Peer prediction markets to elicit unverifiable information

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August 28, 2024

Imagine a survey...

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- **How can we ensure signal acquisition and revelation if cannot compare answer to ground truth?**

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- Bets on what others will say.

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  - Intuitively, yes answers says something about likely experience of other customers.

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3. Study 2: health survey, involving questions about social distancing (in 2020).
   - practical feasibility, with stigmatizing answers;
   - reveal lower compliance with guidelines.

Outline

A pair of boxes

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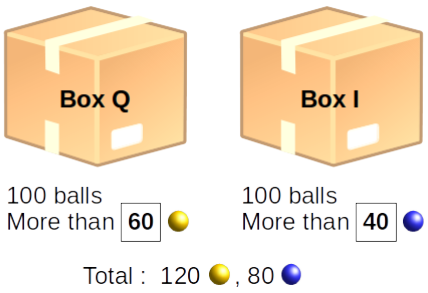

- Q= "more yellow" or I= "less yellow"

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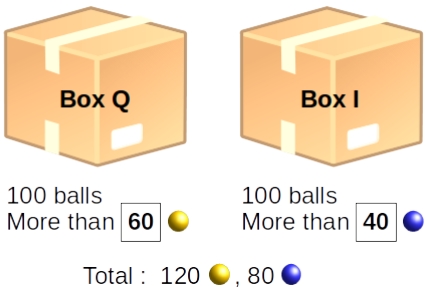

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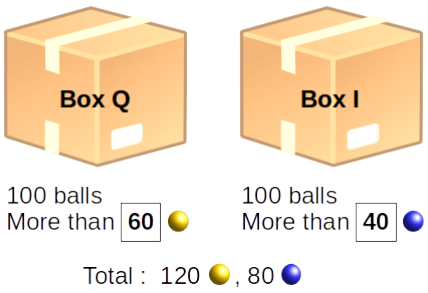


- Q= "more yellow" or I= "less yellow"
- One of the boxes has been selected (=one state of the world occurred, equally likely). Guess which one.
- Want to see a ball (= a signal) from the selected box?

Real effort task to see a ball

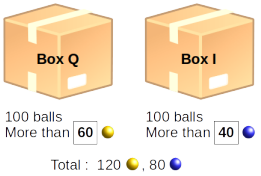
0 0 1 1 0 1

1 0 0 1 0 0

0 0 1 1 1 1

0 0 1 1 0 1

Link with theory



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- Common prior expectations that anyone drawing a ball will get a yellow ball $\bar{\omega} = 60\%$.

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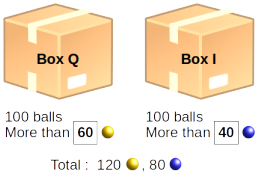

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- Drawing a yellow (blue) ball makes people think the actual box is Q (I).

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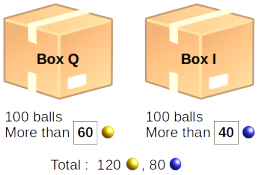

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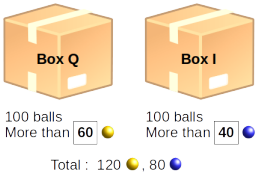

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- Drawing a yellow (blue) ball makes people think the actual box is Q (I).
- Hence, common prior expectations that anyone drawing a ball will think the actual box is Box Q $= \bar{\omega} = 60\%$.
- Two decisions: whether to provide effort (counting 1s to get a ball) and then which box to report.

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- Incentives: if you draw a yellow ball, then you expect Box Q to be the actual box, and therefore more people reporting Box Q (asset value) than expected ex ante (price 60%).
- Can be implemented without observing the actual box and the balls people draw.

3 treatments

- Flat fee: £3.25 completion fee.
- Accuracy incentives: £3.25 $\pm$0.20 if guess is correct or not.
- PPM: £3.25 + PPM with unit 0.20c.

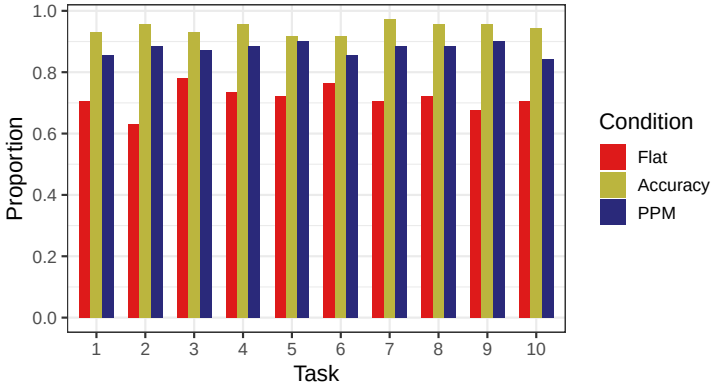
Participants

210 U.S. students from Prolific.

May 2020 online, with Qualtrics.

10 tasks (10 pairs of boxes, 10 matrices).

Results



Proportion of subjects providing an effort (counting 1s to see a ball) across the 10 tasks.

Results

Dep. var.: P(effort task completed)				
	(whole sample)		*(filtered sample)*	
	(1)	(2)	(3)	(4)
PPM	0.16^{**}	0.14^{**}	0.16^{**}	0.14^{*}
	(0.05)	(0.06)	(0.06)	(0.06)
Accuracy	0.23^{***}	0.23^{***}	0.23^{***}	0.23^{***}
	(0.05)	(0.05)	(0.05)	(0.05)
Age		−0.00		−0.00
		(0.00)		(0.00)
Female		0.04		0.04
		(0.04)		(0.04)
US resident		−0.03		−0.02
		(0.07)		(0.07)
Num. obs.	2100	2070	2060	2030
Likl. Ratio.	148.93	175.79	146.39	173.35
LR test p-val	< 0.0001	< 0.0001	< 0.0001	< 0.0001
AIC	1649.70	1549.38	1638.88	1539.16

$^{***}p < 0.001$; $^{**}p < 0.01$; $^{*}p < 0.05$; $^{+}p < 0.1$

Table: Marginal effects, logistic regression (baseline category: Flat)

Outline

Screenshot

Question 2 of 8 (show instructions)

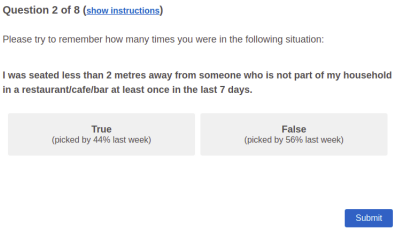
Please try to remember how many times you were in the following situation:

I was seated less than 2 metres away from someone who is not part of my household in a restaurant/cafe/bar at least once in the last 7 days.

True	False
(picked by 44% last week)	(picked by 56% last week)

Submit

Link with theory



- Remembering it happened is receiving signal 1.
- $\bar{\omega} = 0.44$ (common prior expectations).
- Clicking on True is $r_i = 1$.
- effort = mental cost of remembering whether one was seated less than 2 metres away from someone else.
- + psychological costs such as mild stigma of answering "True".

Questions

	Statement
1.	I have been in an elevator with another person in it at least once in the last 7 days
2.	I may have stood less than 2 metres away from the person in front in a queue at least once in the last 7 days
3.	I was seated less than 2 metres away from someone who is not part of my household in a restaurant/cafe/bar at least once in the last 7 days
4.	I have been in a social gathering with more than 6 people who are not part of my household at least once in the last 7 days
5.	I have been in a busy shop/market with no restrictions on number of customers at least once in the last 7 days
6.	I participated in an indoor activity with more than 6 people who are not part of my household at least once in the last 7 days
7.	I have been in a shop/market where one or more of the staff did not wear a mask at least once in the last 7 days
8.	I had an interaction with someone experiencing high body temperature, persistent cough or loss of taste/smell at least once in the last 7 days

Table: Covid-19 survey questions

Treatments

- Control (question **without** past week rate, flat fee)
- Control 2 (question **with** past week rate, flat fee)
- Treatment (question **with** past week rate, PPM)
  - If report True: win (rate of True - 44%)
  - If report False: earn (44% - rate of True)

Participants and timeline

- UK participants
- 50 per treatment per week
- Week 0, just Control
- Weeks 1 & 2, Control, Control 2, Treatment
- November 2020

Results

	P(response = 'true'), marginal effects					
	(week 1)			*(week 2)*		
	(filtered sample)		*(all)*	*(filtered sample)*		*(all)*
	(1)	(2)	(3)	(4)	(5)	(6)
Flat-PastRate	0.05	0.04	0.04	−0.00	−0.01	−0.00
	(0.04)	(0.04)	(0.04)	(0.03)	(0.03)	(0.03)
PPM	0.11***	0.09**	0.09**	0.08*	0.08*	0.08*
	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)	(0.04)
Response time		0.00	0.00		0.00	0.00
		(0.00)	(0.00)		(0.00)	(0.00)
Age		−0.00	−0.00		−0.00	−0.00
		(0.00)	(0.00)		(0.00)	(0.00)
Female?		0.02	0.02		−0.02	−0.02
		(0.03)	(0.03)		(0.03)	(0.03)
UK citizen?		−0.00	0.00		0.04	0.04
		(0.03)	(0.03)		(0.04)	(0.04)
Num. obs.	1259	1259	1264	1279	1279	1280
Likl. Ratio.	10.44	16.28	15.87	8.03	12.85	13.83
LR test p-val	0.0054	0.0123	0.0144	0.0180	0.0455	0.0316
AIC	1662.27	1664.43	1671.58	1660.66	1663.85	1664.94

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Table: Logistic regression, average marginal effects

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- Studies complement each other.
- Support the theory: PPM motivates signal acquisition and revelation.

Thank you!