Many Labs 5: Registered multisite replication of tempting-fate effects in Risen & Gilovich (2008)

Maya B. Mathur[1,2], Diane-Jo Bart-Plange[3], Balazs Aczel[4], Michael H. Bernstein[5], Antonia Ciunci[5], Charles R. Ebersole[3], Filipe Falcão[6], Kayla Gerken[7], Rias A. Hilliard[7], Alan Jern[7], Danielle Kellier[2], Grecia Kessinger[8], Vanessa Kolb[5], Marton Kovacs[4], Caio Lage[9], Eleanor V. Langford[3], Samuel Lins[6], Dylan Manfredi[10], Venus Meyet[8], Don A. Moore[11], Gideon Nave[10], Christian Nunnally[7], Anna Palinkas[4], Kimberly P. Parks[3], Sebastiaan Pessers[12], Tiago Ramos[6], Kaylis Hase Rudy[8], Janos Salamon[4], Rachel L. Shubella[7], Rúben Silva[6], Sara Steegen[12], L.A.R. Stein[5,13,14], Barnabas Szaszi[4], Peter Szecsi[4], Francis Tuerlinckx[12], Wolf Vanpaemel[12], Maria Vlachou[12], Bradford J. Wiggins[8], David Zealley[8], Mark Zrubka[4], & Michael C. Frank[2]

[1] Harvard University, Boston, MA, United States

[2] Stanford University, Stanford, CA, United States

[3] University of Virginia, Charlottesville, VA, United States

[4] ELTE Eötvös Loránd University, Budapest, Hungary

[5] University of Rhode Island, Kingston, RI, United States

[6] University of Porto, Porto, Portugal

[7] Rose-Hulman Institute of Technology, Terre Haute, IN, United States

[8] Brigham Young University - Idaho, Rexburg, ID, United States

[9] Pontifical Catholic University of Rio de Janeiro, Rio de Janeiro, Brazil

[10] University of Pennsylvania, Philadelphia, PA, United States

[11] University of California at Berkeley, Berkeley, CA, United States

[12] University of Leuven, Belgium

[13] Brown University, Providence, RI, United States

[14] Rhode Island Training School, Cranston, RI, United States

Author Note

Correspondence concerning this article should be addressed to Maya B. Mathur, Quantitative Sciences Unit, 1070 Arastradero Rd, Palo Alto, CA, 94305. E-mail: mmathur@stanford.edu

Abstract

Risen & Gilovich (2008) found that subjects believe that "tempting fate" will be punished with ironic bad outcomes (a main effect) and that this effect is magnified under cognitive load (an interaction). A previous replication project (Open Science Collaboration, 2015) failed to replicate both the main effect and the interaction in an online implementation of the protocol that used Amazon Mechanical Turk. The authors of the original study expressed concern that the cognitive load manipulation may have been less effective when implemented online and that subjects recruited online may have responded differently to the specific experimental scenario chosen for replication. To address both concerns, we developed a new protocol in collaboration with the original authors. We used 4 university sites ($n = XXX$ total) chosen for similarity to the site of the original study to conduct a high-powered, preregistered replication focused primarily on the interaction effect. Results [supported/did not support] the focus interaction or the main effect and were [more pronounced/less pronounced/comparable] in 6 additional universities that were less similar to the original site. Post hoc analyses [provided/did not provide] strong evidence for statistical inconsistency between the original study's estimates and the replications; that is, the original study's results [would/would not] have been [extremely unlikely/unlikely/likely/extremely likely] in the estimated distribution of the replications. We also collected a new Mechanical Turk sample under the previous replication protocol, indicating that the updated protocol (i.e., conducting the study in person and in universities similar to the original site) [did not meaningfully change replication results/yielded replications results more similar to the original study]. Secondary analyses [supported/failed to support] substantive mechanisms for the failure to replicate.

Keywords: replication, reproducibility, preregistered, open data, heuristic, magical thinking

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Risen and Gilovich (2008) examined the existence and mechanisms of the belief that "tempting fate" is punished with ironic bad outcomes. They hypothesized, for example, that students believe that they are more likely to be called on in class to answer a question about the assigned reading if, in fact, they had not done the reading (and thus had "tempted fate") versus if they had come to class prepared (and thus had not "tempted fate"). Risen and Gilovich (2008) additionally hypothesized that deliberative thinking (sometimes termed "System 2" processing (Epstein, Lipson, Holstein, & Huh, 1992)) may help suppress irrational heuristics regarding tempting fate, and thus a cognitive load manipulation designed to preoccupy System 2 resources would magnify the effect of tempting fate on subjects' perceived likelihood of a bad outcome. That is, they hypothesized a positive interaction between cognitive load and tempting fate on subjects' perceived likelihood of an ironic bad outcome.

Risen and Gilovich (2008)'s Study 6, the focus of replication, used a between-subjects factorial design to assess this possibility (total analyzed $n = 120$). Subjects were randomly assigned to read a scenario in which they imagined themselves having tempted fate by not having done the assigned reading or, alternatively, not having tempted fate by having done the assigned reading. Additionally, subjects were randomly assigned to complete the task with or without cognitive load. Subjects not under cognitive load simply read the scenario and then judged the likelihood of being called on in class. Subjects under cognitive load counted backwards by 3s from a large number while reading the scenario, after which they provided the likelihood judgment. This study provided evidence for the predicted main effect of tempting fate in subjects not assigned to cognitive load (estimated difference in perceived likelihood on a 0-10 scale after tempting fate vs. not tempting fate: $b = 1.03$ with 95% CI: [0.09, 1.97]; $p = 0.03$)[1] as well as the focus interaction effect (estimated effect of tempting

[1]Approximate effect sizes were recomputed from rounded values in Risen and Gilovich (2008).

fate vs. not tempting fate for subjects under cognitive load vs. not under cognitive load: $b = 1.54$ with 95% CI: [0.05, 3.03]; $p = 0.04$).

We selected Risen and Gilovich (2008) for replication because, per the selection criteria of all Many Labs 5 replications, this study was previously replicated by Open Science Collaboration (2015). The previous replication found little evidence for either a main effect of tempting fate without cognitive load ($n = 226$, $b = 0.20$ with 95% CI: [-0.58, 0.97]; $p = 0.62$) or the focus interaction ($b = 0.03$ with 95% CI: [-1.14, 1.20]; $p = 0.96$) (Mathur & Frank, 2012). However, prior to the collection of replication data by this previous replication effort (termed "RPP"), the authors of the original study expressed concerns about the replication protocol. Due to feasibility constraints, the RPP replication proceeded without addressing these concerns. Specifically, the replication was implemented on the crowdsourcing website Amazon Mechanical Turk, a setting that could potentially compromise the cognitive load manipulation if subjects were already multitasking or were distracted. Additionally, the experimental scenario, which required subjects to imagine being unprepared to answer questions in class, may be less personally salient to subjects not enrolled in an elite university similar to Cornell University, the site of the original study. Thus, as part of the Many Labs 5 project, the present multisite replication aimed to: (1) reassess replicability of Risen and Gilovich (2008) using an updated protocol designed in collaboration with the original authors to mitigate potential problems with the previous replication protocol; and (2) formally assess the effect of updating the protocol in this manner by comparing its results to newly collected results under the previous replication protocol.

Disclosures

The protocol, sample size criteria, exclusion criteria, and statistical analysis plan were preregistered[2] with details publicly available (https://osf.io/8y6st/ for the protocol and XXX

[2]One site (BYUI) was permitted to collect data prior to preregistration of the statistical analysis plan due to their time constraints; the lead investigator and all other authors remained blinded to this site's results until preregistration and data collection were complete.

for the analyses); departures from these plans are reported in this manuscript. All data, materials, and analysis code are publicly available and documented (XXX). Sites obtained ethics committee approval when appropriate to their geographical location and institutional requirements, and data were collected in accordance with the Declaration of Helsinki.

Methods

In consultation with the original authors, we designed a replication procotol that more closely duplicated the original design than did the RPP replication (Table 1). Primary analyses used only data from university sites located in the United States and meeting an academic criterion for similarity to the original site (Table 1, row 1); these sites are termed "similar sites". We additionally used the previous RPP replication protocol without modification to collect a new sample on Amazon Mechanical Turk ("MTurk"). Finally, we collected secondary data in several universities not meeting the SAT criterion for similarity to Cornell or located outside the United States, henceforth termed "dissimilar sites". Data from dissimilar sites were used in secondary analyses to further increase power and assess whether, as hypothesized, site similarity in fact moderates the focus effect. For sites whose subjects were not expected to speak fluent English, questionnaire materials were translated and verified through independent back-translation.

Original protocol	RPP replication protocol	Updated replication protocol	Reason for update
Subjects were undergraduates at Cornell University.	Subjects were United States residents participating online through Amazon Mechanical Turk.	Subjects in primary analyses were undergraduates at United States universities with median SAT scores >90th percentile nationally.	Subjects in settings with high academic pressure may find the stimuli more personally salient. A university's average SAT score may serve as a proxy for such pressure.
Subjects completed the experiment in a low-distraction, private lab setting.	No restrictions were placed on the physical setting in which subjects completed the experiment.	Subjects in all analyses completed the experiment in controlled physical settings with reasonable isolation from other subjects (e.g., private lab room, private cubicles in a shared room).	The cognitive load manipulation may be more effective when other distractions are minimal.

Table 1: Comparison of experimental protocols used in the original study, the RPP replication, and the present replication.

The primary statistical estimands were (1) the focus interaction within similar sites and (2) the difference in this interaction between similar sites and MTurk (modeled as a three-way interaction, as described below). Sample sizes were chosen to provide, in aggregate, more than 80% power to detect a three-way interaction with effect size more than 0.75 standard deviations of perceived likelihood. Because detecting the three-way interaction requires substantially larger sample sizes than detecting the focus interaction alone, this choice of sample sizes also provided $> 99\%$ power to detect, within similar sites alone, a focus interaction of the size reported in the original study. Each site additionally attempted to reach these power criteria internally, though in many cases this was not feasible. Site-level and aggregate analyses were conducted by one author (MBM), who was blinded to results until all sites had completed data collection; these analyses were audited for accuracy by other authors.

We collected four new measures, developed in discussion with the original authors, for use in secondary analyses. As manipulation checks for the effectiveness of the cognitive load manipulation, we asked subjects assigned to cognitive load to assess on a 0-10 scale the perceived effort associated with this task (*"How much effort did the counting task require?"*) and the task's difficulty (*"How difficult was the counting task?"*). Additionally, the original authors speculated that the experimental scenario (regarding answering questions in class) may be personally salient to subjects in an academically competitive environment similar to the site of the original study, but may be less so for MTurk subjects or subjects in dissimilar universities. To assess this possibility, we developed new measures in collaboration with the original authors which required subjects to evaluate on a 0-10 scale the importance of answering questions correctly in class (*"If you were a student in the scenario you just read about, how important would it be for you to answer questions correctly in class?"*) and the perceived negativity of answering incorrectly (*"If you were a student in the class, how bad would you feel if you were called on by the professor, but couldn't answer the question?"*).

Results

Descriptive analyses

Table 2 displays sample sizes, the number of exclusions, and protocol characteristics for all sites. To estimate the main effect of tempting fate and the focus interaction within each site, we fit an ordinary least squares regression model of perceived likelihood on tempting fate, cognitive load, and their interaction within each site. This analysis approach is statistically equivalent to the ANOVA model fit in the original study while also yielding coefficient estimates that are directly comparable to those estimated in primary analysis models, discussed below. Figures 1 and 2, respectively, display these within-site estimates for the main effect and interaction.[3]

Among the 4 similar sites, XXX had main effect estimates in the same direction as the original study estimate, [comment on their relative effect sizes]. Main effect estimates in similar sites had p-values ranging from XXX to XXX. In the MTurk sample, the main effect estimate was [in the same direction as/in the opposite direction from] the original, [comment on its effect size compared to original], and it was [larger than/smaller than/nearly identical to] the estimate previously obtained under the same protocol in RPP. Considering all 10 university sites, XXX had main effect estimates in the same direction as the original study. These estimates were [of smaller magnitude than/of larger magnitude than/of similar magnitude to] the original estimate.

[Insert forest plot for main effect estimates ordered by site type (MTurk, similar, dissimilar) and then by sample size. Legend: Point estimates and 95% CIs for each site (black circles) are from ordinary least squares regression fit to that site's data. For similar sites, pooled point estimates and 95% CIs (orange diamonds) are from the primary mixed model. For dissimilar sites (orange diamonds), these are from the secondary mixed model.

[3] An alternative for the study-specific estimates would be to use estimates of random intercepts and random slopes by site from the mixed model, but here we use subset analyses for a descriptive characterization that relaxes the across-site distributional assumptions of the mixed model.

Site	Location	Analyzed *n*	Excluded *n*	Recruitment and compensation	Language	Physical setting
Online site						
Amazon Mechanical Turk (MTurk)	N/A			U.S. online workers (pay)	English	Online
Similar university sites						
University of Pennsylvania (UPenn)	Philadelphia, PA			Undergraduates from university subject pool (pay)	English	Lab with private cubicles (groups of about 20)
University of California at Berkeley (UCB)	Berkeley, CA			Undergraduate business majors (credit)	English	Lab with private cubicles (groups of 1-13)
University of Virginia (UVA)	Charlottesville, VA			Undergraduates from introductory psychology class (credit)	English	Lab with private rooms (groups of 1-4)
Stanford University	Stanford, CA			Undergraduates from introductory psychology class (credit)	English	Lab room (individually)
Dissimilar university sites						
Eotvos Lorand University	Budapest, Hungary			Undergraduates from psychology course (credit)	Hungarian	Lab with private cubicles (groups of 5-20)
Katholieke Universiteit Leuven (KUL)	Leuven, Belgium			Undergraduates from university subject pool (credit or pay)	Dutch	Lab with private cubicles (groups of 1-2)
University of Porto (UP)	Porto, Portugal			Undergraduates from introductory psychology class (no compensation)	Portuguese	Lab with private cubicles (groups of 1-4)
Brigham Young University - Idaho (BYUI)	Rexburg, ID			Undergraduates from introductory psychology class (credit and raffle entry)	English	Lab with private rooms (groups of 1-2)
University of Rhode Island (URI)	Kingston, RI			Undergraduates from multiple psychology courses	English	Lab with private cubicles (groups of 1-4)
Rose-Hulman Institute of Technology (RHIT)	Terre Haute, IN			Recruited peers of undergraduate research assistants (no compensation)	English	Lab room (individually)

Analyzed n = total subjects included in analysis; excluded n = total subjects excluded from analysis in keeping with a priori criteria or post hoc exclusions at Eotvos Lorand University.

Table 2: Summary of sites and participants.

Pooled point estimates represent the average main effect among subjects in similar universities or in all universities.]

Considering the focus interaction estimate, XXX of 4 similar sites had estimates in the same direction as the original, and these were [of similar magnitude/of larger magnitude/of smaller magnitude] with p-values ranging from XXX to XXX. In the MTurk sample, the interaction estimate was in the [same/opposite] direction from the original estimate and was [similar/larger/smaller] in magnitude [than/to] the RPP estimate. Considering all 10 university sites, XXX had point estimates in the same direction as the original study,

[comment on their relative magnitudes compared to original]. p-values across all universities ranged from XXX to XXX. [note if any sites were outliers]

[Insert forest plot for interaction estimates ordered by site type (MTurk, similar, dissimilar) and then by sample size. Legend: Point estimates and 95% CIs for each site (black circles) are from ordinary least squares regression fit to that site's data. For similar sites, pooled point estimates and 95% CIs (orange diamonds) are from the primary mixed model. For dissimilar sites (orange diamonds), these are from the secondary mixed model. Pooled point estimates represent the average interaction effect among subjects in similar universities or in all universities.]

Primary analyses

Primary analyses aimed to: (1) estimate the focus interaction and the main effect under the updated protocol in similar sites; and (2) assess whether the focus interaction and the main effect estimates differed between the updated protocol and the RPP protocol. To this end, we combined data from the similar sites and MTurk to fit a linear mixed model with fixed effects representing main effects of tempting fate, cognitive load, and protocol (similar sites under the updated protocol vs. MTurk). To account for correlation of observations within a site, the model also contained random intercepts by site and random slopes by site of tempting fate, cognitive load, and their interaction; in all analyses, all random effects were assumed independently and identically normal.[4] This model allows estimation of the focus effect within similar sites and within MTurk and permits formal assessment of the extent to which these effects differ (via the three-way interaction of

[4] As a planned sensitivity analysis, we also refit the same ANOVA model used in the original study, which ignores correlation of observations within sites. [comment on whether results of this analysis were similar to primary results] (Supplement). We obtained [similar/different] results in additional sensitivity analyses in which we fit a model to only the subset of data from similar sites (dropping the MTurk coefficient) or in which we fit meta-analytic counterparts to the primary model (Supplement). [if relevant, comment on how results differed]

Table 3: In units of perceived likelihood on a 0-10 scale, estimates of the main effect and focus interaction effect in similar university sites and under the RPP protocol (MTurk), as well as estimates of the difference between these estimates. Total n = XXX.

Parameter	Estimate	95% CI	p-value
Tempt main effect within MTurk			
Tempt main effect within similar sites			
Effect of similar site vs. MTurk on tempt main effect			
Tempt-load interaction within MTurk			
Tempt-load interaction within similar sites			
Effect of similar site vs. MTurk on tempt-load interaction			

protocol, tempting fate, and cognitive load). Details of the model specification and interpretations for each coefficient of interest are provided in the preregistered protocol.

The primary analysis model included XXX subjects from similar sites and MTurk. Consistent with the RPP replication, the present results collected on MTurk did not strongly support the main effect of tempting fate (Table 3), and nor did results collected under the updated protocol in similar sites (Table 3, row 2). Updating the protocol [appeared to increase/appeared to decrease/did not appear to change] the main effect estimate (Table 3, row 3). Furthermore, results from the new MTurk sample [supported/did not support] the focus interaction (Table 3, row 4), and [so did/nor did] results under the updated protocol (Table 3, row 5). Updating the protocol [appeared to increase/appeared to decrease/did not meaningfully affect] the focus interaction estimate (Table 3, row 6). [comment on amount of statistical heterogeneity across sites for both the main effect and interaction]

Secondary analyses: All university sites

Planned secondary analyses addressed the same questions as the primary analyses, but additionally incorporated data from dissimilar university sites (total n = XXX). Site type was treated as a categorical variable (MTurk, similar university site, or dissimilar university site)[5]. Additionally, these analyses formally estimated the difference in results between similar and dissimilar sites. Results (Table 4) [supported/did not support] the main effect or the focus interaction in [comment on differences between site types]. The main effect estimate in dissimilar sites was [larger than/smaller than/comparable to] that in similar sites (Table 4, row 4), [but/and] [the interaction estimate was smaller than the original estimate/the interaction estimate was larger than the original estimate/as was the interaction estimate] (Table 4, row 8). [comment on amount of statistical heterogeneity across sites for both the main effect and interaction] We conducted post hoc secondary analyses (Supplement) to assess the extent to which the replication findings were statistically consistent with the original study; that is, whether it is plausible that the original study was drawn from the same distribution as the replications (Mathur & VanderWeele, 2017).

Evaluating proposed explanations for replication failure

Anticipating that results may have differed between similar and dissimilar sites, we planned to conduct secondary analyses assessing proposed explanations for the previous replication failure in RPP. [describe results of secondary analyses assessing whether efficacy of cognitive load manipulation, perceived effort, or perceived difficulty differed between MTurk vs. all university subjects]

To assess differences in academic attitudes, we used subjects[6] from all types of sites, including MTurk, to fit linear mixed models regressing perceived importance (n = XXX) and

[5] An alternative model specification in which all universities were treated as a single category yielded similar results (Supplement).

[6] These analyses again excluded subjects from UC Berkeley, which did not collect the new measures due to a data collection error.

Table 4: In units of perceived likelihood on a 0-10 scale, estimates of the main effect and focus interaction effect in similar university sites, dissimilar university sites, and under the RPP protocol (MTurk), as well as estimates of the difference between these estimates. Total n = XXX.

Parameter	Estimate	95% CI	p-value
Tempt main effect within MTurk			
Tempt main effect within similar sites			
Tempt main effect within dissimilar sites			
Effect of similar vs. dissimilar site on tempt main effect			
Tempt-load interaction within MTurk			
Tempt-load interaction within similar sites			
Tempt-load interaction within dissimilar sites			
Effect of similar vs. dissimilar site on tempt-load interaction			

perceived negativity (n = XXX) on site type (similar, dissimilar, or MTurk) with random intercepts by site. [Supporting/Contrary to] our speculation, MTurk subjects reported that answering questions correctly was [less important than did/as important as/more important than did] subjects at similar universities (b = XXX with 95% CI: XXX; p = XXX) or at dissimilar universities (b = XXX with 95% CI: XXX). Additionally, when asked to assess how bad it would be to answer incorrectly, MTurk subjects [responded higher than/responded comparably to/responded lower than] subjects at similar sites (b = XXX with 95% CI: XXX; p = XXX) and at dissimilar sites (b = XXX with 95% CI: XXX; p = XXX). [comment on direction and strength of effects if present]

Lastly, in a planned analysis, we assessed variation in results according to a site's similarity to Cornell, now redefining similarity using a continuous proxy (namely, a university's estimated median total SAT score in 2018) rather than the dichotomous

"similar" versus "dissimilar" eligibility criterion for primary analyses. Subjects from universities outside the United States or from MTurk were excluded from this analysis, leaving an analyzed $n = XXX$ from 7 universities with median SAT scores ranging from XXX to XXX of 2400 possible points. We assumed that universities with higher SAT scores would be most similar to Cornell (median SAT: 2134) and therefore considered a linear effect of median SAT score as a moderator of the main effects and interaction of tempting fate with cognitive load. A mixed model [suggested/did not suggest] that median SAT score moderated the main effect of tempting fate (b = XXX for a 10-point increase in SAT score with 95% CI: XXX; p = XXX) or the focus interaction (b = XXX with 95% CI: XXX; p = XXX'). [comment on direction and strength of interaction if present]

Conclusion

We used an updated replication protocol to replicate Risen and Gilovich (2008)'s Study 6 in controlled lab settings at universities chosen for their similarity to the original site. We additionally conducted replications on Amazon Mechanical Turk, as in the previous replication, as well as at less similar universities. This replication project has limitations: first, because the number of similar sites was small, we could not reliably assess variation in results across these sites. Second, as in all direct replications, our replication was limited to a single operationalization of the tempting-fate effect; our results do not necessarily generalize to other experimental scenarios, for example.

[Describe the main effect and interaction estimates in similar sites. Describe the extent to which results differed between data collected under the updated protocol in similar sites and data collected under the previous replication protocol on Amazon Mechanical Turk. Describe the extent to which results differed in dissimilar universities. Describe the extent to which secondary analyses supported proposed mechanisms of replication failure (namely, reduced effectiveness of the cognitive load manipulation on MTurk or reduced personal salience of the experimental scenario on MTurk). Describe whether post hoc analyses

provided evidence for statistical inconsistency between the original study and replications under the original protocol for the main effect and for the focus interaction. Summarize overall findings.]

Contributions

CRE conceived the Many Labs project. MBM, CRE, and MCF designed this multisite replication study. MBM and DJBP oversaw administration. MBM planned and conducted statistical analyses (with MCF auditing the code) and wrote the manuscript. The remaining authors collected data, audited site-level analyses, and approved the final manuscript. The authors have no conflicts of interest with respect to the authorship or publication of this manuscript. All authors approved the final manuscript with one exception (sadly, SP passed away before the manuscript draft was written).

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