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Sunk cost effects for time versus money: Replication of Soman (2001) [Registered Report Stage 1]

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Wenkai Song is with the School of Entrepreneur and Management, ShanghaiTech University, Shanghai.

Gilad Feldman is an Assistant Professor at the Department of Psychology, University of Hong Kong.

Declaration of conflict of interest

The authors declared no potential conflicts of interest with respect to the authorship and/or publication of this article.

Financial disclosure

The authors received no financial support for the research and/or authorship of this article. [open to revision following in-principle acceptance.]

Authorship declaration

Yin Kan CHAN, Cheuk Nam LAU, Tin Ho KWOK, Lok Ching CHOW, and Wai Yan LO designed the study, developed the experimental materials for each study respectively and wrote an initial draft of the Registered Report Stage 1. Nikolay B Petrov took lead over the project, redid the analysis, finalized the materials and analysis scripts, and wrote the manuscript for submission. Wenkai provided feedback on the analyses and documents. Gilad Feldman supervised the project, collected data, and finalized the manuscript for submission.

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We thank Soman for his support and for making the materials available for reproduction.

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Rights

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Contributor Roles Taxonomy

In the table below, we employed CRediT (Contributor Roles Taxonomy) to identify the contribution and roles played by the contributors in the current replication effort.

Role	**Nikolay Petrov**	**Yin Kan CHAN, Cheuk Nam LAU, Tin Ho KWOK. Lok Ching CHOW, Wai Yan LO**	**Wenkai Song**	**Gilad Feldman**
Conceptualization		X		X
Data curation	X	X		X
Formal analysis	X	X		
Funding acquisition				X
Investigation	X	X		
Preregistration verification	X		X	
Data analysis verification	X			
Methodology	X	X		
Project administration				X
Resources	X	X		X
Software	X	X		
Supervision				X
Validation	X			
Visualization	X	X		
Writing – original draft	X	X		
Writing – review and editing	X		X	X

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Abstract

[IMPORTANT: This is a Registered Report Stage 1 before data collection. Written in the past tense as a template to simulate what the final manuscript will look like. No pre-registration or data collection have been conducted.]

The sunk cost effect is the tendency for an individual's decision-making to be biased based on unrecoverable previous investments of resources. Soman (2001) found that sunk cost effect is weaker for time than for money (Studies 1 and 2) and that the facilitation of money-like accounting strengthens the sunk cost effect for time (Study 5). We conducted a close, high-powered, pre-registered replication of Soman (2001) with an online sample of US American Amazon Mechanical Turk (N = 600). We also conducted additional exploratory analyses of the original's hypotheses. We found support/failed to find support for [effect sizes and confidence intervals of original versus replication, split per hypothesis/effect]. Materials, data, and code are available on: https://osf.io/pm264/

Keywords: Judgment, decision-making, sunk cost, escalation of commitment, time, money, opportunity cost

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PCIRR-Study Design Table

Question	Hypothesis	Sampling plan	Analysis plan	Rationale for test	Interpretation given different outcomes	Theory that could be shown wrong by the outcomes
Is the sunk cost effect weaker for time than for money? Does the facilitation of money-like accounting for sunk time costs strengthen the sunk time cost effect?	The sunk cost effect is weaker for time than for money. Facilitation of money-like accounting by using education about economic approaches to time strengthens the sunk cost effect of time	Participants recruited online using the US American Amazon platform.	Chi-square test Two-way between-subject ANOVA	We follow the statistical methods of the original paper.	Based on the criteria used by LeBel et al. (2018) we will examine the replicability of the findings of Soman (2001).	The sunk cost effect is weaker for time than for money and the facilitation of money-like accounting for sunk time costs strengthens the sunk cost effect.

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Sunk cost effects for time versus money: Replication of Soman (2001)

[Registered Report Stage 1]

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People will often increase time and money investments in a failing course of action to try and recover or justify an initial investment, leading to an escalating commitment to a losing course of action. This phenomenon has been coined the "sunk cost effect" (Arkes & Blumer, 1985; Thaler, 1980), given that with larger sunk costs there are stronger tendencies to further escalate.

The sunk cost effect has mostly been investigated with the invested resources being either money or time (or both, e.g. Pandey & Sharma, 2019). In the money domain, findings have been largely consistent and in support of sunk money effects (Arkes & Blumer, 1985; Bornstein et al., 1999; Coleman, 2009; Navarro & Fantino, 2005; Soman & Cheema, 2001), though there were several failures, such as that of Friedman et al. (2007).

Compared to sunk money costs, sunk time costs seem more volatile. For example, Navarro & Fantino (2009) found that undergraduate students were susceptible to sunk time effects across various factors, including the difficulty of and enjoyment from the future time investment and personality responsibility. Silva Castillo et al. (2020) also found evidence for sunk time costs in a within-subject study of 46 undergraduate students, also showing that there is a linear relationship between the time investment and the subjective value placed on the outcome. In comparing money and time for sunk costs, Park and Jang (2014) found that among people from the general population both sunk time and sunk money costs

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independently predicted intentions to cancel a future hypothetical trip. In a similar vein, Pandey and Sharma (2019), across three vignette experiments, found that graduate students were susceptible to sunk time costs but found no support for difference between sunk time and sunk money costs when the money was recoverable. However, in this study, the sunk time cost effect only appeared when the time investment exceeded a specific threshold, which raises the question of what other factors affect the different expressions of the sunk money and sunk time effects.

Some research already points to potential candidates that distinguish between sunk money and sunk time effects. For instance, across online and field studies, Soster et al. (2010) showed that the sunk money and sunk time effects are equivalent if the accounting period is the same, but asymmetrical if the accounting periods are different. Another example comes from Okada and Hoch (2004) who showed that both risk aversion and ambiguity in the outcome produce differences in how time and money costs are accounted for.

Another factor that might differentially affect sunk money and sunk time costs is age. Strough et al. (2008) showed that younger adults are less likely to be susceptible to sunk money costs. One way to contextualise this finding is to consider that sunk costs are not taken in their absolute values, but relative to an individual's total available resource (Garland & Newport, 1991), and older adults are generally wealthier and have less available time, compared to younger adults. Another contextualising factor for the age effect is that experience accounting for both time and money has been shown to predict susceptibility to sunk costs, and younger people likely have much less experience (Bornstein et al., 1999; DeVoe & Pfeffer, 2007; Ronayne et al., 2021).

Methods-wise, Rego et al. (2018) showed that although participants are more likely to stay in an unhealthy relationship when money, but not time, was invested, the effect of sunk time costs was stronger when the outcome was measured on a continuum scale (amount of

who the decision maker is in the scenario and how carefully the decision is considered. In comparing money and time for sunk costs, Park and Jang (2014) found that among people from the general population both sunk time and sunk money costs independently predicted intentions to cancel a future hypothetical trip. In a similar vein, Pandey and Sharma (2019), across three vignette experiments, found that graduate students were susceptible to sunk time costs but found no support for difference between sunk time and sunk money costs when the money was recoverable. However, in this study, the sunk time cost effect only appeared when the time investment exceeded a specific threshold, which raises the question of what other factors affect the different expressions of the sunk money and sunk time effects.

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time willing to invest in an unhappy relationship) rather than as a binary choice (whether or not to invest time).

Overall, although these studies hint at some factors that might affect sunk money and sunk time effects differently, the underlying reasons for these differences remain unclear.

To address this question, Soman (2001) focused on three reasons that make accounting for the sunk costs of time more difficult compared to those of money: 1) time cannot be inventoried or replaced, 2) time is not as easily aggregated as money, 3) accounting for money, unlike time, is a routine activity. In this seminal work, Soman (2001) asked participants, across several experiments, to read scenarios that only differed in whether they were related to time or money and whether there were any sunk costs to be accounted for. Soman's (2001) core finding was that the strength of the sunk cost effect was weaker for time than for money. He further showed that the facilitation of money-like accounting for sunk time costs by highlighting opportunity costs or by educating about an economic approach to time strengthens the sunk time cost effect.

The ubiquity of sunk costs in everyday life and the impact of Soman's (2001) work (439 citations on Google Scholar as of August 2022) suggests the value of revisiting and expanding on this work. To the best of our knowledge, Soman's (2001) research has not been directly replicated.

We aimed to revisit the classic phenomenon and examine the reproducibility and replicability of the classic findings by replicating the studies and improving the design with extensions. Following the recent growing recognition of reproducibility and replicability in psychological science (Brandt et al., 2014; Open Science Collaboration, 2015; Nosek et al., 2022; Zwaan et al., 2018), we embarked on a well-powered pre-registered replication and extensions of Soman (2001).

Methods-wise, Rego et al. (2018) showed that although participants are more likely to stay in an unhealthy relationship when money, but not time, was invested, the effect of sunk time costs was stronger when the outcome was measured on a continuum scale (amount of time willing to invest in an unhappy relationship) rather than as a binary choice (whether or not to invest time).

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We focused our replication on Studies 1 and 2 as they provided the baseline test of the core hypothesis to elucidate whether people account for both the magnitude (Study 1) and the presence (Study 2) of sunk costs in each domain. We also targeted Study 5 as it suggested a method for potential mitigation of the effect. We summarized the hypotheses and effects for Studies 1, 2, and 5 in Table 1.

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Table 1
Soman (2001): Summary of studies and hypotheses and a comparison of original and replication effects

Hypotheses	Study	Description	Statistical test	Original or Replication	Effect Size[a] [95% CI]	Replication outcome[b]
Hypothesis 1: The sunk-cost effect is weaker in the domain of temporal costs than in the domain of monetary costs.	1 **(Theatre and concert tickets)**	Two types of tickets are expressed in two different types of sunk cost domains – either time or money to investigate the relative strength of each domain.	Chi-square; difference between sunk time and sunk money conditions in rate of choosing a ticket	Original	φ_c = .61 [.43, .78]	
				Replication	φ_c = .01 [.00, .10]	no signal – inconsistent
	2 **(Choosing a project)**	The domain (time/money) and the existence of sunk cost (present/absent) are manipulated within a scenario, describing potential projects to work on to test the strength of the sunk cost effects across domains.	Chi-square; difference between sunk time and no sunk time conditions in rate of choosing a project	Original	φ_c = .02 [.00, .18]	
				Replication	φ_c = .00 [.00, .04]	no signal – consistent
			Chi-square; difference between sunk money and no sunk money conditions in rate of choosing a project	Original	φ_c = .32 [.12, .52]	
				Replication	φ_c = .03 [.00 - .15]	no signal – inconsistent
Hypothesis 2a: If the absence of a sunk time cost effect is due to difficulties associated with the accounting of time, then the facilitation of accounting should cause the effect to reappear. [Alternative hypothesis]	5 **(Education and opportunity costs)**	The level of opportunity cost (high/low) and education (present/absent) were manipulated to evaluate the strength of sunk cost effects.	ANOVA; opportunity cost main effect	Original	η_p^2 = .09 [.00, .23]	no signal – inconsistent
				Replication	η_p^2 = .00 [.00, .02]	
			ANOVA; education main effect	Original	η_p^2 = .17 [.04, .32]	no signal – inconsistent
				Replication	η_p^2 = .01 [.00, .02]	
Hypothesis 2b: If the absence of a sunk time cost effect is due to the fact that individuals behave rationally when evaluating past time investments, then the facilitation of accounting should not cause the effect to reappear. [Null hypothesis]			ANOVA; opportunity cost by education interaction	Original	η_p^2 = .00 [.00, .02]	
				Replication	η_p^2 = .00 [.00, .02]	no signal – consistent

[a] We provide additional detail regarding the calculation of effect sizes in the supplementary materials "Effect sizes calculation and power analysis".
[b] We classified each effect using the criteria set out by LeBel et al. (2018)

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Studies overview: Replications of Studies 1, 2, and 5

[IMPORTANT:
Method and results sections were written using a randomized dataset produced by Qualtrics to simulate what these sections will look like after data collection. These will be updated following the data collection. This is written in the past tense, yet no pre-registration or data collection have been conducted.]

Open Science Declaration

This replication is submitted as a Registered Report (Chambers & Tzavella, 2022; Nosek & Lakens, 2014; Scheel et al., 2021; Wiseman et al., 2019).

We will pre-register the experiment on the Open Science Framework (OSF) and data collection will be launched shortly after pre-registration. Pre-registrations and all materials used in these experiments are available in the supplementary materials. We provided all materials, data, code, and pre-registration on: https://osf.io/pm264/.

All measures, manipulations, and exclusions conducted for this investigation will be reported, all studies will be pre-registered with power analyses, and data collection will be completed before analyses. We reported results after exclusions below, and in the supplementary materials, we detailed a comparison between pre- and post-exclusion findings as well as any deviations from the pre-registered plan ("Comparisons and deviations" subsection), with additional disclosures ("Open science disclosures" subsection).

Procedure

[For review: The Qualtrics survey .QSF file and an exported DOCX file are provided in the OSF folder. A preview link of the Qualtrics survey is provided on: https://hku.au1.qualtrics.com/jfe/preview/SV_bNSYF5TiOnh8VrU?Q_CHL=preview&Q_SurveyVersionID=current]

We focused on Soman's (2001) Studies 1, 2, and 5. We combined the three studies into a unified single data collection. This allowed us to maximize our resources and had the added advantage that we can rule out any sample characteristics that might be driving

Studies overview: Replications of Studies 1, 2, and 5

[IMPORTANT:
Method and results sections were written using a randomized dataset of *N*=515 produced by Qualtrics to simulate what these sections will look like after data collection. Note that we aim to recruit a full sample size of 1030 for replication analyses after exclusion and only split for the order effects analyses. All analyses results will be updated following the data collection. This is written in the past tense, yet no pre-registration or data collection have been conducted.]

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Procedure

[For review: The Qualtrics survey .QSF file and an exported DOCX file are provided in the OSF folder. A preview link of the Qualtrics survey is provided on: https://hku.au1.qualtrics.com/jfe/preview/previewId/af9ed4a0-f30e-4088-8408-07e4b05a8ecd/SV_bNSYF5TiOnh8VrU?Q_CHL=preview&Q_SurveyVersionID=current]

We focused on Soman's (2001) Studies 1, 2, and 5. We combined the three studies into a unified single data collection. This allowed us to maximize our resources and had the

differences in successful versus unsuccessful replications. Additionally, a single unified survey allowed us to conduct additional exploratory within-subjects analyses and explore links between different studies, something that is not possible with the original's design. Given that the replication of Study 5 involved education about sunk time costs with a scenario that was first introduced in Study 1, we fixed the order so that Study 5 is always last, with randomized order for the replications of Studies 1 and 2.

Participants first provided consent, after which they read an outline for the studies and three questions confirmed participants qualifications as being American, their understanding of the study procedures, and their agreement to pay close attention (Yes/No/Not sure presented in random order, and participants not answering Yes were asked to return the task). Participants then completed three studies, first Studies 1 and 2 in randomized order, followed by Study 5. In each of the studies, participants read a hypothetical scenario presenting them with two alternatives. In all studies, participants indicated their choice between the two alternatives, and in Studies 1 and 5 they also indicated their preference between the two options on a Likert scale (see below). After completing the studies, participants answered questions inquiring about their seriousness and familiarity with the materials, reported their experience during the survey, and provided demographic information (with no implications for participation or pay). Finally, participants were thanked and debriefed. Our replication project received ethical approval from the University of Hong Kong (REF ID: EA210265).

Materials

The descriptions of the stimuli in the target article were limited. We reached out to the authors and received a scanned copy of the paper materials used in the original. We are very grateful for the author's support in making these available. The survey used was made available on the OSF, and a summary of the materials and questions used is provided in the supplementary materials ("Materials used" subsection).

added advantage that we can rule out any sample characteristics that might be driving differences in successful versus unsuccessful replications. Additionally, a single unified survey allowed us to conduct additional exploratory within-subjects analyses and explore links between different studies, something that is not possible with the original's design. Given that the replication of Study 5 involved education about sunk time costs with a scenario that was first introduced in Study 1, we fixed the order so that Study 5 is always last, with randomized order for the replications of Studies 1 and 2.

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Power analysis

We used a "small-telescope" approach in planning our sample size (Simonsohn, 2015). This approach allows us to both achieve the power to reject a zero-effect null hypothesis, assuming there is a true effect, and to detect an effect much smaller than the original could have possibly detected. To achieve this, it is recommended to use a replication sample 2.5 times that of the original. This is an especially powerful approach in conjunction with our implementation of the studies by combining them into a single survey as it means that powering the largest study entails giving even more power to the other ones. Thus, given that Soman (2001) used a sample size of 206 in his Study 2, we aimed to recruit 600 participants, which is 2.5 times the original plus a 15% planned exclusion rate.

We conducted a sensitivity analysis, and the expected final sample, after the pre-registered exclusion criteria have been applied, (N=515) was sufficiently large to detect same effects as the original (>99.9%), and to detect effect sizes at least 2 times smaller than that of the original (80% power to detect 5 times smaller for Study 1, 2 times smaller for Study 2, 2.5 times smaller for Study 5 – see "Power analysis" subsection).

Exclusion criteria

We excluded participants who indicated low proficiency in English and the understanding of our materials (<5 on a 1-7 scale), low seriousness (<4 on 1-5 scale), familiarity with the materials (answered "Yes" to seeing these materials before), and participants who dropped out and failed to complete all three studies.

Participants

Overall, 515 participants passed the exclusion criteria and were included in the final analyses (M_{age} = 56.69, SD_{age} = 23.94; 24.08% females, 27.38% males). We provided details of the sample and a comparison to Soman's (2001) samples in Table 2.

A methodological comparison between the original and the current study on key dimensions can be found in Table 2.

Table 2

Original vs replication methodological comparison

	Original	Replication	Reason for change
Participants	Undergraduate students from Hong Kong University of Science and Technology and University of Colorado.	Participants from CloudResearch/Amazon MTurk.	Larger more diverse sample.
	Study 1, 2 and 5 were done separately with different participants.	Study 1, 2 and 5 were done in the same survey with the same participant.	Addressing sample concerns and allowing for exploratory analyses comparing effects across studies.
Delivery	Paper questionnaires	Online questionnaire using Qualtrics	
Questions	The original studies did not use any comprehension checks or instructional manipulation checks.	We used comprehension and instructional manipulation checks in our replication.	To ensure that participants read and understood the materials.
Materials	In Study 5, a class on opportunity cost was delivered to those in the education condition.	A passage about opportunity cost along with questions about that passage as instructional manipulation checks were presented.	To adjust to an online sample, we used a passage that participants read instead of a class.
Scale	In Study 5 the preference scale was originally from 1 to 9 and presented as such.	We adjusted the presentation of the scale to 4/0/4 instead of 1 to 9.	Avoid biasing participants in a certain direction.
Order of studies	Study 1 -> Study 2 -> Study 5	Randomized the order of studies 1 and 2 only, but not study 5. Study 5 is presented last at the end of the experiment.	To address potential impact of presentation order.

Materials

The descriptions of the stimuli in the target article were limited. We reached out to the authors and received a scanned copy of the paper materials used in the original. We are very grateful for the author's support in making these available. We used the same content with the minor exception that we started each scenario with "Imagine you are a student" to adjust to the different sample (undergraduates vs general population, see Table 2). We made some minor stylistic changes to the presentation of the materials (using bold/underline/italics at places). The survey used was made available on the OSF, and a summary of the materials and questions used is provided in the supplementary materials ("Materials used" subsection).

Power analysis

We used a "small-telescope" approach in planning our sample size (Simonsohn, 2015). This approach allows us to both achieve the power to reject a zero-effect null hypothesis, assuming there is a true effect, and to detect an effect much smaller than the original could have possibly detected. To achieve this, it is recommended to use a replication sample 2.5 times that of the original. This is an especially powerful approach in conjunction with our implementation of the studies by combining them into a single survey as it means that powering the largest study entails giving even more power to the other ones. Thus, given that Soman (2001) used a sample size of 206 in his Study 2, we calculated a needed sample of at least 515 participants. However, we also wanted to test whether the order in which the studies was presented (Study 1 first vs Study 2 first) affected the results, thus we doubled that sample and planned for a 15% planned exclusion rate, meaning we aimed to recruit 1212 participants in order to get a total of 1030 participants, with equal numbers completing Study 1 or Study 2 first.

We conducted a sensitivity analysis for both the 515 and 1030 target samples. We found that we had 99%+ power to detect the original smallest original effect sizes in each study and 80% power to detect effect sizes at least half of those of the original – see Table 3.

Table 3

Power analysis

Study	Smallest effect size from original	Power to detect smallest effect size from original		Smallest effect size detectable with 80% power	
		$N = 515$	$N = 1030$	$N = 515$	$N = 1030$
Study 1	.61	99%+	99%+	.12	.09
Study 2	.32	99%+	99%+	.17	.12
Study 5	.31	99%+	99%+	.13	.09

Note. Effect size for Study 1 and 2 is φ_c and for Study 5 - η_p^2; see "Effect sizes calculation" section in the supplementary materials.

Exclusion criteria

We excluded participants who indicated low proficiency in English and the understanding of our materials (<5 on a 1-7 scale), low seriousness (<4 on 1-5 scale), familiarity with the materials (answered "Yes" to seeing these materials before either at the end or at any of the two familiarity checks in Study 1 and 2), failure to comprehend the scenarios (inaccurate response on a) a question whether the scenario was about time or money and b) a question about whether their understanding of the materials was accurate, after ensuring they have understood the critical information), and participants who dropped out and failed to complete all three studies. We report the number of people excluded for each criterion and analyze their effect in the "Pre-exclusion vs post-exclusion results comparison" section in the supplementary materials.

Participants

Overall, 1030 participants passed the exclusion criteria and were included in the final analyses (M_{age} = 56.69, SD_{age} = 23.94; 24.08% females, 27.38% males). We provided details of the sample and a comparison to Soman's (2001) samples in Table 4.

We will recruit native English speakers who were born, raised, and located in the US on Amazon Mechanical Turk using the CloudResearch/TurkPrime platform (Litman et al., 2017). Based on our extensive experience of running similar judgment and decision-making replications on MTurk, to ensure high-quality data collection, we will employ the following CloudResearch options: Duplicate IP Block. Duplicate Geocode Block, Suspicious Geocode Block, Verify Worker Country Location, Enhanced Privacy, CloudResearch Approved Participants, Block Low Quality Participants, etc. We will also employ Qualtrics' fraud and spam prevention measures: reCAPTCHA, prevent multiple submissions, prevent ballot stuffing, bot detection, security scan monitor, and relevantID. We provided more details in the "Additional information about the study" subsection in the supplementary materials.

The assignment pay was calculated based on the federal wage of 7.25USD/hour (though we did not restrict participation based on state-level minimum wage). We first pretested survey duration with 30 participants to make sure our time run estimate was accurate and then adjust pay as needed. The data from the 30 participants was not analyzed separately from the rest of the sample other than to assess survey completion duration and needed pay adjustments. For those pretest participants, if the survey duration was longer than expected, they were paid a bonus as a pay adjustment.

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Table 2

Comparison of the Soman's (2001) and the current sample.

	Soman (2001)	Replication
Sample size	Study 1: 122 Study 2: 206 Study 5: 72	515
Geographic origin	Study 1: Hong Kong Study 2: US American Study 5: US American	US American Amazon Mechanical Turk workers
Gender	Undisclosed	141 males, 124 females, 250 other/did not disclose
Median age (years)	Undisclosed	56
Average age (years)	Undisclosed	56.69
Standard deviation age (years)	Undisclosed	23.94
Age range (years)	Undisclosed	18-99
Medium (location)	Study 1: Physical survey Study 2: Physical survey Study 5: Physical survey	Computer (online)
Compensation	Study 1: Credit Study 2: Undisclosed Study 5: Undisclosed	Nominal payment
Year	2001	2022
Sample source	Undergraduate students	General population

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Gender	Undisclosed	141 males, 124 females, 250 other/did not disclose
Median age (years)	Undisclosed	56
Average age (years)	Undisclosed	56.69
Standard deviation age (years)	Undisclosed	23.94
Age range (years)	Undisclosed	18-99
Medium (location)	Study 1: Physical survey Study 2: Physical survey Study 5: Physical survey	Computer (online)
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Replication of Study 1

Study 1 was meant to test the first hypothesis that the sunk cost effect is weaker for time than for money. Participants read a hypothetical scenario about having invested either time or money and needed to decide whether to invest further resources into a preferred or a non-preferred option. We provided more information on the stimuli, procedure and measures in the supplementary materials ("Materials used" subsection).

Method

Design and procedure

We employed a between-subject design with random allocation in either time or money sunk cost condition. In both conditions, the dependent variables were the same: a two-alternative forced choice, like the original, and a continuous preference scale, which we added (see next section).

Both the sunk time and the sunk money conditions asked participants to imagine that they had invested more resource (time or money) for a ticket for a theatre performance compared to the resource (time or money) invested for a ticket for a rock concert, but that they preferred going to the rock concert.

Measures

Two-alternative Forced Choice (replication)

Participants then had to decide whether they would prefer to go to the theatre performance or the rock concert.

Preference (extension)

Because Study 5 employed very similar scenarios, we wanted to compare the responses from Study 1 to those of Study 5. To do so, we added in Study 1 the same measure

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as the original Study 5, which asked participants to indicate their preference on a scale of 1 (Rock concert) to 9 (Theater performance). The scale was presented to participants as 4 (*Definitely Rock Concert*) through 0 (*Indifferent*) to 4 (*Definitely Theater Performance*). A higher score on the scale represents less susceptibility to sunk cost fallacy. As a preliminary insight, in our replication of Study 5, we added the two-alternative forced choice that the current Study 1 had with the same aim of comparing responses across studies.

Results

Two-alternative Forced Choice (replication)

We conducted a chi-square test and found no support for differences in participants' choice of theatre performance vs rock concert ticket between the sunk time cost (48.8% chose theatre performance ticket) and sunk money cost (50.2% chose theatre performance ticket) conditions, $\chi^2(1) = .09$, $p = .758$, $\varphi_c = .01$, 95% CI [.00, .10] - see Figure 1A).

Whereas in the original study they found that 4.8% of participants preferred the theatre performance ticket in the sunk time condition, and 61.7% in the sunk money condition, thereby showing a strong effect of sunk cost domain, $\chi^2(1) = 44.68$, $p < .001$, $\varphi_c = .61$ 95% CI [.43, .78], in the current study, we failed to find support for this finding.

Preference (extension)

We conducted an independent samples t-test and found no support for differences between the preference ratings of people in the time condition ($M = 4.85$, $SD = 2.60$) compared to those in the money condition ($M = 4.85$, $SD = 2.55$), $t(512.88) = 0.00$, $p = .998$ – see Figure 1A.

Discussion

[To be added at Stage 2]

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Discussion

[To be added at Stage 2]

Replication of Study 2

In this study, we further interrogated the first hypothesis, namely that the sunk cost effect is weaker for time than for money, by building on the previous study by adding another condition: whether there is a sunk cost or not. This allowed us to test whether the sunk cost effect would appear when comparing sunk cost versus no sunk cost conditions in each domain (time/money).

Method

Design

We employed a 2 (*sunk cost domain*: time or money) x 2 (*sunk cost presence*: sunk cost or no sunk cost) between-subjects design with random allocation. In all conditions, the dependent variable was the same two-alternative forced choice.

Procedure

In the sunk cost conditions (regardless of the sunk cost domain), participants were asked to imagine that they had already invested substantial resources in developing a new rocket engine invention for a competition compared to no resource invested in developing a solar-powered pump. To finish either project would require the same resources, but they learn that the winner of last year's competition also worked on a rocket engine design. They are then asked whether they would prefer to continue working on the rocket engine design (on which they have already spent resources) or to complete a solar-powered pump design.

In the no sunk cost condition, participants are presented with the same story, but they are not told that they had already invested resources in either design. We provided additional details in the "Materials used" subsection of the supplementary materials.

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Results

We conducted two chi-square tests to analyze the difference between the sunk cost and no sunk cost conditions in each domain (time and money). With time sunk cost, we found no support for differences between those that read the sunk cost scenario (45.1% chose the rocket engine) and those who read the no sunk cost scenario (44.9% chose the rocket engine) in choosing which design to work on, $\chi^2(1) = .00$, $p = .970$, $\varphi_c = .00$, 95% CI [.00, .04]. With money sunk cost, we also found no support for differences between those that read the sunk cost scenario (51.9% chose the rocket engine) and those who read the no sunk cost scenario (49.2% chose the rocket engine) in choosing which design to work on, $\chi^2(1) = .19$, $p = .665$, $\varphi_c = .03$, 95% CI [.00, .15] – see Figure 1B).

In comparison, the original study also found no support for an effect in the time domain, 20.4% chose the rocket engine in the sunk cost, and 19.0% in the no sunk cost, $\chi^2(1) = .04$, $p = .852$, $\varphi_c = .02$, 95% CI [.00, .18], but did find support for an effect in the money domain, 55.1% chose the rocket engine in the sunk cost, and 24.0% in the no sunk cost, $\chi^2(1) = 10.03$, $p = .002$, $\varphi_c = .32$, 95% CI [.12, .52].

We failed to find support for differences between sunk cost and no sunk cost conditions in either time or money domain. This conclusion is in line with the original's findings for the time domain but contradicts the findings for the money domain.

Discussion

[To be added at Stage 2]

Replication of Study 5

In this study, we tested the second hypothesis, namely whether the facilitation of accounting for time strengthens the sunk time cost effect. To do this, we presented

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Discussion

[To be added at Stage 2]

participants with a few paragraphs aimed at educating them about economic approaches to time. Additionally, we also varied the magnitude of the opportunity cost, such that it could be either low or high. This setup allowed us to test not only whether the education intervention works, but also the conditions in which that occurs.

Method

Design

We employed a 2 (*opportunity cost*: low or high) x 2 (*education*: education or no education) between-subjects design with random allocation. In all conditions, the dependent variables were the same: a continuous preference scale, like the original, and a two-alternative forced choice, which we added (see next section).

Procedure

The scenario was similar to the one used in the replication of Study 1 with two differences. First, in the high opportunity cost condition, participants were told that they were 'badly pressed for time', while in the low opportunity cost condition they were told that there is 'relative flexibility in your schedule'. Second, an education intervention was implemented: those who received education about opportunity costs were asked to read a short passage, which explained what an opportunity cost is and gave a thorough example. We provided additional details in the "Materials used" subsection of the supplementary materials.

Measures

Preference (replication)

Participants indicated their preferences on a scale of 1 (*Rock concert*) to 9 (*Theater performance*) which we presented to participants as 4 (*Definitely Rock Concert*), 0 (*Indifferent*) and 4 (*Definitely Theater Performance*). A higher score on the scale represents

Replication of Study 5

In this study, we tested the second hypothesis, namely whether the facilitation of accounting for time strengthens the sunk time cost effect. To do this, we presented participants with a few paragraphs aimed at educating them about economic approaches to time. Additionally, we also varied the magnitude of the opportunity cost, such that it could be either low or high. This setup allowed us to test not only whether the education intervention works, but also the conditions in which that occurs.

Method

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We employed a 2 (*opportunity cost*: low or high) x 2 (*education*: education or no education) between-subjects design with random allocation. In all conditions, the dependent variables were the same: a continuous preference scale, like the original, and a two-alternative forced choice, which we added (see next section).

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less susceptibility to sunk cost fallacy. We note that this is a deviation from the original's measure that ranged from 1 to 9 in presentation. We made this adjustment to avoid biasing participants towards the option presented with larger numbers.

Forced Choice (extension)

To be able to compare the findings of Study 1 with that of Study 5 that employed similar stimuli we added the same two-alternative forced choice measure that was used in Study 1. As in Study 1 (above), participants had to decide whether they would prefer to go to the theatre performance or the rock concert.

Results

Preference (replication)

To analyze the effects of opportunity cost and education on preference ratings for one ticket or the other, we selected Type-III ANOVA (to account for any variance in potential interactions; Field 2017). Assumptions for normality, outliers and homogeneity of variances were met, although ANOVA is robust to these violations with large samples (Blanca et al., 2017).

We conducted a 2 (Opportunity cost) x 2 (Education) between-groups ANOVA on preference ratings. We found no support for a main effect of opportunity cost, $F(1, 511) = .64$, $p = .425$, $\omega^2 = -.00$, $\eta_p^2 = .00$, 95% CI [.00, .02] with those in the high opportunity cost condition ($M = 4.89$, $SD = 2.61$) not providing statistically different preference ratings than those in the low opportunity cost condition ($M = 5.07$, $SD = 2.60$). We also found no support for a main effect of education, $F(1, 511) = 2.65$, $p = .104$, $\omega^2 = .00$, $\eta_p^2 = .01$, 95% CI [.00, .02] with no support for differences preference ratings between those who underwent education ($M = 5.17$, $SD = 2.53$) compared to those who did not undergo education ($M =$

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4.79, *SD* = 2.67). We found no support for an interaction effect between the independent variables, $F = 1.11$, $p = .294$ – see Figure 1C).

In comparison, in the original study they found a main effect of opportunity cost, $F(1, 68) = 6.63$, $p < .020$, $\omega^2 = .073$, $\eta_p^2 = .089$, 95% CI [.00-.23], with those in the high opportunity cost condition ($M = 6.20$[1]) providing higher preference ratings that those in the low opportunity cost condition ($M = 4.86$). The original study also found a main effect of education, $F(1, 68) = 13.65$, $p < .001$, $\omega^2 = .149$, $\eta_p^2 = .167$, 95% CI [.04-.32], with those who underwent education ($M = 6.36$) providing higher preference ratings than those who did not undergo education ($M = 4.52$). The interaction between the two factors was not supported in the original study, $p > .950$.

Thus, though we also find no interaction effects, we fail to replicate the main effects of opportunity cost and education.

Forced choice (extension)

To analyze the two-alternative forced choice responses, we built a generalized linear model (GLM). We have already built this model for our later exploratory analyses (see section "Study 1 versus Study 5: Analysis of within-subject effects" for details of the model building procedure) which included the same two independent variables as the ANOVA, namely opportunity cost, education and their interaction, as well as an additional independent variable and other interactions. In that generalized linear model, we coded the factors such that we get the results for the current study, therefore we report the results for the two main effects of interest and their interaction.

[1] The original did not report standard deviations.

.02] with no support for differences preference ratings between those who underwent education (M = 5.17, SD = 2.53) compared to those who did not undergo education (M = 4.79, SD = 2.67). We found no support for an interaction effect between the independent variables, F = 1.11, p = .294 – see Figure 1C).

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Specifically, the GLM showed no support for a main effect of opportunity cost (OR = .71 [.43, 1.16], p = .172), no support for a main effect of education (OR = .99 [.70, 1.40], p = .967), and no support for an interaction (OR = 1.95 [.98, 3.91], p = .059) – see Figure 1C right-hand side as well as Table 3.

Discussion

[To be added at Stage 2]

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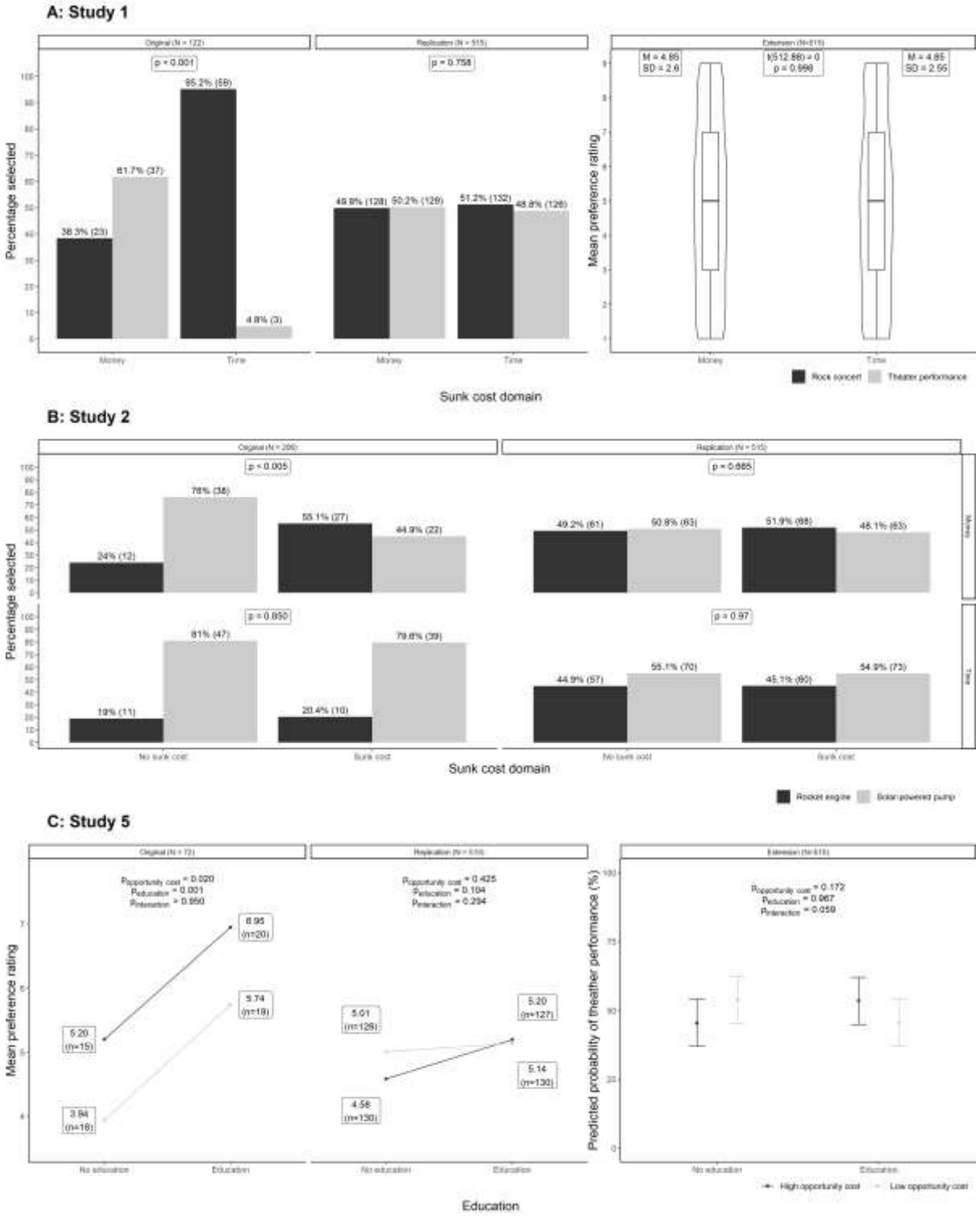
Discussion

[To be added at Stage 2]

Figure 1

Summary of results comparing Soman's original studies to the current replication effort



Note. Bold text denotes support for an effect at the 0.05 level.

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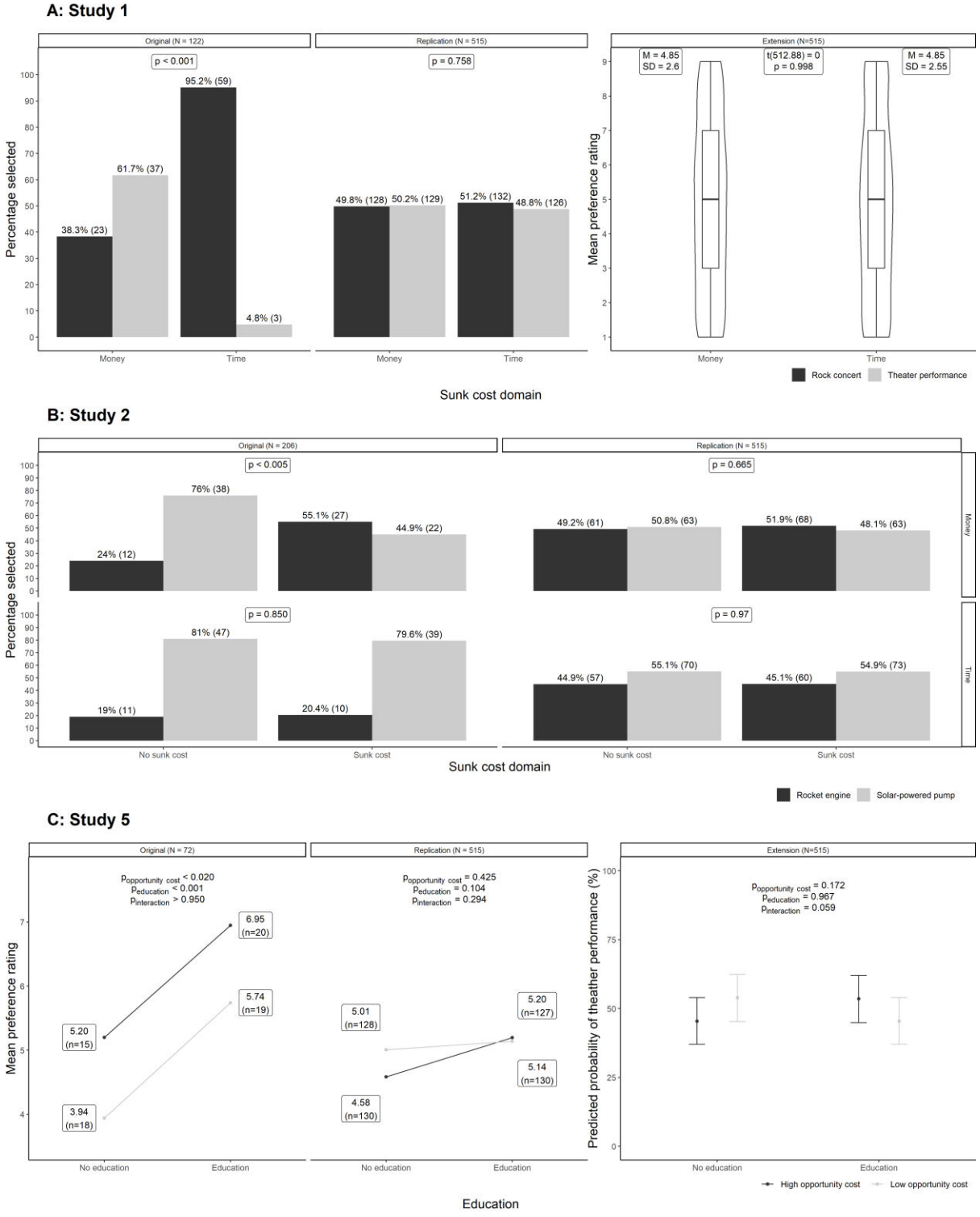
Summary of results comparing Soman's original studies to the current replication effort



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Summary of results

Replication results

[Evaluation of findings using LeBel et al. (2019) criteria and discussion on effects, see Table 1 for summary]

Additional analyses and checks

Sunk cost effect stronger for money than for time: Re-analysis using logistic regression

To address H1, Soman (2001) conducted multiple chi-square tests. Specifically, in Study 2, he showed that in the money condition, the chi-square test found support for differences between sunk cost and no sunk cost conditions, whereas the same difference was not supported for the time condition.

A different way to approach H1 is to ask whether the likelihood of picking the option associated with sunk costs (rocket engine in Study 2) is different not only between levels of a single independent variable (sunk cost presence or sunk type) but also whether there was an interaction between the two variables. To address this question, we conducted logistic regression analyses for Study 2 for both the original and the replication data.

We ran a logistic regression for Study 2. The dependent variable was coded as 0 (solar-powered pump) and 1 (rocket engine). The predictors in the model were sunk type (money/time) and sunk cost presence (no sunk cost/sunk cost) as well as their interaction. We wanted our model to test whether there was a main effect of sunk type in the sunk cost present condition (thereby replicating the effect from Study 1) and also whether there was a main effect of sunk presence, regardless of the sunk type. In order to achieve this, we coded sunk type as a sum contrast and sunk presence as a treatment contrast, with sunk cost present

Summary of results

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as its baseline condition. In order to get predicted probabilities from the model for main effects with no baseline condition for remaining factors (in this case the main effect for sunk presence), we applied marginal standardization, which has been reliably shown to be a robust method compared to alternatives (Muller & MacLehose, 2014; Williams, 2012).

The results of the logistic regression for Study 2 on Soman's (2001) original data showed that there was support for a main effect of sunk type, such that the odds of selecting the rocket engine design in the sunk cost condition went down by 79% in the domain of time compared to money (OR = .21 [.08, .50], p = .001). Soman's data also revealed support for a main effect of sunk cost presence, regardless of sunk type, such that the odds of selecting the rocket engine were 52% lower in the no sunk cost compared to the sunk cost condition (OR= .48 [.25, .92], p = .027; sunk cost effect differences between the money and time domains: OR = 3.55 [.99, 13.06], p = .053; see Figure 2A).

We conducted a logistic regression for Study 2 in our replication data and found no support for a main effect of sunk type (OR = .76 [.47, 1.23], p = .270), no support for a main effect of sunk presence (OR = .94 [.67, 1.33], p = .739), and no support for an interaction (OR = 1.10 [.55, 2.21], p = .779) – see Figure 2B. See Table 4 for a summary.

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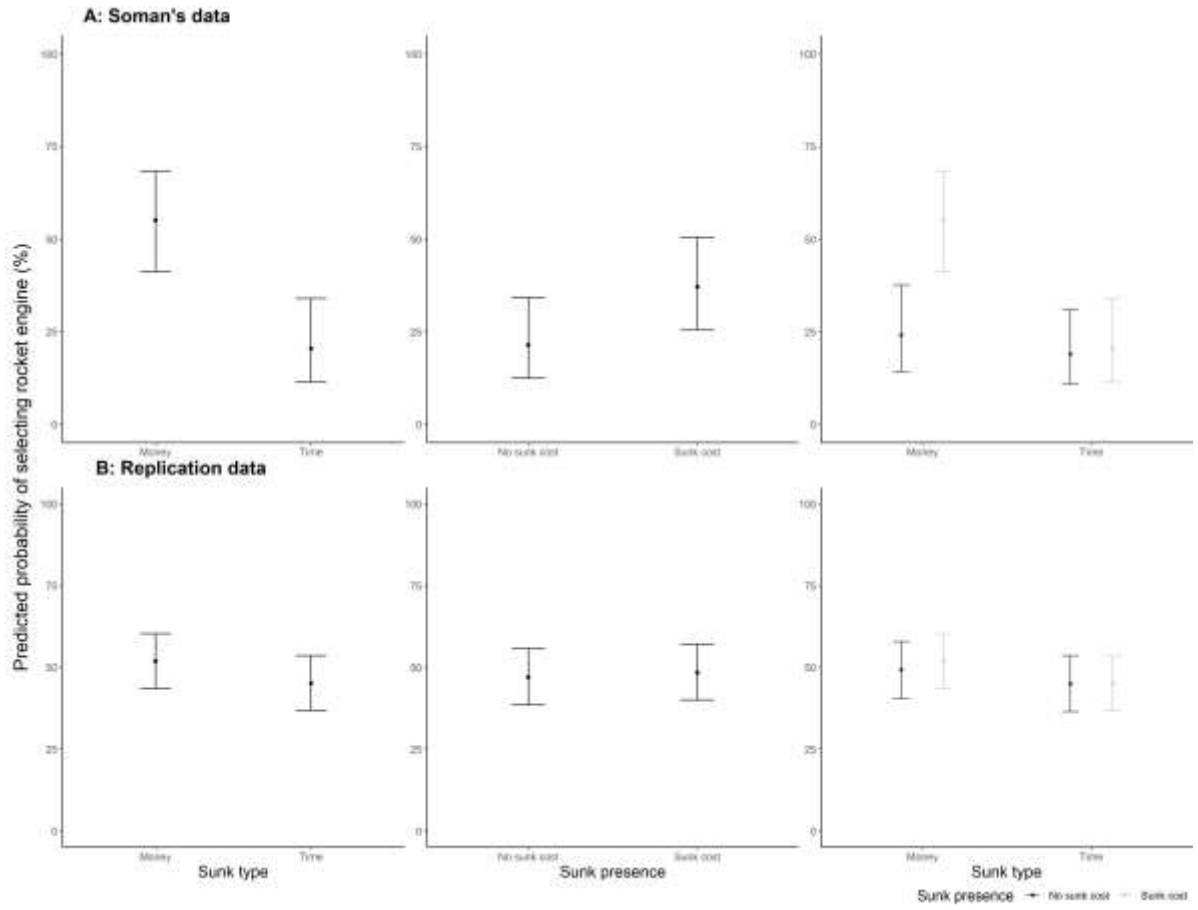
Figure 2

Study 2: Predicted probabilities from logistic regression analyses



Note. The main effect of sunk type is plotted based on predicted probabilities from the sunk cost present condition, while the main effect of sunk presence is plotted using marginal standardization across levels of sunk type.

Study 1 versus Study 5: Analysis of within-subject effects

We extended the original analyses of H2 by considering an additional within-subject factor: study. Specifically, we took advantage of three of our design choices: 1) the replications of Study 1 and Study 5 both involved the same theater performance vs rock concert ticket scenario, with the only difference that the design of Study 5 was a 2x2 between-subjects; 2) the same participants completed both Study 1 and Study 5 in the same

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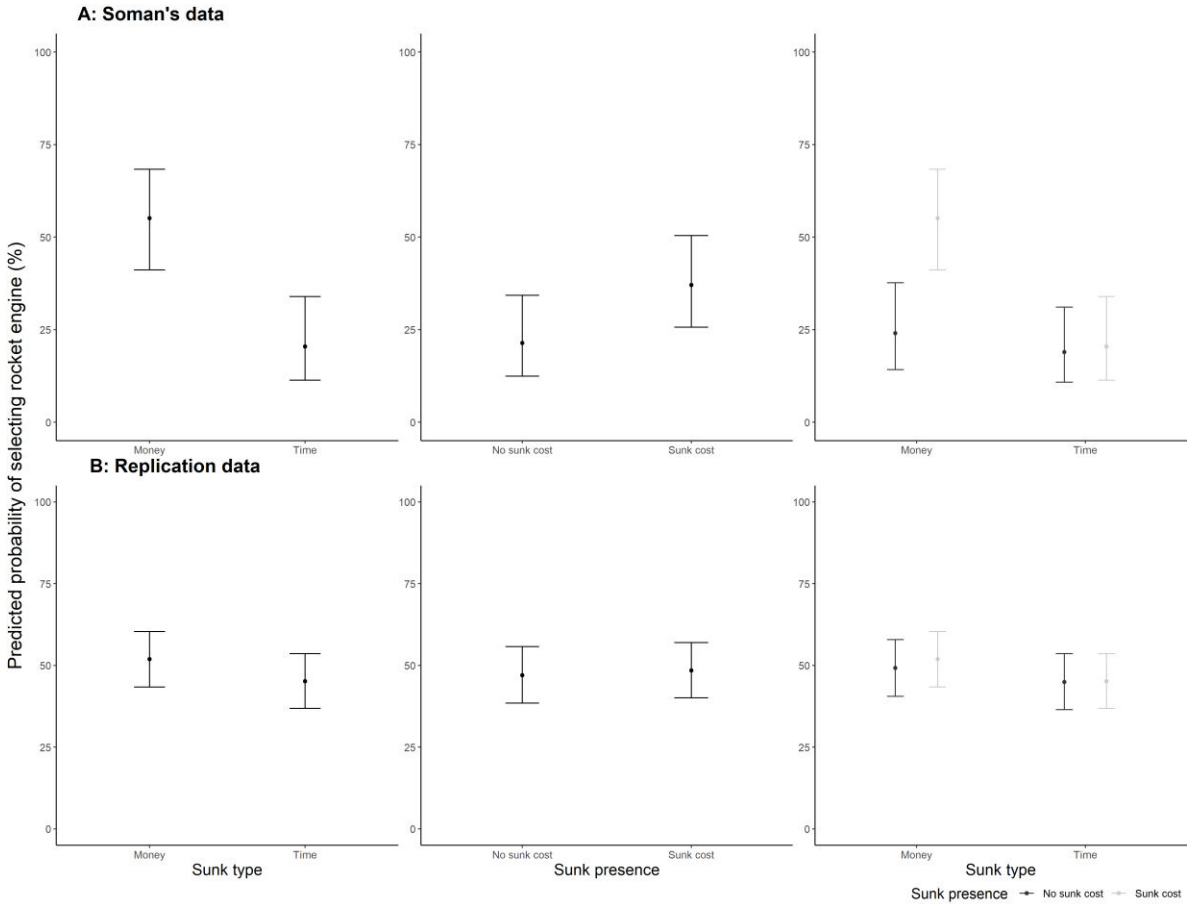

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survey; 3) we included both the two-alternative forced choice and the Likert response scales in both Study 1 and Study 5.

This allowed us to address two additional questions: 1) What are the differences between Study 1 and the high versus low opportunity cost conditions in Study 5 (i.e., study by opportunity cost interaction, in the no education condition in Study 5), and 2) Are those differences affected by education (study by opportunity cost by education interaction). To test both questions, we focused on the time sunk cost domain, as Study 5 only included the vignette version in the time domain.

To address these questions, we constructed two linear models: one linear model (LM) with preference ratings on a continuous scale as the dependent variable and one generalized LM (GLM) with ticket choice (theater performance coded as 1 and rock concert as 0) as the dependent variable. We included three independent variables: study (Study 1 vs Study 5), opportunity cost (low vs high), education (no education vs education), and all their interactions. The factor variables were coded such that study was set as a treatment contrast, with Study 5 as the baseline condition, opportunity cost was coded as a sum contrast, and education was coded as a treatment contrast, with no education as the baseline condition.

The results of both models suggested that there was no two-way interaction between study and opportunity cost in the no education condition, nor was there a three-way interaction between opportunity cost, study and education in either of the models – see Figure 3 and Table 3 for outputs of those models and Table 4 for a summary of the results.

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Table 3

Results of linear (DV: Preference) and generalized linear (DV: Binary choice) models from the additional within-subjects analysis

Predictors	Preference			Two-alternative forced choice		
	Estimate	*95% CI*	*p*	*Odds Ratio*	*95% CI*	*p*
opportunity cost	-.06	-.96 – .85	.901	.71	.43 – 1.16	.172
study	-.07	-.63 – .48	.795	.80	.52 – 1.23	.315
education	-.04	-.68 – .60	.902	.99	.70 – 1.40	.967
opportunity cost x study	-.37	-1.47 – 0.74	.518	.82	.35 – 1.94	.656
opportunity cost x education	.26	-1.02 – 1.54	.692	1.95	.98 – 3.91	.059
study x education	.41	-.37 – 1.19	.302	1.48	.81 – 2.71	.204
opportunity cost x study x education	.22	-1.34 – 1.79	.780	.96	.29 – 3.23	.954

Table 5

Results of linear (DV: Preference) and generalized linear (DV: Binary choice) models from the additional within-subjects analysis

Predictors	Preference			Two-alternative forced choice		
	Estimate	*95% CI*	*p*	*Odds Ratio*	*95% CI*	*p*
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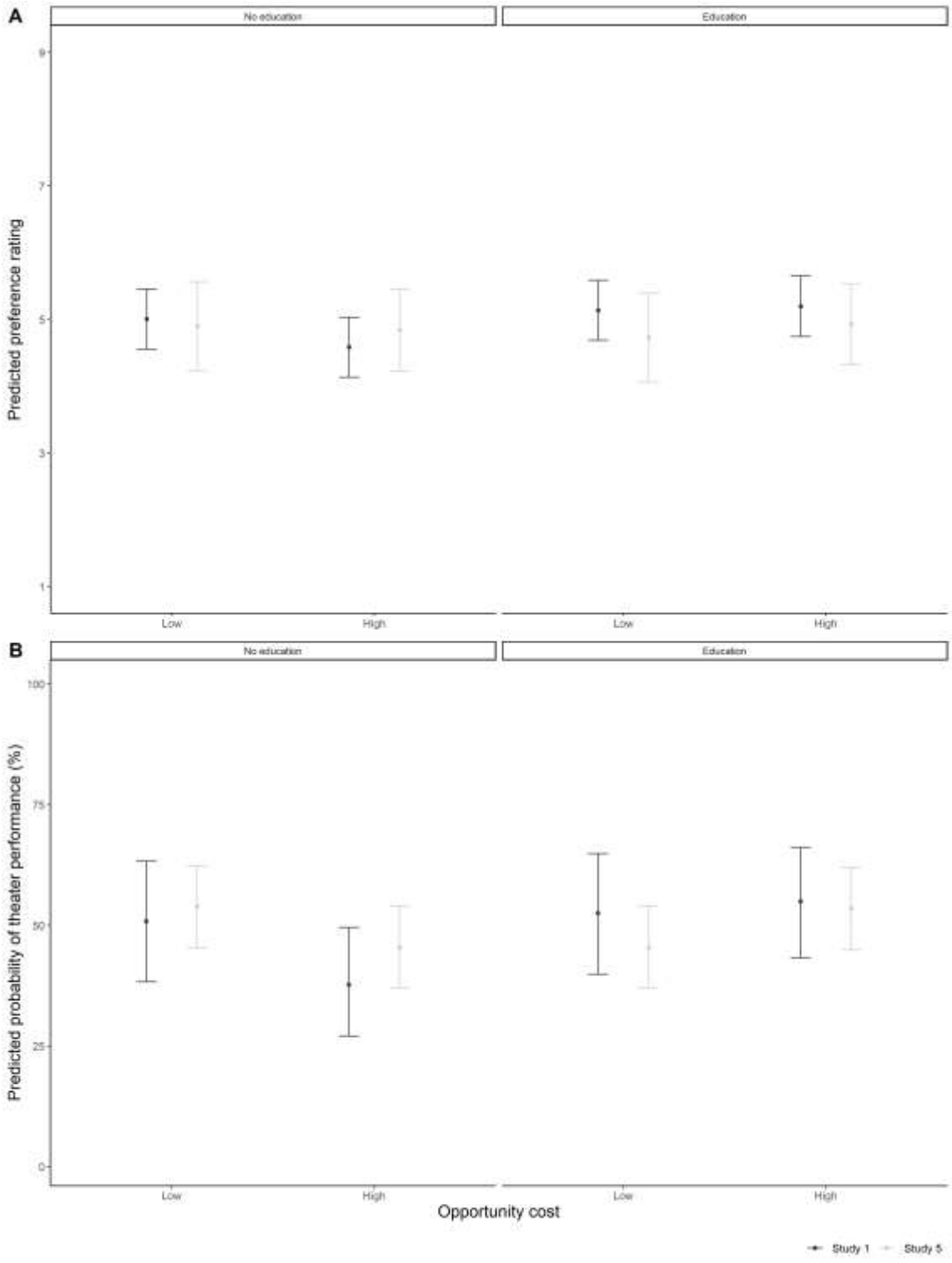
Predicted responses from linear (DV: preference) and generalized linear (DV: two-alternative forced choice) models from the three-way interaction between the predictors



Note. Panel A shows the three-way interaction for the LM with the continuous preference variable as the DV and Panel B shows the three-way interaction for the GLM with the binary choice between rock concert and theater performance as the DV.

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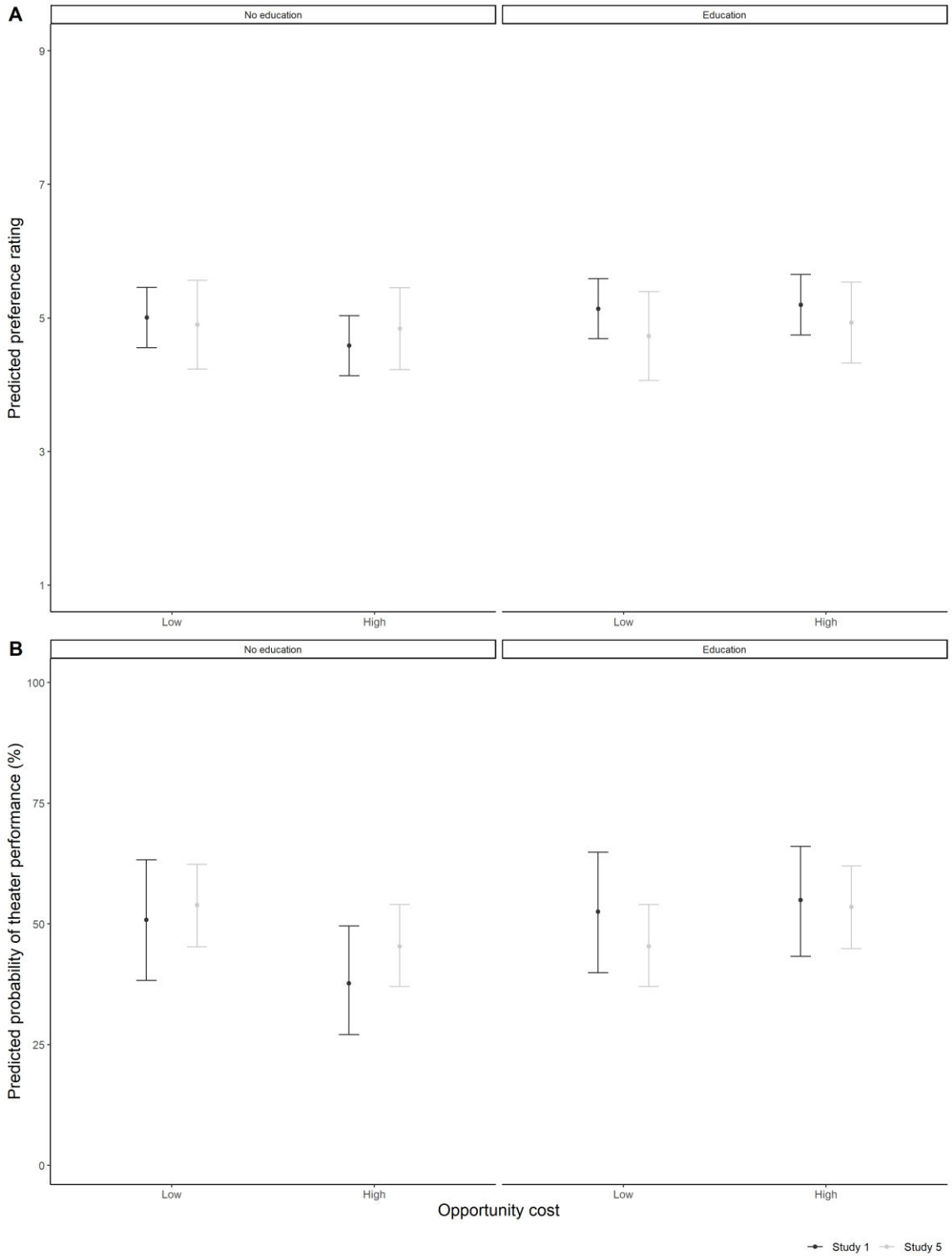
Predicted responses from linear (DV: preference) and generalized linear (DV: two-alternative forced choice) models from the three-way interaction between the predictors



Note. Panel A shows the three-way interaction for the LM with the continuous preference variable as the DV and Panel B shows the three-way interaction for the GLM with the binary choice between rock concert and theater performance as the DV.

Table 4

Summary of additional analyses

Hypothesis	*Question addressed*	*Analysis used*	*Consistent with replication analysis (Yes/Mixed/No)*	*Details*
The sunk cost effect is weaker for time than for money.	Does the likelihood of picking the option associated with sunk costs (rocket engine in Study 2) vary significantly between levels of one independent variables (sunk cost presence or sunk type) given a change in the other (i.e., an interaction effect)?	2x2 logistic regression on both Soman's original data as well as the replication data.	Yes	Both re-analyses yielded the same conclusions as the replication analyses, despite being at odds with each other in terms of effects detected.
Facilitation of money-like accounting by using education about economic approaches to time strengthens the sunk cost effect of time (tested only in the time domain).	What are the differences between Study 1 and the high versus low opportunity cost conditions in Study 5 (i.e., study by opportunity cost interaction, in the no education condition in Study 5)?	Two linear models: one linear model with preference ratings as the dependent variable and one generalized LM with 2-alternative ticket choice as the dependent variable. The models included three independent variables: study (Study 1 vs Study 5), opportunity cost (low vs high), education (no education vs education), and all their interactions.	Yes	Both statistically non-significant interactions show that, at least in the time domain, neither the opportunity cost, nor the education manipulations, made a difference. Although this is aligned with the replication analyses in our sample, it contradicts Soman's (2001) conclusion.
	Are differences between Study 1 and the high versus low opportunity cost conditions in Study 5 affected by education (study by opportunity cost by education interaction)?		Yes	

Table 6

Summary of additional analyses

Hypothesis	*Question addressed*	*Analysis used*	*Consistent with replication analysis (Yes/Mixed/No)*	*Details*
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Facilitation of money-like accounting by using education about economic approaches to time strengthens the sunk cost effect of time (tested only in the time domain).	What are the differences between Study 1 and the high versus low opportunity cost conditions in Study 5 (i.e., study by opportunity cost interaction, in the no education condition in Study 5)? Are differences between Study 1 and the high versus low opportunity cost conditions in Study 5 affected by education (study by opportunity cost by education interaction)?	Two linear models: one linear model with preference ratings as the dependent variable and one generalized LM with 2-alternative ticket choice as the dependent variable. The models included three independent variables: study (Study 1 vs Study 5), opportunity cost (low vs high), education (no education vs education), and all their interactions.	Yes Yes	Both statistically non-significant interactions show that, at least in the time domain, neither the opportunity cost, nor the education manipulations, made a difference. Although this is aligned with the replication analyses in our sample, it contradicts Soman's (2001) conclusion.

Between subject studies and order effects (exploratory)

[If we fail to find support for the target's findings, we will conduct additional exploratory analyses examining order effects and controlling for order.]

[If we fail to find support for the target's findings, we will conduct additional exploratory analyses examining Studies 1 and 2 only when they were the first study presented to participants. This would address possible confounds between the studies, resembling running two separate studies.]

General Discussion

[To be added/expanded at Stage 2]

Limitations of the original study: Directions for improvement

[To be added at Stage 2]

[Addressing reviewers' feedback on best fit analyses, and our inclusion of both the target's analyses and new analyses.]

Limitations of our replication and directions for future research

[To be expanded at Stage 2. Below is a sample text, which will be updated/expanded after data collection.]

[Our replication was conducted more than two decades after Soman (2001) was published, with changes in the way people think of both time and money that might have impacted the findings. This is partly why ongoing repeating replications are needed, to keep our knowledge about an important phenomenon up to date.]

Order effects between studies

One deviation from the original study is that all participants completed all scenarios. We considered this to be a stronger design with many advantages that we laid out in the "Studies overview" section above, yet one disadvantage is that answers to one scenario may bias participants' answers to following scenarios (recall that Study 1 and 2 were presented in random order followed by Study 5). To address this is to run all analyses for each of the studies by only focusing on the participants that completed that study first, and to examine order as a moderator. [TBD conclusion: We found [no] differences in conclusions – see Table 7.]

Table 7

All analyses re-ran, split by whether Study 1 or Study 2 was presented first

Analysis	Statistical test and factors		Full sample		Study 1 first		Study 2 first	
			ES	*p*	ES	*p*	ES	*p*
Replication analyses								
Study 1: Forced choice		Chi-square						
Study 1: Preference		Independent samples t-test						
Study 2: Time domain		Chi-square						
Study 2: Money domain		Chi-square						
Study 5: Preference	between-groups ANOVA	opportunity cost						
		education						
		opportunity cost x education						
Study 5: Forced choice	Generalized Linear Model	opportunity cost						
		education						
		opportunity cost x education						
Additional analyses and checks								
Study 2 re-analysis	Logistic Regression	sunk type						
		sunk presence						
		sunk type x sunk presence						
Study 1 versus Study 5: Analysis of within subject effects	Linear model	opportunity cost						
		study						
		education						
		opportunity cost x study						
		opportunity cost x education						
		study x education						
		opportunity cost x study x education						
	Generalized Linear Model	opportunity cost						
		study						
		education						
		opportunity cost x study						
		opportunity cost x education						
		study x education						
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Note. Reported effect sizes (ES) are: Chi-square – φ_c, Independent samples t-test – Cohen's *d*, ANOVA - η_p^2, Generalized Linear Model and Logistic Regression - Odds Ratios, Linear model – β.

[Our replication had limitations, and we needed to make several adjustments to the target's design to accommodate our sample and method of delivery. First, participants in the original study were students who were enrolled in a particular class, whereas participants in our replication were sampled from the general population. This makes it possible that the student sample was systematically different in some respect, compared to the general population. Second, we made adjustments to the opportunity cost manipulation. Third, in the original, the education intervention was implemented by manipulating when the study was conducted – either before a classroom discussion about the economic value of time (control condition) or after (education condition) – whereas in our replication, the intervention was implemented by having participants read information on the screen and complete comprehension checks. These changes were necessary given the change in the medium, yet it may have affected the results. Fourth, the studies were originally run separately, and in our design, we ran the studies together, with Study 5 always last, given its similarity to Study 1. This allowed us additional insights and a comparison between Study 5 and Study 5, yet this does mean that our adjustments make the replication of Study 5 less direct in comparison to Studies 1 and 2, with higher likelihood of the results being different than that of the target's.]

[Based on feedback from peer review: potentially discuss how sample demographics, such as education level or employment experience, and our pay based on a federal minimum wage rather than by state, may correlate with outcome measures.]

Conclusion

[To be added at Stage 2]

General Discussion

[To be added/expanded at Stage 2]

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Conclusion

[To be added at Stage 2]

References

Arkes, H. R., & Blumer, C. (1985). The psychology of sunk cost. *Organizational Behavior and Human Decision Processes*, *35*(1), 124–140. https://doi.org/10.1016/0749-5978(85)90049-4

Blanca, M. J., Alarcón, R., & Arnau, J. (2017). Non-normal data: Is ANOVA still a valid option? *Psicothema*, *29.4*, 552–557. https://doi.org/10.7334/psicothema2016.383

Bornstein, B. H., Christine Emler, A., & Chapman, G. B. (1999). Rationality in medical treatment decisions: Is there a sunk-cost effect? *Social Science & Medicine*, *49*(2), 215–222. https://doi.org/10.1016/S0277-9536(99)00117-3

Chambers, C. D., & Tzavella, L. (2022). The past, present and future of Registered Reports. *Nature Human Behaviour*, *6*(1), 29–42. https://doi.org/10.1038/s41562-021-01193-7

Coleman, M. D. (2009). Sunk Cost and Commitment to Dates Arranged Online. *Current Psychology*, *28*(1), 45–54. https://doi.org/10.1007/s12144-009-9042-5

DeVoe, S. E., & Pfeffer, J. (2007). When time is money: The effect of hourly payment on the evaluation of time. *Organizational Behavior and Human Decision Processes*, *104*(1), 1–13. https://doi.org/10.1016/j.obhdp.2006.05.003

Friedman, D., Pommerenke, K., Lukose, R., Milam, G., & Huberman, B. A. (2007). Searching for the sunk cost fallacy. *Experimental Economics*, *10*(1), 79–104. https://doi.org/10.1007/s10683-006-9134-0

Garland, H., & Newport, S. (1991). Effects of absolute and relative sunk costs on the decision to persist with a course of action. *Organizational Behavior and Human Decision Processes*, *48*(1), 55–69. https://doi.org/10.1016/0749-5978(91)90005-E

References

Arkes, H. R., & Blumer, C. (1985). The psychology of sunk cost. *Organizational Behavior and Human Decision Processes*, *35*(1), 124–140. https://doi.org/10.1016/0749-5978(85)90049-4

Blanca, M. J., Alarcón, R., & Arnau, J. (2017). Non-normal data: Is ANOVA still a valid option? *Psicothema*, *29.4*, 552–557. https://doi.org/10.7334/psicothema2016.383

Bornstein, B. H., & Chapman, G. B. (1995). Learning lessons from sunk costs. *Journal of Experimental Psychology: Applied*, *1*(4), 251–269. https://doi.org/10.1037/1076-898X.1.4.251

Bornstein, B. H., Christine Emler, A., & Chapman, G. B. (1999). Rationality in medical treatment decisions: Is there a sunk-cost effect? *Social Science & Medicine*, *49*(2), 215–222. https://doi.org/10.1016/S0277-9536(99)00117-3

Chambers, C. D., & Tzavella, L. (2022). The past, present and future of Registered Reports. *Nature Human Behaviour*, *6*(1), 29–42. https://doi.org/10.1038/s41562-021-01193-7

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Friedman, D., Pommerenke, K., Lukose, R., Milam, G., & Huberman, B. A. (2007). Searching for the sunk cost fallacy. *Experimental Economics*, *10*(1), 79–104. https://doi.org/10.1007/s10683-006-9134-0

LeBel, E. P., McCarthy, R. J., Earp, B. D., Elson, M., & Vanpaemel, W. (2018). A Unified Framework to Quantify the Credibility of Scientific Findings. *Advances in Methods and Practices in Psychological Science*, *1*(3), 389–402. https://doi.org/10.1177/2515245918787489

LeBel, E. P., Vanpaemel, W., Cheung, I., & Campbell, L. (2019). A brief guide to evaluate replications. *Meta-Psychology*, *3*.

Litman, L., Robinson, J., & Abberbock, T. (2017). TurkPrime.com: A versatile crowdsourcing data acquisition platform for the behavioral sciences. *Behavior Research Methods*, *49*(2), 433–442. https://doi.org/10.3758/s13428-016-0727-z

Muller, C. J., & MacLehose, R. F. (2014). Estimating predicted probabilities from logistic regression: Different methods correspond to different target populations. *International Journal of Epidemiology*, *43*(3), 962–970. https://doi.org/10.1093/ije/dyu029

Navarro, A. D., & Fantino, E. (2005). The Sunk Cost Effect in Pigeons and Humans. *Journal of the Experimental Analysis of Behavior*, *83*(1), 1–13. https://doi.org/10.1901/jeab.2005.21-04

Navarro, A. D., & Fantino, E. (2009). The sunk-time effect: An exploration. *Journal of Behavioral Decision Making*, *22*(3), 252–270. https://doi.org/10.1002/bdm.624

Nosek, B. A., & Lakens, D. (2014). Registered Reports. *Social Psychology*, *45*(3), 137–141. https://doi.org/10.1027/1864-9335/a000192

Okada, E. M., & Hoch, S. J. (2004). Spending Time versus Spending Money. *Journal of Consumer Research*, *31*(2), 313–323. https://doi.org/10.1086/422110

Pandey, S. K., & Sharma, D. (2019). Sunk time fallacy with recoverable monetary costs. *Marketing Intelligence & Planning*, *37*(2), 154–167. https://doi.org/10.1108/MIP-02-2018-0052

Garland, H., & Newport, S. (1991). Effects of absolute and relative sunk costs on the decision to persist with a course of action. *Organizational Behavior and Human Decision Processes*, *48*(1), 55–69. https://doi.org/10.1016/0749-5978(91)90005-E

LeBel, E. P., McCarthy, R. J., Earp, B. D., Elson, M., & Vanpaemel, W. (2018). A Unified Framework to Quantify the Credibility of Scientific Findings. *Advances in Methods and Practices in Psychological Science*, *1*(3), 389–402. https://doi.org/10.1177/2515245918787489

Litman, L., Robinson, J., & Abberbock, T. (2017). TurkPrime.com: A versatile crowdsourcing data acquisition platform for the behavioral sciences. *Behavior Research Methods*, *49*(2), 433–442. https://doi.org/10.3758/s13428-016-0727-z

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Okada, E. M., & Hoch, S. J. (2004). Spending Time versus Spending Money. *Journal of Consumer Research*, *31*(2), 313–323. https://doi.org/10.1086/422110

Park, J.-Y., & Jang, S. (Shawn). (2014). Sunk costs and travel cancellation: Focusing on temporal cost. *Tourism Management, 40*, 425–435. https://doi.org/10.1016/j.tourman.2013.08.005

Rego, S., Arantes, J., & Magalhães, P. (2018). Is there a Sunk Cost Effect in Committed Relationships? *Current Psychology*, *37*(3), 508–519. https://doi.org/10.1007/s12144-016-9529-9

Ronayne, D., Sgroi, D., & Tuckwell, A. (2021). Evaluating the sunk cost effect. *Journal of Economic Behavior & Organization*, *186*, 318–327. https://doi.org/10.1016/j.jebo.2021.03.029

Scheel, A. M., Schijen, M. R. M. J., & Lakens, D. (2021). An Excess of Positive Results: Comparing the Standard Psychology Literature With Registered Reports. *Advances in Methods and Practices in Psychological Science*, *4*(2), 25152459211007468. https://doi.org/10.1177/25152459211007467

Silva Castillo, L. H., Cisneros Plazola, M. C., Torres Ceja, C. de J., & Hernández Rosas, E. (2020). The sunk-time effect: Effect of time invested and reward magnitude using within-subject design. *Behavioural Processes*, *181*, 104247. https://doi.org/10.1016/j.beproc.2020.104247

Soman, D. (2001). The mental accounting of sunk time costs: Why time is not like money. *Journal of Behavioral Decision Making*, *14*(3), 169–185. https://doi.org/10.1002/bdm.370

Soman, D., & Cheema, A. (2001). The Effect of Windfall Gains on the Sunk-Cost Effect. *Marketing Letters*, *12*(1), 51–62.

Pandey, S. K., & Sharma, D. (2019). Sunk time fallacy with recoverable monetary costs. *Marketing Intelligence & Planning*, *37*(2), 154–167. https://doi.org/10.1108/MIP-02-2018-0052

Park, J.-Y., & Jang, S. (Shawn). (2014). Sunk costs and travel cancellation: Focusing on temporal cost. *Tourism Management*, *40*, 425–435. https://doi.org/10.1016/j.tourman.2013.08.005

Rego, S., Arantes, J., & Magalhães, P. (2018). Is there a Sunk Cost Effect in Committed Relationships? *Current Psychology*, *37*(3), 508–519. https://doi.org/10.1007/s12144-016-9529-9

Ronayne, D., Sgroi, D., & Tuckwell, A. (2021). Evaluating the sunk cost effect. *Journal of Economic Behavior & Organization*, *186*, 318–327. https://doi.org/10.1016/j.jebo.2021.03.029

Scheel, A. M., Schijen, M. R. M. J., & Lakens, D. (2021). An Excess of Positive Results: Comparing the Standard Psychology Literature With Registered Reports. *Advances in Methods and Practices in Psychological Science*, *4*(2), 25152459211007468. https://doi.org/10.1177/25152459211007467

Silva Castillo, L. H., Cisneros Plazola, M. C., Torres Ceja, C. de J., & Hernández Rosas, E. (2020). The sunk-time effect: Effect of time invested and reward magnitude using within-subject design. *Behavioural Processes*, *181*, 104247. https://doi.org/10.1016/j.beproc.2020.104247

Soman, D. (2001). The mental accounting of sunk time costs: Why time is not like money. *Journal of Behavioral Decision Making*, *14*(3), 169–185. https://doi.org/10.1002/bdm.370

Soster, R. L., Monga, A., & Bearden, W. O. (2010). Tracking Costs of Time and Money: How Accounting Periods Affect Mental Accounting. *Journal of Consumer Research*, *37*(4), 712–721. https://doi.org/10.1086/656388

Strough, J., Mehta, C. M., McFall, J. P., & Schuller, K. L. (2008). Are Older Adults Less Subject to the Sunk-Cost Fallacy Than Younger Adults? *Psychological Science*, *19*(7), 650–652. https://doi.org/10.1111/j.1467-9280.2008.02138.x

Thaler, R. (1980). Toward a positive theory of consumer choice. *Journal of Economic Behavior & Organization*, *1*(1), 39–60. https://doi.org/10.1016/0167-2681(80)90051-7

Williams, R. (2012). Using the Margins Command to Estimate and Interpret Adjusted Predictions and Marginal Effects. *The Stata Journal: Promoting Communications on Statistics and Stata*, *12*(2), 308–331. https://doi.org/10.1177/1536867X1201200209

Wiseman, R., Watt, C., & Kornbrot, D. (2019). Registered reports: An early example and analysis. *PeerJ*, *7*, e6232. https://doi.org/10.7717/peerj.6232

Soman, D., & Cheema, A. (2001). The Effect of Windfall Gains on the Sunk-Cost Effect. *Marketing Letters*, *12*(1), 51–62.

Soster, R. L., Monga, A., & Bearden, W. O. (2010). Tracking Costs of Time and Money: How Accounting Periods Affect Mental Accounting. *Journal of Consumer Research*, *37*(4), 712–721. https://doi.org/10.1086/656388

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Williams, R. (2012). Using the Margins Command to Estimate and Interpret Adjusted Predictions and Marginal Effects. *The Stata Journal: Promoting Communications on Statistics and Stata*, *12*(2), 308–331. https://doi.org/10.1177/1536867X1201200209

Wiseman, R., Watt, C., & Kornbrot, D. (2019). Registered reports: An early example and analysis. *PeerJ*, *7*, e6232. https://doi.org/10.7717/peerj.6232

Sunk cost effects for time versus money: Replication of Soman (2001) [Registered Report Stage 1]

Supplementary materials

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Sunk cost effects for time versus money: Replication of Soman (2001) [Registered Report Stage 1]

Supplementary materials

Table of Contents

Effect sizes calculation and power analysis

In order to calculate the φ_c effect size of the Soman's (2001) Studies 1 and 2, where a chi-squared test was used, we inputted the raw frequencies into R and used the package *DescTools* (v0.99.44) and the function *CramerV* to calculate the φ_c statistic and a 95% confidence interval. The same function was used for the replication.

In order to calculate the effect sizes of the ANOVA test for the original, we used R's package *effectsize*, in order to calculate η_p^2 (function: *F_to_eta2*). We used the R package *MOTE* to calculate the ω^2 (function: *omega.F*). In order to calculate both the η_p^2 and the ω^2 for the replication, we used the package *sjstats* (function: *anova_stats)*. In order to obtain Cohen's *f* effect size measure for the power analyses, the package *effectsize* was used (function: *F_to_f*), which translated an F statistic to Cohen's *f*.

These calculations can be found in the R script in the online repository on OSF, files “Soman 2001 - Power analysis script.Rmd” and “Soman 2001 - Power analysis script.html”.

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Comparisons and deviations

Replication classification

We summarized our replications as very close for Studies 1 and 2 and between close and far replication for Study 5, using the classification criteria set out by LeBel et al. (2018).

Design facet	**Study 1**	**Study 2**	**Study 5**
Effect, Hypothesis	Same	Same	Same
IV Construct	Same	Same	Same
DV Construct	Same	Same	Same
IV Operationalization	Same	Same	Same
DV Operationalization	Same	Same	Same
Population (e.g., age)	Similar	Similar	Similar
IV Stimuli	Same	Same	Different
DV Stimuli	Same	Same	Different
Procedural Details	Similar	Similar	Different
Physical Setting	Different	Different	Different
Contextual Variables	Different	Different	Different
Replication classification	Very close replication	Very close replication	Close/far replication

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Physical Setting	Different	Different	Different
Contextual Variables	Different	Different	Different
Replication classification	Very close replication	Very close replication	Close/far replication

Original vs replication methodological comparison

	Original	Replication	Reason for change
Participants	Undergraduate students from HKUST and Coronado University.	Participants from Amazon MTurk.	Larger more diverse sample.
	Study 1, 2 and 5 were done separately with different participants.	Study 1, 2 and 5 were done in the same survey with the same participant.	Addressing sample concerns and allowing for exploratory analyses comparing effects across studies.
Delivery	Paper questionnaires	Online questionnaire using Qualtrics	
Questions	The original studies did not use any comprehension checks or instructional manipulation checks.	We used comprehension and instructional manipulation checks in our replication. Participants must pass these checks to proceed.	To ensure that participants read and understood the materials.
Materials	In Study 5, a class on opportunity cost was given educated condition before undergoing the experiment.	A passage about opportunity cost along with questions about that passage as instructional manipulation checks were presented to participants instead of a class.	To adjust to an online sample, we adjusted to use used a passage that participants read instead of a class.
Scale	In Study 5 the preference scale was originally from 1 to 9 and presented as such.	We adjusted the presentation of the scale to 4/0/4 instead of 1 to 9.	Avoid biasing participants in a certain direction.
Order of studies	Study 1 -> Study 2 -> Study 5	Randomized the order of studies 1 and 2 only, but not study 5. Study 5 is always put at the last part of the experiment.	To address potential impact of presentation order.

Pre-exclusion vs post-exclusion results comparison

Exclusion criterion	N excluded
Dropped out	XX
Low proficiency in English and understanding of materials (<5 on a 1-7 scale)	XX
Low seriousness (<4 on 1-5 scale)	XX
Familiarity with the materials	XX
Failed to answer comprehension check questions	XX

	Test	Exclusions	Test statistic	*df*	*p*	Effect size	Difference
Study 1	Chi-square; difference between sunk time and sunk money conditions in rate of choosing a ticket	Before	$\chi^2 = .03$	1	.863	$\varphi_c = .01$	No difference
		After	$\chi^2 = .09$	1	.758	$\varphi_c = .01$	
Study 2	Chi-square; difference between sunk time and no sunk time conditions in rate of choosing a project	Before	$\chi^2 = .00$	1	1	$\varphi_c = .00$	No difference
		After	$\chi^2 = .00$	1	.970	$\varphi_c = .00$	
	Chi-square; difference between sunk money and no sunk money conditions in rate of choosing a project	Before	$\chi^2 = .37$	1	.543	$\varphi_c = .04$	No difference
		After	$\chi^2 = .19$	1	.665	$\varphi_c = .03$	
Study 5	ANOVA; opportunity cost main effect	Before	$F = .19$	1, 511	.666	$\eta_p^2 = .00$	No difference
		After	$F = .64$	1, 511	.425	$\eta_p^2 = .00$	
	ANOVA; education main effect	Before	$F = 2.98$	1, 511	.085	$\eta_p^2 = .01$	No difference
		After	$F = 2.65$	1, 511	.104	$\eta_p^2 = .01$	
	ANOVA; opportunity cost by education interaction	Before	$F = .40$	1, 511	.528	$\eta_p^2 = .00$	No difference
		After	$F = 1.11$	1, 511	.294	$\eta_p^2 = .00$	

Pre-exclusion vs post-exclusion results comparison

	Test	Exclusions	Test statistic	*df*	*p*	Effect size	Difference
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Study 2	Chi-square; difference between sunk time and no sunk time conditions in rate of choosing a project	Before	$\chi^2 = .00$	1	1	$\varphi_c = .00$	No difference
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	Chi-square; difference between sunk money and no sunk money conditions in rate of choosing a project	Before	$\chi^2 = .37$	1	.543	$\varphi_c = .04$	No difference
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Pre-registration plan versus final report comparison

[To be added at Stage 2]

Pre-registration plan versus final report comparison

[To be added at Stage 2]

Open science disclosures

Item	***Disclosure***
Materials, data, and analysis scripts	Materials, data (raw and cleaned, with identifiers removed), and analysis scripts have been made publicly available on the Open Science Framework (review link: []).
Data collection	Data collection was completed before any analysis.
Conditions reporting	All collected conditions have been reported.
Data exclusions	Details have been reported in this document.
Variables reporting	All variables collected for this study have been reported and included in the provided data.

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Materials used

Study 1

Manipulation

Participants were randomized into either a sunk time or a sunk money condition and read a hypothetical scenario.

Sunk time scenario	**Sunk money scenario**
Theater performance or rock concert #1 Imagine that you recently saw an advertisement on the bulletin board. A literature professor was looking for a research assistant to work for about 15 hours. The payment was in the form of a front row seat to a professional theater performance. On the same bulletin board, a music professor was also looking for a research assistant to work for about five hours, and this assistant would be paid with a ticket (in a good section) to a rock concert by a band that you like. You had recently seen posters for both the theater performance and the rock concert. You think you will like to see both these events, **although you expect to like the rock concert more**. You work for both the professors - 15 hours for literature and 5 hours for music - and get paid with the two tickets (theater and rock concert respectively). As you are putting the tickets away in your wallet, you notice that both events are scheduled for the same evening and are both at good locations on campus. The tickets are non-transferable. nor can they be exchanged. You can use only one of the tickets and not the other.	**Theater performance or rock concert #1** Imagine that you recently saw an advertisement on the student bulletin board. A literature professor was looking for a research assistant to work for about 15 hours. The payment is in the form of a front-row seat to a professional theater performance. On the same bulletin board, a music professor was also looking for a research assistant to work for about five hours, and this assistant would be paid with a ticket (in a good section) to a rock concert by a band that you like. You had recently seen posters for both the theater performance and the rock concert. You think you would like to see both these events, **although you expect to like the rock concert more**. You work for both the professors - 15 hours for literature and 5 hours for music - and get paid a total of $80. Given that you had the money from these jobs, you purchased tickets for both these events. The ticket for the theater cost $60 while a ticket to the rock concert cost $20. As you are putting the tickets away in your wallet, you notice that both events are scheduled for the same evening and are both at good locations on campus. The tickets are not transferable, nor can they be exchanged. You can only use one of the tickets and not the other

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Participants were randomized into either a sunk time or a sunk money condition and read a hypothetical scenario.

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Theater performance or rock concert #1 Imagine you are a student and you recently saw an advertisement on the student bulletin board. A literature professor was looking for a research assistant to work for about 15 hours. The payment was in the form of a front row seat to a professional theater performance. On the same bulletin board, a music professor was also looking for a research assistant to work for about five hours, and this assistant would be paid with a ticket (in a good section) to a rock concert by a band that you like. You had recently seen posters for both the theater performance and the rock concert. You think you will like to see both these events, although you expect to like the rock concert more. You work for both the professors - 15 hours for literature and 5 hours for music - and get paid with the two tickets (theater and rock concert respectively). As you are putting the tickets away in your wallet, you notice that both events are scheduled for the same evening and are both at good locations on campus. The tickets are non-transferable. nor can they be exchanged. You can use only one of the tickets and not the other.	**Theater performance or rock concert #1** Imagine you are a student and you recently saw an advertisement on the student bulletin board. A literature professor was looking for a research assistant to work for about 15 hours. The payment is in the form of a front-row seat to a professional theater performance. On the same bulletin board, a music professor was also looking for a research assistant to work for about five hours, and this assistant would be paid with a ticket (in a good section) to a rock concert by a band that you like. You had recently seen posters for both the theater performance and the rock concert. You think you would like to see both these events, although you expect to like the rock concert more. You work for both the professors - 15 hours for literature and 5 hours for music - and get paid a total of $80. Given that you had the money from these jobs, you purchased tickets for both these events. The ticket for the theater cost $60 while a ticket to the rock concert cost $20. As you are putting the tickets away in your wallet, you notice that both events are scheduled for the same evening and are both at good locations on campus. The tickets are not transferable, nor can they be exchanged. You can only use one of the tickets and not the other

Measures

Forced choice (replication)

In both condition the participants were asked:

Which ticket will you use?

- o Theater performance
- o Rock concert

Preference (extension)

Which ticket will you use? Please indicate your preference for attending the rock concert vs. theater on the scale below.

	Definitely Rock Concert				Indifferent				Definitely Theater Performance
	4	3	2	1	0	1	2	3	4
Which even do you prefer to attend?	O	O	O	O	O	O	O	O	O

These were presented to participants as 4 to 4 but coded as 1 to 9.

Measures

Forced choice (replication)

In both condition the participants were asked:

> Which ticket will you use?
>
> ○ Theater performance
> ○ Rock concert

Preference (extension)

> Which ticket will you use? Please indicate your preference for attending the rock concert vs. theater on the scale below.

	Definitely Rock Concert				Indifferent				Definitely Theater Performance
	4	3	2	1	0	1	2	3	4
Which even do you prefer to attend?	O	O	O	O	O	O	O	O	O

These were presented to participants as 4 to 4 but coded as 1 to 9.

Comprehension checks

Right after the response, on a separate page, participants were asked:

> Finally, in the scenario, to the best of your understanding:
>
> What was the cost of the tickets, time or money?
>
> ○ Time (hours spent working)
> ○ Money (cash)

On the next page, participants were given a quiz, which they had to answer correctly in order to proceed to the next page. The page contained the entire scenario that they had previously seen as well as the following information and questions (same for both time and money conditions):

> In this section we would like to check with you to verify your understanding of the previous scenario. The scenario below is the same as the one in the previous page, followed by comprehension questions.
>
> <entire scenario that they had just seen>

Study 2

Manipulation

Participants were randomized to read one of four scenarios – 2 (*sunk cost domain*: time or money) x 2 (*sunk cost presence*: sunk cost or no sunk cost).

Time		**Money**	
Sunk cost	**No sunk cost**	**Sunk cost**	**No sunk cost**
"New invention" competition You are planning to submit an entry to the 'new invention' competition organized by the students' club. You have spent 30 hours preparing a design for an innovative rocket engine and estimate that it will take you an additional 10 hours to finish it. You just learned that **the winner of the previous year's competition was also working on a rocket engine** design similar to yours. You had also thought about working on an (equally innovative and good) design for a solar-powered pump that would take about 10 hours to complete. You can submit only one entry, and since the deadline is very close, you must choose now. The question is - Should you spend 10 hours trying to finish your rocket engine design given what you know, or would you rather work on the solar-powered pump?	**"New invention" competition** You are planning to submit an entry to the 'new invention' competition organized by the students" club. You thought about preparing a design for an innovative rocket engine, and you estimate that it will take you 10 hours to finish it. You just learned that **the winner of the previous year's competition was also working on a rocket engine** design similar to yours. You had also thought about working on an (equally innovative and good) design for a solar-powered pump that would take about 10 hours to complete. You can submit only one entry, and since the deadline is very close, you must choose now. The question is: Should you spend 10 hours trying to work on the rocket engine design or would you rather work on the solar-powered pump?	**"New invention" competition** You are planning to submit an entry to the 'new invention' competition organized by the students' club. You had already spent $90 on the rocket engine design. You expect that it will cost you an additional $30 to finish. You just learned that **the winner of the previous year's competition was also working on a rocket engine** design similar to yours. You had also thought about working on an (equally innovative and good) design for a solar-powered pump that would cost about $30 to complete. You can submit only one entry, and since the deadline is very close, you must choose now. The question is: Should you spend $30 trying to finish your rocket engine design or would you rather work on the solar-powered pump?	**"New invention" competition** You are planning to submit an entry to the 'new invention' competition organized by the students" club. You thought about preparing a design for an innovative rocket engine, and you estimate that it will cost approximately $30 to finish it. You just learned that **the winner of the previous year's competition was also working on a rocket engine** design similar to yours. You had also thought about working on an (equally innovative and good) design for a solar-powered pump that would cost about $30 to complete. You can submit only one entry, and since the deadline is very close, you must choose now. The question is: Should you spend $30 trying to work on the rocket engine design or would you rather work on the solar-powered pump?

To make sure that you read and understood the scenario, please answer the following comprehension questions.

How did you obtain the theater performance and rock concert tickets?

- I bought them myself with the money I had from the salary that I received from working for the literature professor (US$60) and the music professor (US$20).
- I received the tickets from the music and literature professors as compensation for the work I did for them

How did you get paid for the 15 hours work you did for the literature professor?

- I received US$60 salary, which I used to buy a theater performance ticket
- I received a theater performance ticket

How did you get paid for the 5 hours work you did for the music professor?

- I received US$20 salary, which I used to buy a rock concert ticket
- I received a rock concert ticket

Which event did you think you will like better?

- Theater performance
- Rock concert

After answering correctly all of the above comprehension quiz questions, participants were asked if their initial comprehension was accurate and what they would choose if they could choose again:

Now that you've answered the quiz and checked all answers, we want to check with you: Did you correctly understand the scenario the first you read it when you answered about your decision of which ticket to use?

Please note that the answer to this question will NOT in any way impact your current participation or your compensation. Please answer honestly to help us ensure accurate insights from this research.

- Yes, I understood the scenario correctly the first time when I made the decision which ticket to use
- No, the comprehension questions helped me realize that I did not understand the scenario correctly the first time when I made the decision which ticket to use.

Suppose you have the chance to choose again...

Which ticket will you use? If you had to choose which one to use, which would you use?

- Rock concert
- Theater performance

Familiarity check

After completing Study 1, participants were asked:

Have you ever been presented with a scenario similar to the one you have just read?

Please note that the answer to this question will NOT in any way impact your current participation or your compensation. Please answer truthfully.

- Answer scale:
  - Yes, I have seen this scenario before;
  - No, this is the first time I encounter this scenario.

If they responded positively, the were asked:

Where have you seen the scenario before?

- Answer scale: [single line text box]

Study 2

Manipulation

Participants were randomized to read one of four scenarios – 2 (*sunk cost domain*: time or money) x 2 (*sunk cost presence*: sunk cost or no sunk cost).

Time		**Money**	
Sunk cost	**No sunk cost**	**Sunk cost**	**No sunk cost**
"New invention" competition Imagine you are a student and are planning to submit an entry to the 'new invention' competition organized by the students' club. You have spent 30 hours preparing a design for an innovative rocket engine and estimate that it will take you an additional 10 hours to finish it. You just learned that **the winner of the previous year's competition was also working on a rocket engine** design similar to yours. You had also thought about working on an (equally innovative and good) design for a solar-powered pump that would take about 10 hours to complete. You can submit only one entry, and since the deadline is very close, you must choose now. The question is - Should you spend 10 hours trying to finish your rocket engine design given what you know, or would you rather work on the solar-powered pump?	**"New invention" competition** Imagine you are a student and are planning to submit an entry to the 'new invention' competition organized by the students" club. You thought about preparing a design for an innovative rocket engine, and you estimate that it will take you 10 hours to finish it. You just learned that **the winner of the previous year's competition was also working on a rocket engine** design similar to yours. You had also thought about working on an (equally innovative and good) design for a solar-powered pump that would take about 10 hours to complete. You can submit only one entry, and since the deadline is very close, you must choose now. The question is: Should you spend 10 hours trying to work on the rocket engine design or would you rather work on the solar-powered pump?	**"New invention" competition** Imagine you are a student and are planning to submit an entry to the 'new invention' competition organized by the students' club. You had already spent $90 on the rocket engine design. You expect that it will cost you an additional $30 to finish. You just learned that **the winner of the previous year's competition was also working on a rocket engine** design similar to yours. You had also thought about working on an (equally innovative and good) design for a solar-powered pump that would cost about $30 to complete. You can submit only one entry, and since the deadline is very close, you must choose now. The question is: Should you spend $30 trying to finish your rocket engine design or would you rather work on the solar-powered pump?	**"New invention" competition** Imagine you are a student and are planning to submit an entry to the 'new invention' competition organized by the students" club. You thought about preparing a design for an innovative rocket engine, and you estimate that it will cost approximately $30 to finish it. You just learned that **the winner of the previous year's competition was also working on a rocket engine** design similar to yours. You had also thought about working on an (equally innovative and good) design for a solar-powered pump that would cost about $30 to complete. You can submit only one entry, and since the deadline is very close, you must choose now. The question is: Should you spend $30 trying to work on the rocket engine design or would you rather work on the solar-powered pump?

Measures

In all cases **participants had two options**:

- Rocket engine
- Solar-powered pump

Measures

In all cases **participants had two options**:

- Rocket engine
- Solar-powered pump

Comprehension checks

Right after the response, on a separate page, participants were asked:

> Finally, in the scenario, to the best of your understanding:
>
> What was the scenario mainly focused on, time or money?
>
> - Time (hours spent working)
> - Money (cash)
>
> To the best of your understanding:
>
> Have you already invested anything in your current design?
>
> - Yes, I have already made some investment in the current design.
> - No, I have not yet invested anything in my design

On the next page, participants were given a quiz, which they had to answer correctly in order to proceed to the next page. The page contained the entire scenario that they had previously seen as well as the following information and questions (same for all conditions):

> In this section we would like to check with you to verify your understanding of the previous scenario. The scenario below is the same as the one in the previous page, followed by comprehension questions.
>
> <entire scenario that they had just seen>
>
> What did you spend so far in your work on the rocket engine?
>
> - Nothing
> - US$90
> - 30 hours
> - US$30
> - 90 hours
>
> What did you spend so far in your work on the solar powered pump?
>
> - Nothing
> - US$90
> - 30 hours
> - US$30
> - 90 hours

Study 5

Manipulation: Opportunity cost education

Participants were first randomized to either receive opportunity cost education or not. If they did, they saw the following information:

Importance of considering time as opportunity cost

NB: You will be asked short questions to ensure you have understood this information.

Below is a short passage on opportunity cost which is relevant for the kinds of decisions that you answered. Please read it carefully. We will present you with a similar decision to the ones you already made once you finished reading:

Opportunity cost refers to the highest-valued option forgone in making a choice. It includes both monetary costs (i.e. highest-valued alternative use of the money) and time costs (i.e. highest-valued alternative use of the time).

We often overlook the more implicit time costs when considering opportunity costs.

Let us look at an example: You are going to take a 3-day stay-cation in a hotel next to a glamorous lake. The expenditures during the whole stay-cation, such as food expenses, will cost you $50. You have booked the hotel for the stay-cation at $250 and the price is non-refundable. In those 3 days, you could have worked for a temporary job in a book fair, where you could earn $600. What is your total opportunity cost of going on the stay-cation?

In this problem, the $50 food expenditure is a part of the opportunity cost as you directly incur a payment due to the stay-cation plan. However, since the $250 hotel fee has been paid and is non-refundable, you could not retrieve the amount whether you decide to join the stay-cation or not. Hence, the hotel fee is not part of the opportunity cost. Lastly, the $600 salary is said to be a time cost since you forgo the option to work at the book fair if you choose to go on the stay-cation. Thus, the opportunity of earning income is forgone and it is counted as an implicit cost.

Therefore, the opportunity cost in this scenario is $(50+600) = $650.

This example illustrates why **time cost is a part of the opportunity cost in an economic sense**.

Comprehension check questions

If participants read this information they were then asked two instructional comprehension check questions which they had to answer correctly to proceed:

What does opportunity cost refer to?

- The cost you incur when you engage in any activity.

What would it take you to finish the rocket engine design?

- Nothing
- US$30
- 10 hours
- US$10
- 30 hours

What would it take you to finish the solar-powered pump design?

- Nothing
- US$30
- 10 hours
- US$10
- 30 hours

After answering correctly all of the above comprehension quiz questions, participants were asked if their initial comprehension was accurate and what they would choose if they could choose again:

Now that you've answered the quiz and checked all answers, we want to check with you: Did you correctly understand the scenario the first you read it when you answered about your decision of which ticket to use?

Please note that the answer to this question will NOT in any way impact your current participation or your compensation. Please answer honestly to help us ensure accurate insights from this research.

- Yes, I understood the scenario correctly the first time when I made the decision which ticket to use
- No, the comprehension questions helped me realize that I did not understand the scenario correctly the first time when I made the decision which ticket to use.

Suppose you have the chance to choose again...

Which ticket will you use? If you had to choose which one to use, which would you use?

- Rocket engine
- Solar-powered pump

Familiarity check

After completing Study 1, participants were asked:

Have you ever been presented with a scenario similar to the one you have just read?

Please note that the answer to this question will NOT in any way impact your current participation or your compensation. Please answer truthfully.

- Answer scale:

- Yes, I have seen this scenario before;
- No, this is the first time I encounter this scenario.

If they responded positively, the were asked:

Where have you seen the scenario before?

- Answer scale: [single line text box]

Study 5

Manipulation: Opportunity cost education

Participants were first randomized to either receive opportunity cost education or not. If they did, they saw the following information:

Importance of considering time as opportunity cost

NB: You will be asked short questions to ensure you have understood this information.

Below is a short passage on opportunity cost which is relevant for the kinds of decisions that you answered. Please read it carefully. We will present you with a similar decision to the ones you already made once you finished reading:

Opportunity cost refers to the highest-valued option forgone in making a choice. It includes both monetary costs (i.e. highest-valued alternative use of the money) and time costs (i.e. highest-valued alternative use of the time).

We often overlook the more implicit time costs when considering opportunity costs.

Let us look at an example: You are going to take a 3-day stay-cation in a hotel next to a glamorous lake. The expenditures during the whole stay-cation, such as food expenses, will cost you $50. You have booked the hotel for the stay-cation at $250 and the price is non-refundable. In those 3 days, you could have worked for a temporary job in a book fair, where you could earn $600. What is your total opportunity cost of going on the stay-cation?

In this problem, the $50 food expenditure is a part of the opportunity cost as you directly incur a payment due to the stay-cation plan. However, since the $250 hotel fee has been paid and is non-refundable, you could not retrieve the amount whether you decide to join the stay-cation or not. Hence, the hotel fee is not part of the opportunity cost. Lastly, the $600 salary is said to be a time cost since you forgo the option to work at the book fair if you choose to go on the stay-cation. Thus, the opportunity of earning income is forgone and it is counted as an implicit cost.

Therefore, the opportunity cost in this scenario is $(50+600) = $650.

This example illustrates why **time cost is a part of the opportunity cost in an economic sense**.

Comprehension check questions

If participants read this information they were then asked two instructional comprehension check questions which they had to answer correctly to proceed:

What does opportunity cost refer to?

- The cost you incur when you engage in any activity.

- The cost incurred by not engaging in an alternative activity of higher value relative to the chosen activity.
- The cost associated with an activity that has both benefits and downsides.

Why was $600 part of the opportunity cost calculation in the scenario you read?

- It was the salary from a temporary job.
- It was a high value option.
- It was the time cost associated with forgoing to work at the book fair at the expense of going to the stay-cation.

Manipulation: Opportunity cost

Afterwards, participants read one of two scenarios, depending on whether they were in the high or low opportunity cost condition:

High opportunity cost	**Low opportunity cost**
Theater performance or rock concert #2 [Revisited] (IMPORTANT: we added new information highlighted in the large text below, please reread the paragraph and consider the new information) Imagine that you recently saw an advertisement on the bulletin board. A literature professor was looking for a research assistant to work for about 15 hours. The payment was in the form of a front row seat to a professional theater performance. On the same bulletin board, a music professor was also looking for a research assistant to work for about five hours, and this assistant would be paid with a ticket (in a good section) to a rock concert by a band that you like. You had recently seen posters for both the theater performance and the rock concert. You think you will like to see both these events, **although you expect to like the rock concert more.** It is the fall semester - you were taking five classes and working three part-time jobs to support yourself. As a result, **you have been badly pressed for time**. Yet, you work for both the professors - 15 hours for literature and 5 hours for music - and get paid with the two tickets (theater and rock concert respectively). As you are putting the tickets away in your wallet, you notice that both events are scheduled for the	**Theater performance or rock concert #2 [Revisited]** (IMPORTANT: we added new information highlighted in the large text below, please reread the paragraph and consider the new information) Imagine that you recently saw an advertisement on the bulletin board. A literature professor was looking for a research assistant to work for about 15 hours. The payment was in the form of a front row seat to a professional theater performance. On the same bulletin board, a music professor was also looking for a research assistant to work for about five hours, and this assistant would be paid with a ticket (in a good section) to a rock concert by a band that you like. You had recently seen posters for both the theater performance and the rock concert. You think you will like to see both these events, **although you expect to like the rock concert more.** It is the summer - you did not have to take any classes and did not have to work to support yourself. Therefore, **there is relative flexibility in your schedule.** You work for both the professors - 15 hours for literature and 5 hours for music - and get paid with the two tickets (theater and rock concert respectively). As you are putting the tickets away in your wallet, you notice that both events are scheduled for the

- The cost incurred by not engaging in an alternative activity of higher value relative to the chosen activity.
- The cost associated with an activity that has both benefits and downsides.

Why was $600 part of the opportunity cost calculation in the scenario you read?

- It was the salary from a temporary job.
- It was a high value option.
- It was the time cost associated with forgoing to work at the book fair at the expense of going to the stay-cation.

Manipulation: Opportunity cost

Afterwards, participants read one of two scenarios, depending on whether they were in the high or low opportunity cost condition:

High opportunity cost	**Low opportunity cost**
Theater performance or rock concert #2 [Revisited] (IMPORTANT: we added new information highlighted in the large text below, please reread the paragraph and consider the new information) Imagine you are a student and you recently saw an advertisement on the student bulletin board. A literature professor was looking for a research assistant to work for about 15 hours. The payment was in the form of a front row seat to a professional theater performance. On the same bulletin board, a music professor was also looking for a research assistant to work for about five hours, and this assistant would be paid with a ticket (in a good section) to a rock concert by a band that you like. You had recently seen posters for both the theater performance and the rock concert. You think you will like to see both these events, **although you expect to like the rock concert more.** It is the fall semester - you were taking five classes and working three part-time jobs to support yourself. As a result, **you have been badly pressed for time**. Yet, you work for both the professors - 15 hours for literature and 5 hours for music - and get paid with the two tickets (theater and rock concert respectively). As you are putting the tickets away in your wallet,	**Theater performance or rock concert #2 [Revisited]** (IMPORTANT: we added new information highlighted in the large text below, please reread the paragraph and consider the new information) Imagine you are a student and you recently saw an advertisement on the student bulletin board. A literature professor was looking for a research assistant to work for about 15 hours. The payment was in the form of a front row seat to a professional theater performance. On the same bulletin board, a music professor was also looking for a research assistant to work for about five hours, and this assistant would be paid with a ticket (in a good section) to a rock concert by a band that you like. You had recently seen posters for both the theater performance and the rock concert. You think you will like to see both these events, **although you expect to like the rock concert more.** It is the summer - you did not have to take any classes and did not have to work to support yourself. Therefore, **there is relative flexibility in your schedule.** You work for both the professors - 15 hours for literature and 5 hours for music - and get paid with the two tickets (theater and rock concert respectively). As you are putting the tickets away in your wallet,

same evening and are both at good locations on campus. The tickets are non-transferable. nor can they be exchanged. You can use only one of the tickets and not the other.	same evening and are both at good locations on campus. The tickets are non-transferable. nor can they be exchanged. You can use only one of the tickets and not the other.

Measures

In both conditions participants were asked:

Preference (extension)

Which ticket will you use? Please indicate your preference for attending the rock concert vs. theater on the scale below.

	Definitely Rock Concert				Indifferent				Definitely Theater Performance
	4	3	2	1	0	1	2	3	4
Which even do you prefer to attend?	O	O	O	O	O	O	O	O	O

These were presented to participants as 4 to 4 but coded as 1 to 9.

[Note: this is a deviation from the original's 1 to 9 scale]

Forced choice(extension)

Which ticket will you use?

- Theater performance
- Rock concert

Funneling section

Three funneling questions:

- How serious were you in filling out this questionnaire?
  - Answer scale: 1 (not at all) to 5 (very much)
- Have you ever seen the materials used in this study or similar before?
  If yes - please indicate where.
  - Answer scale: No; Yes (if yes, please write in the box below where)

you notice that both events are scheduled for the same evening and are both at good locations on campus. The tickets are non-transferable. nor can they be exchanged. You can use only one of the tickets and not the other.	you notice that both events are scheduled for the same evening and are both at good locations on campus. The tickets are non-transferable. nor can they be exchanged. You can use only one of the tickets and not the other.

Measures

In both conditions participants were asked:

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	4	3	2	1	0	1	2	3	4
Which even do you prefer to attend?	O	O	O	O	O	O	O	O	O

These were presented to participants as 4 to 4 but coded as 1 to 9.

[Note: this is a deviation from the original's 1 to 9 scale]

Forced choice(extension)

Which ticket will you use?

- Theater performance
- Rock concert

Funneling section

Three funneling questions:

- How serious were you in filling out this questionnaire?
  - Answer scale: 1 (not at all) to 5 (very much)
- Have you ever seen the materials used in this study or similar before?
  If yes - please indicate where.

- What do you think the purpose of the study was? (one sentence)
    - Answer scale: [free text box]
- Help us improve for the next studies - Did you spot any errors? Anything missing or wrong? Something we should pay attention to in next runs? (briefly)
    - Answer scale: [free text box]

- Answer scale: No; Yes (if yes, please write in the box below where)

- What do you think the purpose of the study was? (one sentence)
  - Answer scale: [free text box]
- Help us improve for the next studies - Did you spot any errors? Anything missing or wrong? Something we should pay attention to in next runs? (briefly)
  - Answer scale: [free text box]

Additional information about the study

[Note: Will be completed/updated after data collection]

1. Setting: The study was conducted online via an online questionnaire using Qualtrics. There was no fixed physical setting in which the study was conducted. In addition, we did not disallow participation using any specific devices.
2. Duration of Study Sessions: Participants were allowed 10 minutes to complete all study materials, sessions ended earlier if participants completed study earlier. Participants completed the questionnaire for an average of seconds.
3. Time of Day: As questionnaires are conducted online, there is no limit to what time of the day the participants should complete the questionnaire. They could do it at any time of their convenience.
4. Data collection dates: Data collection started on XX/XX/XXXX, and ended on XX/XX/XXXX.
5. Participant Recruitment: Participants were recruited using Amazon Mechanical Turk.

Data collection procedures

This study was conducted on Amazon Mechanical Turk with American participants. We imposed the following settings in recruiting our participants:

1. Participants were paid $1.25 as a fixed participation reward. This amount was determined by multiplying the expected completion time (in mins.) with the minimal federal wage in the U.S. (i.e., $0.121 per minute).
2. The expected completion time was set at 10 minutes in advance.
3. The most time we allowed each worker to complete the study was 30 minutes.
4. We limited all workers' HIT Approval Rate to be between 95% and 100%.
5. We limited each worker's number of HITs approved to be between 5,000 and 100,000.
6. We blocked Suspicious Geocode Locations and Universal Exclude List Workers.
7. We blocked duplicate IP addresses and duplicate geolocation.
8. We enabled HyperBatch so that all eligible workers were able to participate in our HIT immediately after the survey was launched.
9. We restricted workers' location to be in the U.S.

Additional information about the study

[Note: Will be completed/updated after data collection]

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References

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References

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