

Bayes' Rule

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Overview of Presentation

Explanation of Bayes' Rule

My **Hypotheses**

Review of Experiment

Experiment **Results**

My **Conclusion**

Questions

1.

What is Bayes' Rule?

A brief explanation of Thomas Bayes' Theorem



When acquiring new information, it is useful to think about the difference between the initial beliefs, the information obtained, and the new beliefs after seeing the information.

Bayes' Rule

$$P(A|B) = \frac{P(B|A)P(A)}{P(B|A)P(A) + P(B|\bar{A})P(\bar{A})}$$

$$P(\text{red} | C) = \frac{P(C | \text{red}) \times P(\text{red})}{P(C | \text{red}) \times P(\text{red}) + P(C | \text{blue}) \times P(\text{blue})}$$



2.

My Hypotheses

My Hypotheses

H1

When players do not see a draw, their mean predictions will be around 50.

H3

Because right predictions are incentivized, Group 2 will have more accurate predictions.

H2

When players see at least two of the same color on a draw, they will be more likely to predict that the draw came from the same color cup (i.e. if they see two red, they will more likely predict that the red cup is being used).



2.

The Experiment

Experiment with Bayes' Rule

Two groups with similar set ups

- ❖ Red or Blue Cup with marbles.
- ❖ Computerized & random draws.
- ❖ Shown marbles after draw, but not the cup.
- ❖ Equal amount of marbles, equal likelihood of being chosen.
- ❖ Random payoff, or payoff if red cup was used.
- ❖ Payoff table was 1st die throw
- ❖ Random die throw after that
- ❖ **Difference:** One group received \$0 payoff, other group received \$2 payoff.



3.

The Results

Hypothesis 1

Round	ID Number	Cup Used	Draw(s)	Bayes Rule Prediction	Elicited Probability for Cup A
1 HA HA	ID 1	Blue Cup	* * * * *	50	50
1 Lord Voldemort	ID 2	Red Cup	* * * * *	50	90
1 Coca Cola	ID 3	Blue Cup	* * * * *	50	55
1 666 666	ID 4	Blue Cup	* * * * *	50	55
1 fall 20	ID 5	Red Cup	* * * * *	50	40

Group 1
M = 58

Hypothesis 1 (continued)

Round	ID Number	Cup Used	Draw(s)	Bayes Rule Prediction	Elicited Probability for Cup A
1 funny orange	ID 1	Blue Cup	*****	50	80
1 Mini Polar Bear	ID 2	Red Cup	*****	50	8
1 Bad gal Rihanna	ID 3	Blue Cup	*****	50	55
1 ready ornah	ID 4	Blue Cup	*****	50	50
1 skrt skrt	ID 5	Red Cup	*****	50	40

Group 2
M = 46.6

Hypothesis 2

Group 1 (Without Payoffs)

Group 1 (Without Payoffs)														
Round 3					Round 4					Round 5				
ID Number	Cup Used	Draws	Bayes'	Elicited Probability	ID Number	Cup Used	Draws	Bayes'	Elicited Probability	ID Number	Cup Used	Draws	Bayes'	Elicited Probability
1	Blue	RB	50	0	1	Red	RRB	67	50	1	Blue	BBRB	20	50
2	Red	RB	50	84	2	Blue	RRB	67	25	2	Red	BRBR	50	95
3	Blue	BR	50	66	3	Blue	BRB	33	5	3	Red	RRBR	80	95
4	Red	RR	80	70	4	Red	RBR	67	45	4	Red	RRRR	94	30
5	Red	RR	80	10	5	Blue	BRR	67	99	5	Red	RRRR	94	99

Hypothesis 2 (cont.)

Group 2 (With Payoffs)

Group 2 (With Payoffs)														
Round 3					Round 4					Round 5				
ID Number	Cup Used	Draws	Bayes's	Elicited Probability	ID Number	Cup Used	Draws	Bayes's	Elicited Probability	ID Number	Cup Used	Draws	Bayes's	Elicited Probability
1	Blue	BR	50	39	1	Blue	BBB	11	30	1	Red	RBRB	50	30
2	Blue	BR	50	10	2	Blue	BBB	11	50	2	Blue	RRRB	80	50
3	Red	RR	80	100	3	Red	RRB	67	100	3	Red	RRBB	50	100
4	Blue	RR	80	70	4	Blue	RRB	67	65	4	Blue	BBBB	6	65
5	Red	BB	20	30	5	Red	BRB	33	1	5	Blue	BBBB	6	1

Hypothesis 3

Group 1

Average of Average Decisions
From Bayes' Prediction = 22.5

Decision Averages for All Treatments:

Bayes' Prediction	Average Decision	Median Decision	Two-Thirds Interval	Number Observations
20	50.0	50		1
33	37.3	22.5		4
50	59.4	60.5	(45, 87)	9
67	44.8	37.5	(22.5, 74.5)	6
80	58.3	70		3
94	64.5	64.5		2

Group 2

Average of Average Decisions
From Bayes' Prediction = 12.98

Decision Averages for All Treatments:

Bayes' Prediction	Average Decision	Median Decision	Two-Thirds Interval	Number Observations
6	30.5	30.5		2
11	40.0	40		2
20	30.0	30		1
33	35.0	50		3
50	44.7	40	(9, 67.5)	9
67	53.6	50		5
80	73.3	70		3

The background consists of several overlapping, semi-transparent geometric shapes in various shades of green and teal. A large teal shape is in the center, with darker teal and lighter green shapes layered above and below it. The overall effect is a modern, abstract design.

4.

My Conclusion

Conclusion

- H1 - Participants may have still been trying to figure out how to play the game since it was only the first round.
- H2 - Seemed to have been more plausible for Group 2
- H3 - Group 2 was more accurate in their predictions than Group 1



Thanks!



Any questions?

