To the Depths of the Sunk Cost: Experiments Revisiting the Elusive Effect

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Motivation

- Sunk cost effect (SCE): tendency to be influenced by prior irrecoverable costs
- Wide acceptance in psychology with convincing anecdotes
- Obvious implication – higher upfront costs prompt people to increase usage/engagement
- However, the existence of the effect has not been conclusive in economics
  - Developmental: Ashraf et al. (2010), Cohen and Dupas (2010)
  - Educational: Ketel et al. (2016)

Our Contributions

- We examine two potential explanations to the conflict:
  - The effect has been studied improperly
  - The effect is simply too small to be economically relevant
- We identify deficiencies of the prior attempts (discount design)
  - Leading explanations of the effect (loss aversion & regret) predict null result
- Then address them in two experiments
  - Prolific study ($N = 1,806$)
  - Field study on YouTube ($N = 11,040$)

Findings

- We examine two potential explanations to the conflict:
  - The effect has been studied improperly
  - **The effect is simply too small to be economically relevant**
- Online: marginally significant effect ($\sim 0.1SD$)
- YT: null, and significant extensive margin effect
- Broader takeaway: cautionary tale for applying insights from psychology: "big" and robust effect there $\not\Rightarrow$ economic significance

"Sunk cost effect" literature

- "Sunk cost effect" literature
  - **Price-usage: Arkes and Blumer (1985), Friedman et al. (2007), Phillips et al. (1991), Ho et al. (2018)**
  - Escalation of commitment: Staw (1976), Martens and Orzen (2021)

Discount Design – and Its Shortcomings

- Control group: selling a durable good normally
  - Example: mosquito net, seasonal ticket
- Treatment group: selling the same product at discount
- Hypothesis: treatment group uses the good less because the upfront cost is lower
- Our model based on mental accounting implies that the SCE-like behavior may not emerge from the design
  - "Loss pricing" is important!

Intuition for the asymmetric effect

- In case of mental accounting, feeling of loss is not triggered by discount interventions – it is "better than expected" so people do not consider the sunk cost
- This intuition carries through if we instead consider regret utility
- "Expected" level of utility is important in the asymmetry prediction
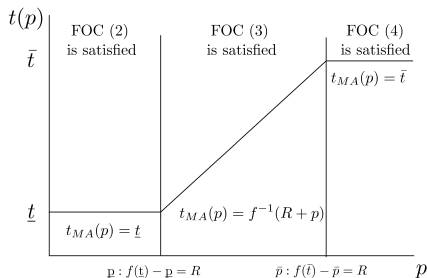
Experiments

- Our experiments feature clear variation in the upfront cost, both gain and loss
- Prolific study
  - Outcome: time spent on a real effort task
  - Intervention: cost to enter the task
- YouTube study
  - Outcome: engagement time with videos
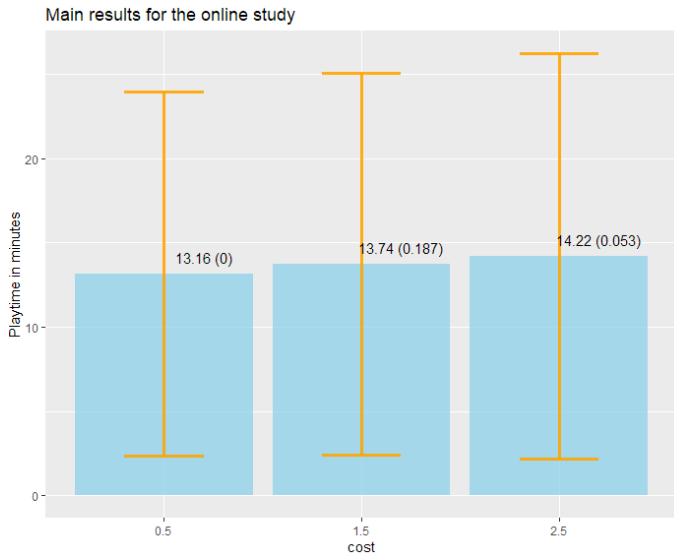 - Intervention: length of pre-video ads

Online Study: Task

Online Study: Results

Main results for the online study

Online Study: Results

	Dependent variable:			
	Playtime in minutes			
	(1)	(2)	(3)	(4)
Price=$1.5	0.584	0.659	0.652	0.711
	(0.656)	(0.664)	(0.655)	(0.663)
Price=$2.5	1.063*	1.285**	1.123**	1.329**
	(0.656)	(0.666)	(0.654)	(0.664)
Observations	1,806	1,749	1,806	1,749
Mean	13.706	13.849	13.706	13.849
Wald test	$p = 0.93$	$p = 0.98$	$p = 0.87$	$p = 0.94$
Attention	No	Yes	No	Yes
Controls	No	No	Yes	Yes

Field Study: Motivation

- Using a browser extension, we randomize the time until YouTube ads are skippable
  - Ad time is sunk, so neoclassical decision makers will not change the video engagement (given the decision to watch)
- In this setting
  - Watching video (post-ad) is the "durable good"
  - Sunk cost is the time cost spent on watching pre-video ads

Sunk time   Engagement time

Time

InTime:
Video loads and an ad starts immediately (could be either skippable or unskippable)

User may watch multiple ads, but must start a skippable ad to be included as an observation

VideoTime:
User skips (or watches fully) a skippable ad, and starts watching the video

OutTime:
User exits the video (they go to a different video/webpage or minimize/close the tab)

Field Study: Recruitment

- Participation: installing a Firefox/Chromium extension designed by us
  - Becoming popular in social media research: Levy (2021), Aridor (2022)
- Recruited from Twitter ads, and Mozilla's campaign
  - Framed as "a research project about user experience on social media"
  - We recruited the sample in July 2022, then collected data during October 2022
  - 590 people are recorded in the database, and 407 saw a skippable ad
- What the extension can do:
  - Collect browsing data on YouTube
  - Manipulate what people see on YouTube

Field Study: Design

- We target skippable ads YouTube shows in place of actual videos
- At the point of the experiment, skippable ads could be skipped after 5 seconds (minimum ad duration (MAD)=5 seconds)
- Our intervention: randomize pre-video MAD to be (0s,5s,10s)
    - Here, we expect the reference point to be formed around 5 seconds

Field Study: Design

- Within variation: each time user sees an ad at the beginning, MAD is randomized
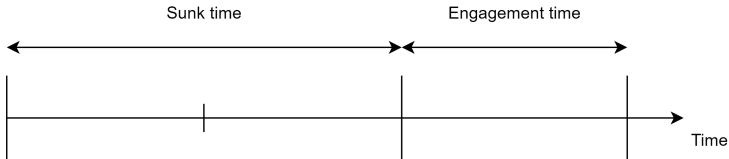- We estimate the following regression:

$$Y_{it} = \alpha_i + \sum_{j=\{5,10\}} \beta_j I(D_{it} = j) + \epsilon_{it}$$

where Y_{it} is the outcome variable for participant i's t-th video (with a skippable ad), and D_{it} is MAD for that video

- $N = 11040$ videos with a skippable ad at the beginning
  balance table

Field Study: Outcomes

- We consider engagement time as the main outcome variable

Sunk time   Engagement time

Time

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Field Study: Main Results

	Sunk Time (1)	Engagement Time (2)	Engagement = 0 (3)	Ad Click (4)
MAD = 5	2.983**	-3.286	0.035***	0.003*
	(1.467)	(9.093)	(0.009)	(0.002)
MAD = 10	7.221***	-1.644	0.053***	0.003*
	(1.539)	(9.824)	(0.009)	(0.002)
Observations	11040	11040	11040	11040
Mean	22.01	221.96	0.22	0.005
Wald P-value	NA	0.763	NA	NA
Individual FE	X	X	X	X

Field Study: Discussion

- The direction of the effect is consistent across video length
- The extensive margin effect is not predicted by the model
  - "Frustration effect": people may get frustrated after seeing the longer ad, and leave the video immediately
- It is hard to avoid if we were to use the intervention in any policy relevant settings (e.g., because of consumer protection laws)
  - Note that we mechanically disallowed this channel in the online study
- Also this likely scales with intervention size – everyone will leave if MAD is an hour…

Summary

- We develop two experiments to comprehensively evaluate the relevance of sunk cost effect
- We found a small effect in online, and null in the YouTube study
  - In line with the idea that SCE is economically small within this paradigm
  - Other considerations (such as frustration in our YouTube study) likely dominate the sunk cost effect in the field
- We need to better understand the precise mechanism and moderators of the effect for policy relevance
  - Escalation of commitment?

Online Study: Design

- Main features of the experiment
  - Induced value to match the model
  - Randomly varying upfront cost both in gain and loss region
  - High power
- Underlying "good": real effort task (counting game) that gives monetary payoff over time
  - Payoff per round is decreasing (cumulative payoff)
- Upfront cost: participants purchase a ticket to enter the counting game (ticket screen)
  - SCE says people work longer if upfront cost is higher

Online Study: Design
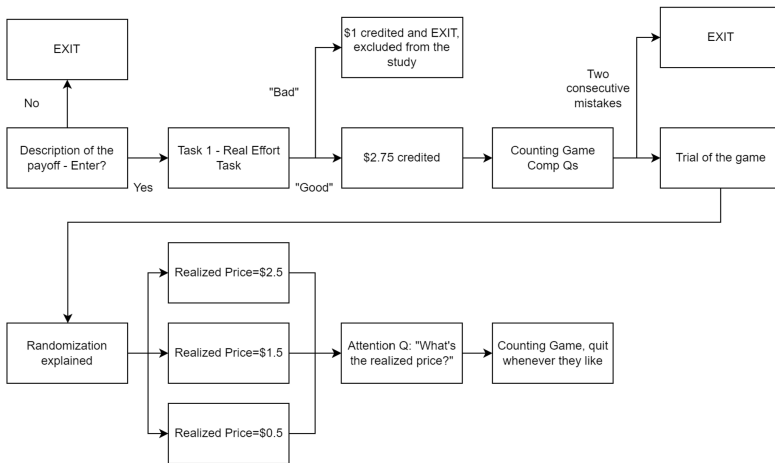
Online Study: Loss Intervention

- Once participants agreed to participate, everyone goes through the price randomization
- Price distribution of the ticket is disclosed beforehand – eliminating the "price as signal" channel
  - $0.5, $1.5, $2.5 all equally likely
- Saliently advertised as $4 bonus on average on top of the show up fee
  - So that $R = \$4$ (including the payoff from the first task)
  - This is reminded before the counting game (as a comprehension Q) to strengthen the reference point
  - The task screen makes it easy to mentally account that way
  - Cumulative payoff is calibrated such that it's difficult to get to R if the upfront cost is $2.5 (about 20 minutes), whereas it is 5 minutes for $0.5
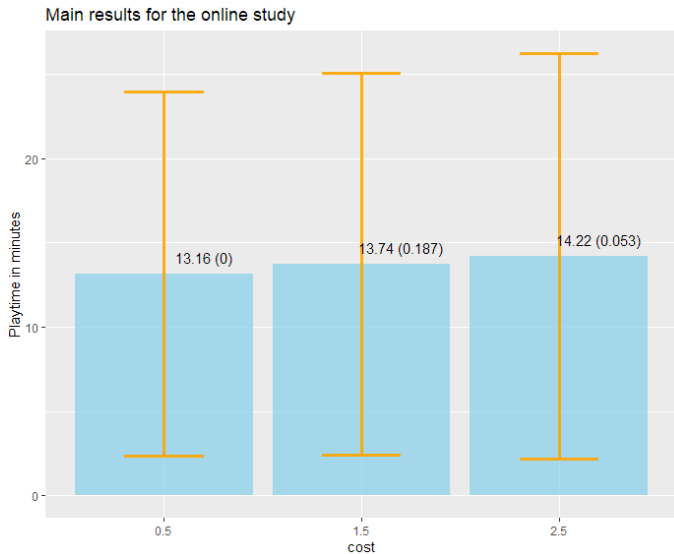
Online Study: Recruitment

- Sample recruited from Prolific, $N = 1,806$ divided into 3 groups
  - Balanced sex and age group (1/3 <35 years old)
- Avg. 30 minutes to complete, \$3.25 show up fee

Online Study: Hypotheses

- Two preregistered hypotheses
- Hypothesis 1: average play time for $2.5 group is higher than $0.5 group
  - One-sided test given the clear theoretical prediction
- Hypothesis 2: effect size between $2.5 and $1.5 is different from between $1.5 and $0.5

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Attention	No	Yes	No	Yes
Controls	No	No	Yes	Yes

Online Study: Discussion

- Strength of the intervention: given the average playtime, the difference in sunk cost is worth 133% of the outside option available to the participants
- Failure to think about R is unlikely to be driving the results
- Null effect on "efficiency" in the real effort task
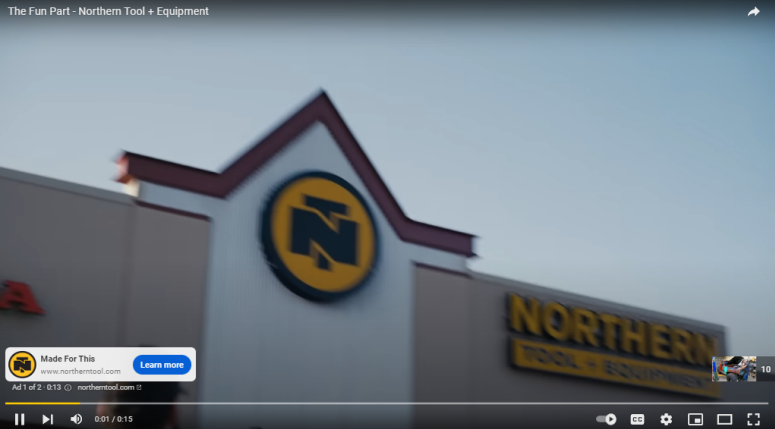- Not driven by income targeting

Unskippable Ad

Skippable Ad

MAD=10 intervention

Payoff

Ticket Screen

your ticket

$0.5 $1.5 $2.5
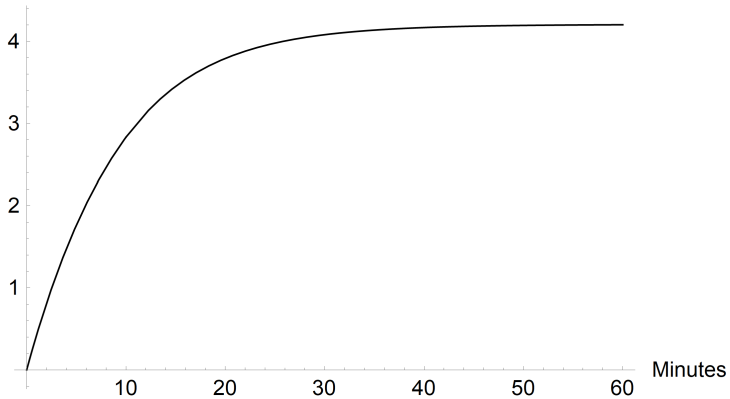
You paid $2.5. Hence, $2.5 was deducted from your account.
Your remaining bonus balance is $0.25.

→

Participation

Warning

Participation in this study is an important decision. During the study, you will earn bonus money by playing two games. The first game is free to enter, but the second game requires purchasing a ticket. Participants will be randomly assigned one of three prices (high, medium, low). Hence, though the average bonus payment is $4, your bonus could be as low as **$0.25**. As there are other studies that you could spend your time on, only proceed if you are comfortable with this.

Yes, I am sure that I want to participate in the study.

No, I do NOT want to participate in the study.

→

Field Study: Descriptive Statistics

	Low (N=3627)		Medium (N=3701)		High (N=3712)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Video Length (Minutes)	22.04	74.66	21.93	75.99	21.36	61.36
Video Length Known	1.00	0.02	1.00	0.02	1.00	0.03
Treated Ad Length (Minutes)	0.99	1.92	1.05	3.50	1.03	2.62
Ad Length Known	0.92	0.27	0.91	0.28	0.92	0.28
Category Known	0.84	0.36	0.86	0.35	0.86	0.35
Category: Music	0.20	0.40	0.20	0.40	0.22	0.41
Category: Entertainment	0.13	0.33	0.12	0.33	0.12	0.33
Category: Politics	0.05	0.23	0.06	0.23	0.06	0.23

Ad Time Subsample

	Dependent variable:					
	Sunk time in seconds					
	(1)	(2)	(3)	(4)	(5)	(6)
MAD=5	6.200***	3.686***	3.502***	2.618**	2.983**	3.567***
	(2.222)	(1.281)	(1.262)	(1.197)	(1.467)	(1.344)
MAD=10	8.480***	6.925***	6.950***	7.032***	7.221***	7.863***
	(2.182)	(1.476)	(1.376)	(1.283)	(1.539)	(1.489)
Observations	1,286	3,770	5,607	8,502	11,040	10,630
Sample	< 3 min.	< 6 min.	< 10 min.	< 20 min.	Full	No MV
Mean sunk time	17.50	18.36	19.50	20.64	22.01	21.99
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes

Engagement Time Subsample

	Dependent variable:					
	Engagement time in seconds					
	(1)	(2)	(3)	(4)	(5)	(6)
MAD=5	-4.398	-6.251*	-6.072	-0.174	-3.286	-6.573
	(4.055)	(3.735)	(4.355)	(5.696)	(9.093)	(9.095)
MAD=10	0.619	-4.670	-9.240**	-4.727	-1.644	-0.094
	(3.802)	(3.710)	(4.366)	(5.709)	(9.824)	(10.008)
Observations	1,286	3,770	5,607	8,502	11,040	10,630
Sample	< 3 min.	< 6 min.	< 10 min.	< 20 min.	Full	No MV
Mean engagement time	56.83	86.27	115.08	168.56	221.96	222.41
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes

Extensive Margin Subsample

			Dependent variable:			
			Engagement time = 0			
	(1)	(2)	(3)	(4)	(5)	(6)
MAD=5	0.091***	0.050***	0.037***	0.030***	0.035***	0.036***
	(0.031)	(0.016)	(0.013)	(0.010)	(0.009)	(0.009)
MAD=10	0.064**	0.064***	0.056***	0.047***	0.053***	0.054***
	(0.029)	(0.016)	(0.013)	(0.010)	(0.009)	(0.009)
Observations	1,286	3,770	5,607	8,502	11,040	10,630
Sample	< 3 min.	< 6 min.	< 10 min.	< 20 min.	Full	No MV
Mean	0.226	0.208	0.218	0.216	0.220	0.219
Individual FE	Yes	Yes	Yes	Yes	Yes	Yes