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An exercise in self-replication: Replicating Shah, Mullainathan, and Shafir (2012)

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ABSTRACT

Shah et al. (2012) examined how different forms of scarcity affect attention and borrowing behavior. Results from a series of lab experiments suggested that (1) various forms of scarcity have similar effects on cognition and behavior, (2) scarcity leads to attentional shifts and greater focus (3) scarcity can lead people to over-borrow, and (4) scarcity can lead to cognitive fatigue. Camerer (2018) recently conducted replications of studies from a set of social science papers, and failed to replicate the result on cognitive fatigue from Shah et al. (2012). In this paper, we present high-powered replications of all studies from Shah et al. (2012). We describe which results appear more robust and which results appear to be less robust. We conclude with some thoughts on the value of self-replications.

1. Introduction

A growing body of research in psychology examines the ways in which people respond to resource scarcity (e.g., Carvalho, Meier, & Wang, 2016; Mani, Mullainathan, Shafir, & Zhao, 2013; Mullainathan & Shafir, 2013; Roux, Goldsmith, & Bonezzi, 2015; Shah et al., 2012; Shah, Shafir, & Mullainathan, 2015; Shah, Zhao, Mullainathan, & Shafir, 2018; Sharma & Alter, 2012; Spiller, 2011). This work has developed around several broad themes. First, various forms of scarcity have similar effects on cognition and behavior—for instance, the psychology of poverty (i.e., monetary-scarcity) shares common mechanisms with the psychology of being busy (i.e., time-scarcity). Second, scarcity leads to attentional shifts. People experiencing scarcity often become more focused on pressing needs. Finally, this increased focus can tax mental bandwidth. That is, different forms of scarcity can impede cognitive function.

The evidence in this line of work comes from two methodological paradigms. Quasi-experimental methods examine how behavior varies across groups of people with different amounts of a resource (e.g., comparing the wealthy to the poor), or how behavior changes within a person as their resources fluctuate (Mani et al., 2013; Shah et al., 2015). Other studies use a pure experimental approach. In those studies, participants are given different endowments of a resource to make some participants "poor" and others "rich" (e.g., Shah et al., 2012; Tomm & Zhao, 2016). Some of our own work falls into the latter paradigm. For example, in one of our papers we observed that experimentally induced scarcity led people to become more focused in how they used their resources. This increase in focus had some benefits, namely more efficient use of the resources. But it also had negative consequences, as scarcity apparently led to attentional shifts away from some problems. People neglected predictable future demands on their budgets, which led them to over-borrow. And the increase in focus also seemed to lead to cognitive fatigue in subsequent tasks.

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Recently, Camerer et al. (2018) conducted replications of a number of studies published in a set of social science papers. As part of that work, they failed to replicate the first experiment from our 2012 paper ("Some consequences of having too little," *Science*). That experiment, on cognitive fatigue, was not a central contribution of our paper. Camerer et al. decided to replicate the first studies appearing in the chosen set of papers, and although the first experiment in our paper was merely used to set the stage for the studies that followed, this failure to replicate led us to conduct direct replications for all of the experiments in that paper.

Beyond sheer curiosity and some concern, we were motivated to conduct these replications for several reasons. Psychological research has expanded its focus on methodological rigor. It is becoming standard to use larger sample sizes, to report exact replications within a single paper, and to pre-register experiments. We indeed tried to incorporate this rigor into later papers in this line of work (e.g., Shah et al., 2015). But the 2012 paper included experiments with smaller sample sizes and a few post-hoc analyses. And while most experiments in the paper were conceptual replications of a central finding (namely, that scarcity leads to over-borrowing), there were no full replications within the paper. Because this paper has been central to the psychology of scarcity research program, we believed it was important to bring it "up to date"—to replicate these experiments with the larger sample sizes that are now more common. In what follows, we briefly describe the original methods and findings. We then report high-powered exact replications of each experiment. Next, we summarize what our current takeaways are from this line of work, and how those findings compare to our original conclusions. Finally, we discuss the promise of self-replication as a tool for building a more robust psychological science.

2. Some consequences of having too little (2012)

Our original paper began with a motivating question about why poor individuals often engage in counter-productive behaviors like over-borrowing. We suggested that the answer may be attributable not to poverty per se, but rather to the cognitive and behavioral responses to resource scarcity that emerge more generally. We therefore tested whether scarcity itself was sufficient to lead to over-borrowing, and we examined the cognitive mechanisms that might underlie this behavior.

Across our experiments, participants played games in which they were allocated various budgets of different resources. "Poor" participants were given small budgets, while "rich" participants were given larger budgets. For instance, in three of the experiments, participants played different rounds of *Family Feud,* in which they earned points for guessing popular answers to survey questions. Participants were made time-poor or time-rich by being given either smaller or larger budgets of time. Additionally, some participants did not have the option to borrow resources—when they exhausted their budget for a round, they had to move on to the next round. Other participants could borrow resources at high interest rates—when they exhausted their budget for a round, they could choose to keep on going as additional units of the resource were subtracted from their overall budget, along with interest that was charged as a function of the amount of resources borrowed.

In Experiment 1, participants first played a version of *Wheel of Fortune*, in which they were given different budgets of guesses (to be used for solving the puzzle), after which they completed a cognitive control task. Poor participants were allocated fewer guesses than were rich participants. We found that poor participants subsequently performed worse on the cognitive control task than did rich participants. We took this as indirect evidence that scarcity led to increased focus during the game, which then reduced cognitive function on subsequent tasks.

In Experiments 2–5, we tested whether scarcity led to over-borrowing and whether scarcity-induced focus could explain this behavior. In Experiment 2, participants played a game similar to *Angry Birds,* in which they were given different budgets of "shots." We found direct evidence that scarcity led to greater focus. Poor participants spent significantly longer aiming the first shot of each round than did rich participants. Moreover, poor participants averaged more points earned per shot than did rich participants. We also found that, when given an opportunity to borrow, poor participants borrowed a much higher proportion of their budget than did the rich. And this borrowing, because it was expensive, was counter-productive: The poor performed worse with the flexibility to borrow than without it, whereas the rich performed similarly regardless of whether or not they could borrow. We took this as evidence that scarcity itself could lead people to over-borrow. We conceptually replicated this finding in Experiments 3 and 4 with another resource, namely time, in the context of *Family Feud*. Again, we found that time-poor participants over-borrowed and that they entered into cycles of debt, whereas the rich did not. Finally, in Experiment 5, we tested whether scarcity-induced focus would lead the poor to neglect helpful information. Some participants were given "previews" of questions on future rounds, whereas others were not. These previews would be helpful in determining how to budget one's time. We found that rich participants performed better when they had the previews, whereas poor participants did not. We took this as evidence that the poor failed to attend to helpful information because they were too focused on the pressing demands of the current round.

3. Direct replications of these findings

3.1. Method

We conducted one direct replication of each experiment. These replications were pre-registered (see, https://osf.io/vzm23/ for pre-registration and for detailed methods). Each replication was conducted with participants from Amazon.com's Mechanical Turk service (MTurk). We set a target sample size of 250 participants per cell, resulting in a target of 1000 total participants for each experiment except for Experiment 3, which had six cells and a target sample size of 1500 participants. We did not conduct formal a priori power analyses, but these sample sizes exceeded what is needed for 95% power to detect most of the effect sizes from the focal tests in the original paper, as well as 95% power to detect effects that were half the original size (except for Study 5, which was closer to 80% power to detect effects half the original size). The exact number of actual participants (reported below) varies slightly because

some participants completed the experiment without accepting the HITs on MTurk, while others submitted HITs without completing the experiment.

In Experiment 1 ("Wheel of Fortune"), 1054 participants (M_{age} = 35.9; 531 females, 506 males; demographics missing for 17 participants) were recruited. Participants were excluded from the analyses if they were missing subject ID numbers (across all experiments, a missing ID would mean that the session either did not initiate correctly or that the session dropped at some point; both cases would result in missing data) and for having zero correct responses (which would either indicate that the participate was not trying at all or their keystrokes were not being logged correctly). All exclusion rules for all studies were set prior to conducting any analyses. Fifty-seven participants were excluded, leaving 997 for the analyses.

In Experiment 2 ("Angry Blueberries"), 1010 participants (M_{age} = 33.9; 554 females, 434 males; demographics missing for 22 participants) were recruited. Participants were excluded from the analyses if they were missing subject ID numbers, or if an error in the game resulted in an incorrect allotment of blueberries (i.e., if the game ended before they could use their blueberries or if they were able to continue playing after their blueberries were exhausted). Thirty-six participants were excluded, leaving 974 participants for the analyses.

In Experiment 3 ("Family Feud"), 1497 participants (M_{age} = 37.0; 835 females, 633 males; demographics missing for 29 participants) were recruited. Participants were excluded from the analyses if they were missing subject ID numbers, or if an error in the game resulted in an incorrect allotment of time (i.e., if total time used deviated by more than 5 s from what should have been allocated). This final exclusion rule was set because the coding of the timer made it possible for participants to occasionally get an extra second on a round. We set the cutoff at 5 s, prior to analysis, to allow some room for error. Fifty-eight participants were excluded, leaving 1439 for the analyses.

In Experiment 4 ("Family Feud with Debt"), 915 participants (M_{age} = 36.6; 560 females, 351 males, demographics missing for 4 participants) were recruited. Participants were excluded from the analyses if they were missing subject ID numbers, if an error in the game resulted in their practice data being saved in the main data file (this would only occur due to an error in how data were being saved or possibly if participants hit refresh during the game, either of which would make it possible that there were errors in how data were recorded), if they did not complete 20 rounds due to an error in the "no borrowing" condition (failing to complete 20 rounds in this condition could only result from an error in the execution of the experiment, and we could not be confident that all data were stored correctly), or if an error in the game resulted in an incorrect allotment of time (i.e., if total time used deviated by more than 5 s from what should have been allocated). Thirty-nine participants were excluded, leaving 876 for the analyses.

In Experiment 5 ("Family Feud with Previews"), 1013 participants (M_{age} = 35.6; 641 females, 369 males, demographics missing for 3 participants) were recruited. Participants were excluded from the analyses if they were missing subject ID numbers, if an error in the game resulted in their practice data being saved in the main data file, or if an error in the game resulted in an incorrect allotment of time (i.e., if total time used deviated by more than 5 s from what should have been allocated). Forty-one participants were excluded, leaving 972 for the analyses.

3.2. Results

Table 1 shows all the analyses reported in the original paper and supplemental materials, along with the corresponding replication analyses.

3.3. Discussion

Our original paper included 13 analyses across the five experiments. Here, we find that nine of these analyses replicate, two are in the same direction (but much weaker), and two do not replicate. Combined with the original findings, the replication results offer a clearer picture of the robustness of our original hypotheses.

First, with regard to the replication of Experiment 1, we find no evidence for the hypothesis that scarcity-induced focus leads to cognitive fatigue on subsequent tasks. Indeed, the results run opposite to our initial finding. This could be explained by the fact that our *Wheel of Fortune* task creates significantly more work for the rich (who made many more guesses and completed many more puzzles than the poor), which likely imposes its own cognitive burden. Perhaps we would find that the poor do show more fatigue if we held constant the amount of time the poor and rich spent playing the game. Since time spent playing was never recorded, we cannot explore the possibility that our original experiment may have involved less time differential between poor and rich than the subsequent, fuller replication.

Although our original paper was not about depletion, it did open with an experiment which we interpreted as consistent with findings that performance on complex tasks is hampered when resources are depleted. The current replication results suggest that more work is needed to understand the conditions under which scarcity-induced focus might lead to depletion and negative downstream consequences.

In the subsequent replications, we find consistent and strong evidence for the motivating hypothesis of the original paper: Scarcity itself leads to over-borrowing. We see this clearly in Experiments 2, 3, and 4 where poor participants performed significantly worse when they had the flexibility to borrow. With the increase in power, we do see some instances where, because of the high interest costs, the rich perform slightly worse with the flexibility to borrow. But the effects are always far more pronounced for the poor, suggesting that scarcity directly leads to over-borrowing. Second, we find that this is true for multiple kinds of resources, whether with time (Experiments 3 and 4) or tokens/shots (Experiment 2). Third, we also replicate the findings that scarcity leads to greater focus. In Experiment 2, poor participants spent more time deliberating how to use their resources and earned more points per unit as

Table 1
Summary of analyses from original paper and the corresponding replication analyses.

Experiment	Finding	Original Analysis	Replication Analysis	Summary
1: Wheel of Fortune	Scarcity-induced focus leads to cognitive fatigue on subsequent cognitive control task.	Poor participants performed worse (mean ± SD, 45.12 ± 15.87) than did rich participants (52.93 ± 12.79) [$F(1, 54) = 4.16$, $P = 0.046$, $\eta_p^2 = 0.072$ (90% *CI:* 0.001, 0.197)]	Poor participants performed *better* (mean ± SD, 44.05 ± 15.93) than did rich participants (42.03 ± 15.38) [$F(1, 995) = 4.15$, $P = 0.042$, $\eta_p^2 = 0.004$ (0.000, 0.013)]	Does not replicate
2: Angry Blueberries	Scarcity leads to greater focus.	Poor participants spent more time aiming the first shot of each level (log-transformed milliseconds, 8.08 ± 0.42) than did rich participants (7.73 ± 0.39) [$F(1, 64) = 12.96$, $P < 0.001$, $\eta_p^2 = 0.168$ (0.050, 0.299)]	Poor participants spent more time aiming the first shot of each level (log-transformed milliseconds, 8.11 ± 0.45) than did rich participants (7.81 ± 0.40) [$F(1, 972) = 115.79$, $P < 0.001$, $\eta_p^2 = 0.106$ (0.078, 0.137)]	Replicates
2: Angry Blueberries	Scarcity leads to greater focus.	These differences emerged on the very first shot of the game (poor: 8.19 ± 0.52; rich: 7.86 ± 0.52) [$F(1, 64) = 6.58$, $P = 0.013$, $\eta_p^2 = 0.093$ (0.011, 0.214)]	These differences were also apparent on the very first shot of the game, though not significantly so (poor: 8.12 ± 0.63; rich: 8.06 ± 0.63) [$F(1, 972) = 2.47$, $P = 0.116$, $\eta_p^2 = 0.003$ (0.000, 0.011]	Similar pattern, much weaker
2: Angry Blueberries	Scarcity leads to greater focus.	Among participants who could not borrow, the poor earned more points per shot (2.31 ± 0.60) than did the rich (1.67 ± 0.37) [F (1, 31) = 11.92, P = 0.002, $\eta_p^2 = 0.278$ (0.075, 0.452]	Among participants who could not borrow, the poor earned more points per shot (2.42 ± 0.65) than did the rich (1.91 ± 0.51) [F (1, 458) = 81.88, P < 0.001, $\eta_p^2 = 0.152$ (0.105, 0.201)]	Replicates
2: Angry Blueberries	Scarcity leads to over-borrowing.	As a fraction of their budget, poor participants borrowed more shots (0.24 ± 0.15) than the rich (0.02 ± 0.05) [$F(1, 33) = 27.53$, $P < 0.001$, $\eta_p^2 = 0.455$ (0.233, 0.595)]	As a fraction of their budget, poor participants borrowed more shots (0.20 ± 0.14) than the rich (0.03 ± 0.06) [$F(1, 512) = 296.57$, $P < 0.001$, $\eta_p^2 = 0.367$ (0.314, 0.415)]	Replicates
2: Angry Blueberries	Scarcity leads to over-borrowing.	Rich participants performed similarly whether they could not borrow (−0.12 ± 0.77) or could (0.10 ± 1.18), while poor participants fared better when they could not borrow (0.55 ± 0.65) than when they could (−0.55 ± 1.00) [scarcity × borrowing interaction $F(1, 64) = 8.47$, $P = 0.005$, $\eta_p^2 = 0.117$ (0.021, 0.243)]	Rich participants performed similarly whether they could not borrow (0.004 ± 0.91) or could (−0.003 ± 1.08), while poor participants fared better when they could not borrow (0.44 ± 0.81) than when they could (−0.40 ± 0.99) [scarcity × borrowing interaction $F(1, 970) = 44.83$, $P < 0.001$, $\eta_p^2 = 0.044$ (0.025, 0.067)]	Replicates
2: Angry Blueberries	When facing scarcity, greater focus on current demands predicts neglect of future demands.	On rounds where poor participants borrowed, the average amount of time spent aiming each shot in their paycheck correlated positively with how many shots they subsequently borrowed [$r(38) = 0.34$, $P = 0.039$]	On rounds where poor participants borrowed, there was not a significant correlation between the average amount of time spent aiming each shot in their paycheck and how many shots they subsequently borrowed [$r(616) = -0.007$, $P = 0.872$]	Does not replicate
3: Family Feud	Scarcity leads to over-borrowing.	Regardless of interest rate, poor participants borrowed a greater proportion of their budget (0.22 ± 0.15) than did rich participants (0.08 ± 0.15) [$F(1, 102) = 22.39$, $P < 0.001$, $\eta_p^2 = 0.180$ (0.079, 0.286)]	Regardless of interest rate, poor participants borrowed a greater proportion of their budget (0.29 ± 0.20) than did rich participants (0.08 ± 0.13) [$F(1, 984) = 376.21$, $P < 0.001$, $\eta_p^2 = 0.277$ (0.239, 0.313)]	Replicates
3: Family Feud	Scarcity leads to over-borrowing.	Once again, the poor over-borrowed [interaction $F(2, 137) = 6.54$, $P = 0.002$, $\eta_p^2 = 0.087$ (0.021, 0.161)]. Rich participants performed similarly whether they had no option to borrow (0.06 ± 1.10), borrowed without interest (−0.31 ± 0.88), or with interest (0.25 ± 0.98) [$F(2, 137) = 2.14$, $P = 0.122$, $\eta_p^2 = 0.030$ (0.000, 0.082)]. The poor performed best when they could not borrow (0.60 ± 1.14), less well when they borrowed without interest (0.08 ± 0.67), and worst when they borrowed with interest (−0.48 ± 0.94) [$F(2, 137) = 7.49$, $P < 0.001$, $\eta_p^2 = 0.099$ (0.028, 0.175)]	Once again, the poor over-borrowed [interaction $F(2, 1433) = 20.74$, $P < 0.001$, $\eta_p^2 = 0.028$ (0.015, 0.043)]. Rich participants performed similarly whether they had no option to borrow (0.01 ± 0.90), borrowed without interest (0.10 ± 0.98), or with interest (−0.11 ± 1.10) [$F(2, 1433) = 2.68$, $P = 0.069$, $\eta_p^2 = 0.004$ (0.000, 0.010)]. The poor performed best when they could not borrow (0.48 ± 0.89), less well when they borrowed without interest (−0.02 ± 0.94), and worst when they borrowed with interest (−0.41 ± 0.96) [$F(2, 1433) = 51.03$, $P < 0.001$, $\eta_p^2 = 0.066$ (0.047, 0.087)]	Replicates
4: Family Feud with Debt	Scarcity leads to over-borrowing.	Poor participants borrowed a greater proportion of their budget (0.27 ± 0.14) than did rich participants (0.03 ± 0.04) [$F(1, 56) = 70.50$, $P < 0.001$, $\eta_p^2 = 0.557$ (0.404, 0.654)]	Poor participants borrowed a greater proportion of their budget (0.26 ± 0.15) than did rich participants (0.07 ± 0.11) [$F(1, 449) = 217.66$, $P < 0.001$, $\eta_p^2 = 0.326$ (0.270, 0.379)]	Replicates

(*continued on next page*)

Table 1 (*continued*)

Experiment	Finding	Original Analysis	Replication Analysis	Summary
4: Family Feud with Debt	Scarcity leads to over-borrowing.	The poor accumulated debt at a higher rate (mean of slope ± SD, −0.13 ± 0.18) than did the rich (−0.01 ± 0.01) [Mann-Whitney test, $z = 5.46$, $P < 0.001$]. As the game progressed, poor participants increased their proportional borrowing (0.04 ± 0.04) more than did the rich (0.001 ± 0.002) [Mann-Whitney test, $z = 4.70$, $P < 0.001$]	The poor accumulated debt at a higher rate (mean of slope ± SD, −0.09 ± 0.11) than did the rich (−0.02 ± 0.08) [Mann-Whitney test, $z = 12.05$, $P < 0.001$]. As the game progressed, poor participants increased their proportional borrowing (0.007 ± 0.05) more than did the rich (−0.001 ± 0.03) [Mann-Whitney test, $z = 8.84$, $P < 0.001$]	Replicates
4: Family Feud with Debt	Scarcity leads to over-borrowing.	Rich participants performed similarly when they could not borrow (−0.09 ± 0.81) and when they could (0.11 ± 1.20). The poor performed better when they could not borrow (0.54 ± 0.77) than when they could (−0.49 ± 0.94) [interaction $F(1, 114) = 12.81$, $P < 0.001$, $\eta_p^2 = 0.101$ (0.030, 0.193)]	Rich participants performed slightly (but significantly) better when they could not borrow (0.15 ± 0.93) than when they could (−0.16 ± 1.05). The poor performed far better when they could not borrow (0.42 ± 0.88) than when they could (−0.36 ± 0.96) [interaction $F(1, 872) = 12.69$, $P < 0.001$, $\eta_p^2 = 0.014$ (0.004, 0.030)]	Replicates
5: Family Feud with Previews	Scarcity-induced focus leads to neglect of other details.	Poor participants performed similarly with previews (−0.02 ± 0.87) and without (0.02 ± 1.11), while rich participants performed better with previews (0.32 ± 0.98) than without (−0.35 ± 0.92) [scarcity × borrowing interaction $F(1, 133) = 4.29$, $P = 0.040$, $\eta_p^2 = 0.031$ (0.001, 0.093)]. Previews did not have a significant effect on the poor [$F(1, 133) = 0.02$, $P = 0.889$, $\eta_p^2 = 0.000$ (0.000, 0.006)], but their effect was significant for the rich [$F(1, 133) = 7.42$, $P = 0.007$, $\eta_p^2 = 0.053$ (0.008, 0.125)]. NOTE: Simple effects for this experiment were not reported in the original paper	Poor participants performed similarly with previews (0.003 ± 1.03) and without (−0.003 ± 0.97), while rich participants performed slightly (but not significantly) better with previews (0.08 ± 1.04) than without (−0.07 ± 0.96). The scarcity × borrowing interaction was not significant, $F(1, 968) = 1.21$, $P = 0.272$, $\eta_p^2 = 0.001$ (0.000, 0.008). However, the simple effects reveal that the previews did not have a meaningful effect on the poor [$F(1, 968) = 0.006$, $P = 0.938$, $\eta_p^2 = 0.000$ (0.000, 0.003)], but previews were somewhat more helpful for the rich [$F(1, 968) = 2.61$, $P = 0.107$, $\eta_p^2 = 0.003$ (0.000, 0.011)]	Similar pattern, much weaker

a result. It is worth noting that the effect sizes observed in these replications are often smaller than the original effect sizes. Of course, MTurk has changed considerably in the years since we first used it for these studies. We cannot be sure whether the smaller effect sizes are due to changes in the sample, whether our original experiments over-estimated the effect sizes, or some combination of both. Ultimately, however, these replications suggest that the central hypotheses in our original paper are quite robust: Scarcity leads to over-borrowing, this is true for multiple kinds of resources, and scarcity increases focus in how people use their resources.

We find weaker evidence for the hypothesis that scarcity-induced focus leads to attentional neglect. We fully replicated the experiments wherein greater scarcity led to more high-interest borrowing. But we did not find a greater focus on the current round (estimated via the amount of time spent aiming shots) to be associated with higher borrowing rates. The findings from the replication of Experiment 5 are in the same direction as in the original paper, but they are not significant and are much weaker. We believe that this hypothesis needs further testing before it is ruled in or ruled out. Whereas Experiment 5 offers only an indirect test of attentional neglect, recent eye-tracking studies provide more direct evidence for scarcity-induced attentional neglect. For example, Tomm and Zhao (2016) find that people facing financial scarcity fixate more on monetary information and fail to attend to non-monetary information.

Taken together, we find that scarcity leads to over-borrowing and to greater focus. This raises two questions for further research. First, when does scarcity-induced focus *benefit* decision-making (e.g., Shah et al., 2015) and when does it come at the expense of mental bandwidth (e.g., Mani et al., 2013)? Second, what are the other channels through which scarcity might drive over-borrowing (apart from attentional neglect)?

4. Some consequences of self-replication

The present exercise in self-replication offers broader lessons, beyond clarifying the primary contributions of the research of interest here. Much of the attention on the reproducibility of psychological science has been focused on large-scale efforts to examine how many findings replicate in a cross-section of studies (e.g., Camerer et al., 2016, 2018; Open Science Collaboration, 2015; Klein, 2014). These studies are sometimes quasi-randomly selected and they may not always be representative of all (or even the most important) studies in a particular line of work. These efforts are therefore useful as exercises in meta-science—they describe whether there is a general issue with reproducibility. But they necessarily do not permit a deeper dive into individual projects. Of course, independent and focused replications can provide that deeper dive. Yet we also see a role for pre-registered self-replication. For psychologists who intend to develop a program of research around a central set of questions, it is especially important to ensure that each piece is robust. And when papers in that program of research include studies that do not meet high methodological standards (e.g., small sample sizes, which in some cases may be unavoidable), or when other research produces conflicting findings, then it is important to update those papers. And in those circumstances, it may often prove more efficient to do so for oneself. For one thing, self-replications are more likely to be true to the original experimental procedure. In a scientific discipline where “context matters,” it is useful to explore reproducibility while minimizing differences between studies to the extent possible. Naturally, self-replications cannot fully resolve contextual differences, if nothing else because of the simple passage of time and the progress of knowledge, but they can go a long way. Nor can self-replications completely alleviate concerns around authors’ incentives or capabilities. However, pre-registration can help allay some of those concerns, and most often those are not the main worry. Ultimately, self-replication can help researchers navigate increasingly clearer waters, and can provide an important channel by which we continue to ensure that we are building our science on a foundation of solid results.

Declarations of interest

None.

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Appendix A. Supplementary material

Supplementary data to this article can be found online at https://doi.org/10.1016/j.joep.2018.12.001.

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