly, APG remained a significant negative predictor of

stem cell research donations when simultaneously controlling for belief in God, religiosity,

ideology and when separately controlling for belief in God and religiosity (see Table S5 for

standardized betas from multiple regression). However, regressing stem cell research donations

on ideology and APG as predictor variables revealed non-significant effects of both APG ($\beta = -$

.10, $p = .11$) and political ideology ($\beta = -.08$, $p = .18$).

Allocation task, Study 5

In this study, we are giving everybody $.30 to allocate that money to various organizations. In particular, we would like you to choose how to allocate money (in cents) to two different organizations that aim to reduce Vitamin A deficiency and hunger, the International Rice Research Institute and Helen Keller International

The International Rice Research Institute aims to reduce poverty and hunger, improve the health of rice farmers and consumers, and ensure environmental sustainability of rice farming. They have focused on producing "golden rice," a genetically modified variety of rice. Geneticists insert a gene into the rice plant that allows it to produce beta carotene, and experts believe this rice will be the key to solving hunger and that it is more effective than Vitamin A supplements.

Helen Keller International partners with governments, the private sector and other charities throughout Africa and Asia to ensure that health systems include vitamin A supplements as part of regular wellness practices for impoverished communities.

Of note, in June 2016, 107 Nobel Laureates signed a petition urging an end to opposition over Golden Rice, suggesting that Golden Rice "has the potential to reduce or eliminate much of the death and disease caused by a vitamin A deficiency (VAD), which has the greatest impact on the poorest people in Africa and Southeast Asia."

Divide up your 30 cents between these two foundations any way you like. Whatever you allocate to the two organizations we will donate. The sum of your allocations must total 30 cents.

Analyses of religion and politics, Study 5

APG was significantly correlated with political conservatism ($r(304) = .38$, $p < .001$), belief

in God ($r(304) = .75$, $p < .001$), and religiosity ($r(304) = .67$, $p < .001$). Political ideology and

religiosity did not significantly predict the donations difference ($ps > .11$) although belief in God

did, $ß=-.13$, $t(304)=2.29$, $p=.022$. However, regressing donation difference on both belief in God and APG revealed non-significant effects of both APG ($ß=-.08$, $p=.36$) and belief in God ($ß=-.07$, $p=.40$).

These results indicate that political ideology, religiosity, or belief in God cannot account for the association between APG and donation difference, yet for completeness we conducted all individual and simultaneous regressions as in the previous study. APG remained a marginal predictor of donation difference when also controlling for religiosity, $ß=-.13$, $t(303)=1.71$, $p=.09$, and a significant predictor when controlling separately for political ideology, $ß=-.14$, $t(303)=2.35$, $p=.019$. Controlling for belief in God, religiosity, and political ideology simultaneously reduces the effect of APG on donation difference to non-significance, but all other predictors emerge as non-significant as well ($ps>.28$) (see Table S5 for standardized betas from multiple regression). Thus, again, these factors do not account for donation difference over and above the influence of APG.

Scientific practices, Study 6a

In this study, we would like you to evaluate two different practices that have emerged in medicine and science. We want you to evaluate these practices without giving detail about their specific purpose and implementation. One is more well-established, one is more novel.

Practice A is a procedure that is widely used in the scientific and medical community and has been approved by the government for 60 years. Essentially, this procedure is used to manipulate cellular processes within the human body and has broad implications pertaining to the birth, growth, and death of human beings. This practice is well-established and can create fundamental changes to humans' lives. Its risks are well-established as well, and it is the standard practice in place for this type of issue.

Practice B is a novel procedure that has yet to be implemented in the scientific and medical community, and was just recently approved by the government. This procedure is also used to manipulate cellular processes within the human body and has broad implications pertaining to the birth, growth, and death of human beings. This practice is completely brand new and can also create fundamental changes to humans' lives. It has the possibility of replacing the standard practice already in place for this type of issue because of its ability to improve on the risks of Practice A.

Mediation analyses, Study 6a

To determine whether the difference in perceptions of playing God mediated the effect of practice on moral acceptability, we conducted analyses, following the steps outlined by Judd, Kenny, and McClelland [5] for within-subjects mediation. For both the playing God judgment and the moral acceptability judgment, we computed an "novel practice"-minus-established practice" difference score, and confirmed that the difference score for the playing God judgment correlated with the difference score for moral acceptability, ($r(492)$=-.32, p<.001). We then computed the centered sum score for playing God and regressed the difference score for moral acceptability on the difference score and centered sum score for playing God. The significant -.29 slope ($t(491)$=7.58, p<.001) combined with the .10 intercept ($t(491)$=2.90, p=.004) indicates partial mediation. The slope for the centered sum score (-.01) was non-significant (p=.24), suggesting no moderation by the level of the mediating variable. In addition, using the MEMORE macro in SPSS [6] (percentile bootstrap; 20,000 resamples) reveals a significant indirect effect (95% confidence interval=0.04 to 0.12), suggesting mediation as well. In sum, participants judged the novel practice to be less morally acceptable than the established practice because they perceived the novel practice to involve more playing God.

Analyses of religion and politics, Study 6a

APG was significantly correlated with political conservatism ($r(492)$=.38, p<.001), belief in God ($r(492)$=.70, p<.001), and religiosity ($r(492)$=.63, p<.001). In addition, conservatism, belief in God, and religiosity predicted moral unacceptability for both practices (rs<-.21, ps<.001). Nonetheless, when simultaneously or separately controlling for belief in God,

religiosity, and political ideology, APG continued to predict moral unacceptability for both

practices significantly (ps<.001) (see Table S5 for standardized betas from multiple regression).

Practices in legal condition, Study 6b

In this study, we would like you to evaluate two different practices that have emerged in the justice system. We want you to evaluate these practices without giving detail about their specific purpose and implementation. One is more well-established, one is more novel.

Practice A is a procedure that has been approved by the government for 60 years. This procedure is used to sentence drug offenders, which ultimately affects the criminal justice system and the economy. This practice is well-established and can create fundamental changes to the lives of drug offenders and citizens who incur the costs of incarceration. Its risks are well-established, and it is the standard practice in place for this type of issue.

Practice B is a novel procedure that was just recently approved by the government. This procedure is used to sentence drug offenders, which ultimately affects the criminal justice system and the economy. This practice is brand new and can create fundamental changes to the lives of drug offenders and citizens who incur the costs of incarceration. It has the possibility of replacing the standard practice already in place for this type of issue because of its ability to improve on the risks of Practice A.

Analyses of belief in natural order, Study 6b

We examined the influence of belief in natural order on perceptions of playing God and

moral judgment. Belief in natural order predicted perceptions of playing God for both novel and

established practices in both the science and legal domain (βs>.17, ps<.001). We compared these

effects between conditions by regressing the playing God rating on condition (1=science,

0=legal), belief in natural order, and the product of condition X belief in natural order, and for

both practices, the association between belief in natural order and perceptions of playing God

was stronger in the science condition than in the legal condition, βs>.27, ts>2.79, ps$\leq$.005. Belief

in natural order also predicted moral unacceptability for both practices in the science domain,

βs<-.26, ts>5.89, ps<.001, but did not significantly predict moral judgment in the legal condition

(βs<.08, ps>.10). In addition, when simultaneously or separately controlling for belief in God,

religiosity, and political ideology, belief in natural order remained a significant predictor of

playing God (βs>.21, ps$\leq$.001) and moral unacceptability (βs<.16, ps$\leq$.001) in the science condition. These findings demonstrate that belief in a natural order contributes to judgments of playing God, and again these findings suggest a tighter link between perceptions of playing God in the science domain than in the legal domain.

Mediation analyses, Study 6b

To determine whether the difference in perceptions of playing God mediated the effect of condition on differences in moral acceptability, we computed difference scores for playing God, moral acceptability, and then used bootstrapping mediation analysis using the SPSS PROCESS macro [7] (bias-corrected, 20,000 resamples). This analysis revealed that condition (science versus legal domain: coded 1 and 0, respectively) indirectly affected people's differing judgments of moral acceptability for novel versus established practices through differences in perceptions of playing God (95% confidence interval=.0025 to 0.13).

We also examined whether perceptions of playing God mediated the effect of practice on moral judgment in the science condition only to compare results with Study 6a. We first used Judd, Kenny, and McClelland's method [5] for within-subjects mediation. We confirmed that the difference score for the playing God judgment correlated with the difference score for moral acceptability, (r(447)=-.24, p<.001). We then computed the centered sum score for playing God and regressed the difference score for moral acceptability on the difference score and centered sum score for playing God. The significant -.21 slope (t(446)=5.17, p<.001) combined with the .18 intercept (t(446)=3.89, p<.001) indicates partial mediation. The slope for the centered sum score (-.01) was non-significant (p=.79), suggesting no moderation by the level of the mediating variable. In addition, using the MEMORE macro in SPSS [6] (percentile bootstrap;

20,000 resamples) reveals a marginally significant indirect effect (90% confidence interval=0.001 to 0.12), suggesting mediation as well.

Analyses of religion and politics, Study 6b

APG was significantly correlated with political conservatism ($r(900)$=.36, $p<.001$), belief in God ($r(900)$=.74, $p<.001$), and religiosity ($r(900)$=.65, $p<.001$) across conditions. We examined the effects of political ideology, belief in God, and religiosity. In the science condition, conservatism, belief in God, and religiosity predicted moral unacceptability for both practices (rs<-.17, ps$\leq$.001). Nonetheless, when simultaneously or separately controlling for belief in God, religiosity, and political ideology, APG continued to predict moral unacceptability for both practices significantly (ps<.001). The legal condition revealed fewer significant correlations between moral acceptability and ideology, belief in God, and religiosity: Belief in God predicted moral unacceptability of the novel practice, $r(452)$=-.10, p=.039, religiosity marginally predicted moral unacceptability of the novel practice, $r(452)$=-.09, p=.061, and conservatism marginally predicted moral *acceptability* of the established practice, $r(452)$=.09, p=.064. In addition, the relationship between APG and moral unacceptability of the novel practice was reduced to non-significance when controlling in a regression for belief in God or religiosity separately (ps>.81), and the relationship between APG and moral unacceptability of the established practice was reduced to non-significance when controlling in a regression for political ideology (p=.35) (see Table S5 for standardized betas from multiple regressions). These results provide initial evidence for the divergent roles of aversion to playing God (and its interaction with novelty) in the science domain versus the legal domain.

Analyses of religion and politics, Study 7

As specified in our preregistration plan, we conducted regressions examining political ideology, belief in God, and religiosity as predictor variables alongside condition as a predictor as well. As noted below, these demographic measures and others did not differ significantly by condition, despite unequal numbers of participants across condition ($ps>.10$). Nonetheless, we wanted to examine whether the effect of condition remained significant after controlling for these variables. To do so, we created two new condition variables, one that coded Self-playing-God as 1, Other-playing-God as 1, and Control as -2 (to reflect the planned contrast between the two playing God conditions and the control condition), and one that coded Self-playing-God as 1, Other-playing-God as -1, and Control as 0 (to reflect separate conditions). Conducting regressions using these two variables as predictors and attitudes toward scientific practices as an outcome variable while also controlling for political ideology, belief in God, and religiosity (simultaneously or separately) revealed that the condition variable representing the contrast remained significant in every case ($ps\leq.011$) (see Table S5 for standardized betas from multiple regressions). These results suggest that religious and political beliefs do not account for our findings.

Examination of Dropouts, Study 7

Based on recommendations by Zhou and Fishbach [8], we examined, by condition, frequency of participants dropping out upon ostensibly viewing, but just prior to completing the experimental manipulation prompt (including participants later excluded in the primary analysis) and found that 16.86% (59/350), 20.51% (72/351), and 8.31% (29/349) dropped out in the you-

playing-god, others-playing-god, and control condition, respectively[8]. A chi-square indicated

dropout rates differed by condition, $\chi^2(2)=21.24$, $p<.001$, $\varphi=.14$. Follow-up tests revealed that

this effect was driven by both the you-playing-God and others-playing-God conditions differing

from the control condition ($\chi^2=11.60$, $p=.001$, $\varphi=.13$ and $\chi^2=21.11$, $p<.001$, $\varphi=.17$), but not from

each other, $\chi^2=1.54$, $p=.21$, $\varphi=.047$.

Given that our control condition presented a much simpler task (to write about a meal)

than the two playing God conditions, it is possible that participants simply opted out of a more

difficult task. To ensure that participants did not drop out in ways that might systematically

affect responses to our dependent measure (attitudes toward scientific practices), we examined

all demographic variables that lent themselves to numerical values and that correlated with this

measure significantly ($p<.05$) across the entire sample (including participants excluded from the

primary analysis based on our preregistration plan): gender (coded 1=male, 2=female), age,

belief in God, political ideology, and religiosity as measured in Studies 2-7 as well as income

and education. For income, participants were asked to indicate their yearly income (less than

$20,000, $20,000-$40,000, $40,000-$60,000, $60,000-$80,000, $80,000-$100,000, and more

than $100,000; coded 1-6 with the lower value used if participants responded to more than one

income level). For education, participants were asked to indicate the number of years of

education, with answers coded blank if participants did not clearly specify a number.

Examining either non-dropouts alone or non-dropouts and dropouts combined, one-way

ANOVAs for each of these factors revealed that none of them differed significantly by condition

---

[8] This analysis and those reported below contain two dropout participants with matching demographics and IP addresses of participants who completed the study and were included in the primary analysis. Because it is uncertain if these participants constitute duplicate individuals and because they represent relevant data (of people who may have dropped out when confronted with one conditional essay prompt, but not another) we include them in these analyses.

(ps>.11). This finding remained when we included only non-dropouts who indicated they had properly completed the writing task (the participants included in our primary analysis based on our preregistration plan) (ps>.10) and when we combined these non-dropouts from our primary analysis and dropouts (ps>.31). Thus, it is unlikely that participants dropped out from condition in any systematic way that would have affected responses on the dependent variable, and it is more likely that increased dropout occurred in the playing God conditions resulted from factors unrelated to the present dependent measure. Furthermore, this analysis showed that people of generally similar demographic backgrounds participated in each condition.

Table S1. Correlations for individual items with aversion to playing God in Samples A and B (Archival Study 1a).

Item	Correlation - Sample A (1993)	Correlation - Sample B (1994)
"How much confidence do you have in the scientific community?"	.06[+]	.13**
"We believe too often in science, and not enough in feelings and faith"	.38**	.36**
"Overall, modern science does more harm than good"	.21**	.21**
"Nature would be at peace and in harmony if only human beings would leave it alone"	.18**	.21**
"Any change humans cause in nature - no matter how scientific - is likely to make things worse"	.19**	.19**
"All radioactivity is made by humans"	.09**	.28**
"All man-made chemicals can cause cancer if you eat enough of them"	.05[+]	.13**
"Human beings are the main cause of plant and animal species dying out"	.21**	.11**

[+] $p<.07$; * $p<.025$, ** $p\leq.001$.

Note: Positive correlations indicate aversion to playing God corresponds to a negative assessment of science or human involvement in nature. One unexpected finding in both samples was that aversion to playing God predicted agreement with the statement "Modern science will solve our environmental problems with little change to our way of life," the same item that reduces the reliability of the composite in both samples.

Table S2. Correlations for individual items with aversion to playing God (Archival Study 1b, Sample A).

Item	Correlation
"In general, do you think is a good or a bad idea to clone animals such as sheep?"	-.50
"Do you think that it is morally acceptable to clone animals such as sheep, or don't you feel that way?"	-.53
"As you may know, scientists might one day be able to identify animals such as sheep, chickens, cows, and pigs which grow the fastest on the least amount of food and clone them in order to create large flocks of genetically identical animals, which would be less expensive for farmers to raise. Would you consider this a positive or a negative discovery?"	-.39
"Do you think you would or would not eat vegetables and fruits that are clones?"	-.36
"Do you think you would or would not eat meat from animals that are clones?"	-.47
"Which do you think is more likely--that the new cloning techniques will help solve some of the problems that the world faces, or that cloning will create more problems than it solves?"	-.43
"In general, do you think it is a good idea or a bad idea to clone human beings?"	-.21
"Do you think that it is morally acceptable to clone human beings, or don't you feel this way?"	-.24
"In general, would you consider it a good idea or a bad idea to clone not whole human beings, but body parts or vital organs for transplants that are needed as a result of accidents or disease?"	-.30
"Do you think you would or would not take part in a demonstration against the cloning of human beings?"	-.13
"In general, does the prospect of cloning human beings scare you, or not?"	-.26
If you had the chance, would you clone yourself, or, wouldn't you do that?	-.23

All correlations significant, $p<.001$.

Note: Negative correlations indicate aversion to playing God corresponds to disapproval of cloning procedures.

Table S3. Correlations for individual items with aversion to playing God (Archival Study 1b, Sample B).

Item	Correlation
"Do you think is a good or a bad idea to clone animals such as sheep?"	-.36
"In general, do you think it is a good idea or a bad idea to clone human beings?"	-.35
"Do you think each of the following justifies creating a human clone or don't you think so?...To save the life of the person being cloned"	-.27
…To help infertile couples to have children without having to adopt"	-.26
…To produce copies of humans whose vital organs can be used to save the lives of others"	-.15
…To create genetically superior human beings"	-.15
…To allow parents to have a twin child at a later date if they wanted to"	-.19
…To allow parents who have lost a child to create a clone of the child they lost"	-.26
…To allow gay couples to have children using only their own genes"	-.21
"Do you think scientists should be allowed to clone human beings or don't you think so?"	-.37
"If scientists could clone the following people, do you think they should do so?...Albert Einstein"	-.21
…Michael Jordan"	-.13
…Beethoven"	-.18
…Abraham Lincoln"	-.17
…Isaac Newton"	-.19
…Humphrey Bogart"	-.13
"If you had the chance, would you clone yourself, or, wouldn't you do that?"	-.20

All correlations significant, $p<.001$.

Note: Negative correlations indicate aversion to playing God corresponds to disapproval of cloning procedures.

Table S4. T-tests for APG participants vs. other-worry participants on individual items (Archival Study 1c).

Item	*t*
"In general, do you approve or disapprove of the use of genetic testing during pregnancy to find out whether the baby will develop a serious genetic disease?"	7.70
"Do you approve or disapprove of the use of genetic testing during pregnancy to find out whether the baby will have desirable characteristics such as strength or high intelligence?"	5.43
"In general, do you approve or disapprove of the use of in vitro fertilization?"	5.18
"Would you approve or disapprove if parents were offered a way to use P-G-D [preimplantation genetic diagnosis] to…Choose the sex of their child."	6.68
"…Make sure their baby does NOT have a serious genetic disease."	6.50
"…Make sure their baby has desirable characteristics such as high intelligence and strength."	5.07
"…Make sure their baby does NOT have a tendency to develop a disease like cancer when he or she is an adult."	5.57
"… Make sure their baby would be a good match to donate his or her blood or tissue to a brother or sister who is sick and needs a transplant."	3.91
"Would you approve or disapprove if parents were offered a way to change their OWN genes in order to have children who would be smarter, stronger, or better looking?"	4.03
"Would you approve or disapprove if parents were offered a way to change their OWN genes in order to prevent their children from having a genetic disease?"	8.18
"Do you approve or disapprove of scientists working on ways to clone animals?"	11.54
"Do you approve or disapprove of scientists working on ways to clone humans?"	9.46

All *t*-tests significant, *p*<.001.

Note: All tests indicate APG participants vs. other-worry participants express greater disapproval of genetic procedures.

Table S5. Standardized betas for multiple regressions (Studies 2-7).

Study	outcome measure	playing God (perceptions of practices for Study 2; APG scale for Studies 3-6; conditions prompting recall of playing God for Study 7)	political ideology	religiosity	belief in God
2	moral acceptability – drone warfare	-0.25**	0.17**	0.07	-0.07
2	moral acceptability - GMOs	-0.40**	-0.03	-0.05	-0.13
2	moral acceptability - vaccines	-0.42**	-0.02	-0.12	0.03
2	moral acceptability – climate change	-0.17**	0.23**	0.04	-0.06
3	funding – NSF	-0.35**	0.07	-0.21*	0.22*
3	funding – Department of Defense	0.08	0.39**	0.04	-0.11
3	funding – Federal Prison System	0.05	0.02	0.06	0.02
4	donation – National Stem Cell Foundation	-0.24**	-0.11+	0.05	0.15
4	donation – Cure Violence	0.12	-0.08	0.09	0.04
5	donation – International Rice Research Institute minus Helen Keller International	-0.09	0.03	0.06	-0.11
6a	moral acceptability – established practice	-0.44**	-0.04	0.05	-0.09
6a	moral acceptability – novel practice	-0.44**	-0.05	0.04	-0.07
6b	moral acceptability – established practice (legal)	-0.07	0.09+	0.12	-0.06
6b	moral acceptability – novel practice (legal)	-0.15*	0.01	-0.01	0.02
6b	moral acceptability – established practice (science)	-0.38**	-0.04	-0.02	-0.03
6b	moral acceptability – novel practice (science)	-0.46**	0.003	0.004	-0.03
7	Scientific attitudes	0.09*	-.12**	0.01	-0.11+

Notes: +p<.09 *p<.05; **p≤.01.

References

1. Davis JA, Smith TW, Marsden PV. 2007 *General social surveys, 1972–2006* [Computer file] (Ann Arbor, MI: Inter-university Consortium for Political and Social Research).

2. Time Magazine and Cable News Network. 1997 *Yankelovich/Time Magazine/CNN Poll: Campaign Finances/Cloning* [dataset] (Cornell University, Ithaca, NY: Roper Center for Public Opinion Research, RoperExpress [distributor]).

3. Time Magazine and Cable News Network. 2001 *Yankelovich/Time/CNN Poll # 2001-02* [dataset] (Cornell University, Ithaca, NY: Roper Center for Public Opinion Research, RoperExpress [distributor]).

4. Genetics and Public Policy Center. 2002 *Public awareness and attitudes about reproductive genetic technology* [computer file] (John Hopkins University, Baltimore, MD).

5. Judd CM, Kenny DA, McClelland GH. 2001 Estimating and testing mediation and moderation in within-subject designs. *Psychol. Methods*. **6**, 115-134.

6. Montoya AK, Hayes AF. 2017 Two-condition within-participant statistical mediation analysis: A path-analytic framework. *Psychol*. *Methods*. **22**, 6-27

7. Hayes AF. 2013 *Introduction to mediation, moderation, and conditional process analysis*. New York, NY: The Guilford Press.

8. Zhou H, & Fishbach A. 2016 The pitfall of experimenting on the web: How unattended selective attrition leads to surprising (yet false) research conclusions. *J. Pers. Soc. Psychol.* **111**, 493-504.