Behavioural Economics
Experiment Report
<u>Anchoring</u>🔗

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Real-life Example-

1. **Estimating the real value of a property** is a high cognitive load task. It is difficult to find the value of a property, so people tend to make decisions based on the property rates that are prevailing in that specific location (**social anchor**).
2. **Deciding whether to invest in an IPO** is a tedious process as it involves calculations. The grey market price after the listing of the IPO acts as a social anchor, which affects the people's decision of whether or not to invest in a particular stock.

Hypothesis-

Subjects under cognitive load are more likely to make decisions based on socially derived anchors

Research Question-

We are comparing decision-making under high cognitive load and low cognitive load and understand how people depend upon anchors, if at all they do, under these conditions

Experiment Subjects-

Our subject population include students from the STEM field who are currently pursuing graduate studies at colleges like IIITD. This is to make sure that they have knowledge of different types of distributions (random, gaussian, normal) and that they can easily perceive and follow the instructions of the experimenter.

Literature Review-

1. Anchoring in Social Context by L. Meub, T. Proeger

The paper presents a new experimental design to study anchoring in social contexts and provides incentives for unbiased decisions. The results show that social anchors have a stronger effect on decision-making than experimenter-provided anchors, and that incentives can reduce the impact of anchoring.

2. An Experimental Study on Social Anchoring by L. Meub, T. Proeger

The research delved into how individuals' decisions are influenced by cognitive load and social cues. They explored the impact of social sources on decision-making when individuals were under cognitive strain. Their findings highlighted that cognitive load increased the likelihood of people relying on socially derived anchors when making decisions.

3. Anchoring: a valid explanation for biased forecasts when rational predictions are easily accessible and well incentivized? by L Meub, T. Proeger, K Bizer

The study investigates the phenomenon of anchoring, proposing its validity in explaining biased forecasts. Even when rational predictions are readily available and incentivized, biases persist due to the influence of anchors. Anchors, primarily derived from social sources, affect decision-making under cognitive load. The research highlights that these anchors hold considerable sway, leading individuals to deviate from rational predictions. This understanding underscores the significance of considering social influences in decision-making processes, shedding light on why biases persist despite accessible and incentivized rational predictions.

Experiment-

We have 4 components in our experiment:

1. Low Cognitive Load (Basic Experiment)
2. High Cognitive Load (Complex Experiment)
3. Control Group for Basic Experiment
4. Control Group for Complex Experiment

Overview:
This study investigates the impact of socially derived anchors on decision-making under cognitive load. Participants engage in a series of rounds where they are presented with a mathematical formula involving known (a, b, c/d) and hidden (d/e) variables. The primary objective is to assess how exposure to an endogenous anchor, derived from the average guesses of participants, influences subsequent estimations of the formula. The experiment consists of multiple conditions, including a control group and variations in cognitive load.

Experimental Procedure:

Initialization:
Participants are assigned to experimental conditions (e.g., anchor group, control group).
For each participant, known variables a, b, and c {complex: d} are drawn from a normal distribution not disclosed to participants. The hidden variable d, {complex:e} is randomly selected from a normal distribution within the range [-25, 25].

Estimation Phase:
Participants are presented with the **formula****
and are instructed to estimate the value of **x** based on the provided values of a, b, and c {complex: d} . The value of d{complex:e} remains hidden.
The values for a, b, c {complex:d} is same for each participant.
The **draws**** are given with the formula.
This is to be done in given **time frame****.

Feedback and Anchoring:
Participants receive feedback on their estimations, including the true value of x calculated from the randomly drawn d. Additionally, participants are shown the average guess of all participants in their group, serving as the endogenous anchor.
Participants are prompted to predict whether the next value of x, to be presented in subsequent rounds, will be higher or lower than their current estimate. This step emphasizes the social anchor and encourages participants to consider it in their subsequent estimations.

Cognitive Load Manipulation (Complex):
In selected conditions, participants are subjected to a cognitive load task designed to induce additional mental effort during the estimation phase. This task is introduced to investigate potential interactions between cognitive load and the anchoring effect.

Repeat for Multiple Rounds:
The entire process is repeated for a specified number of rounds (e.g., 8 rounds) to observe the persistence or evolution of the anchoring effect over time.
Data on participants' estimates, actual values, and predictions regarding the direction of the next value are collected for analysis.
Experimental Conditions (to be specified for each experiment):
**

Conditions

1. Basic
   X = A+B-C+D
   All the values are drawn from random normal distribution with
      $\mu = (max+min)/2$
      $\sigma = (max-min)/4$
   A = 50, 150
   B = 51, 150
   C = 0, 75
   D = -25, 25
   Time = 60 seconds
   The Values A, B, C are same for each person in a round

```
group = player.group
player_lists = group.get_players()
A = normal_random_integer_within_range(50, 150)
B = normal_random_integer_within_range(51, 150)
C = normal_random_integer_within_range(0, 75)
for p in player_lists:
    p.a = A
    p.b = B
    p.c = C
    p.d = normal_random_integer_within_range(-25, 25)
```

2. Complex
   X = 2*A - B - 0.5*C + D^2 + E
   All the values are drawn from random normal distribution with

   μ = (max+min)/2

   σ = (max-min)/4

   A = 60, 150
   B = 0, 50
   C = 0, 75
   D = 0, 10
   E = -25,25
   Time = 30 seconds
   The Values A, B, C and D are same for each person in a round

```
group = player.group
player_lists = group.get_players()
A = normal_random_integer_within_range(60,150)
B = normal_random_integer_within_range(0,50)
C = normal_random_integer_within_range(0,75)
D = normal_random_integer_within_range(0,10)
for p in player_lists:
    p.a = A
    p.b = B
    p.c = C
    p.d = D
    p.e = normal_random_integer_within_range(-25,25)
```

3. Control Group (No Anchoring)
   Participants in this group only provide estimates without exposure to the average guess of other participants.

Payoffs and Payment-

The payoff is calculated based on the accuracy of participants' answers concerning the correct value of each round. In each round, participants receive Rs. 50, with the difference between their estimated value and the actual value being deducted from Rs. 50. The payment can be equal to 0 but not less than 0. The gains from each round are accumulated and paid at the end of the experiment. Additionally, there is a basic payment of Rs. 150.

For example:
If the correct value is 150 and your estimation is 137.
The difference between the correct value and your estimation is 13.
You would receive Rs. 50 - 13 = Rs. 37 for that round.
Basic:

```
def set_payoffs(group: Group):
    player_lists = group.get_players()
    for p in player_lists:
        real_val = p.a + p.b - p.c + p.d
        p.payoff = max(0, 50 - abs(p.guess - real_val))
```

Complex:

```
def set_payoffs(group: Group):
    player_lists = group.get_players()
    for p in player_lists:
        real_val = 2*p.a - p.b - 0.5*p.c + p.d*p.d + p.e
        p.payoff = max(0, 50 - abs(p.guess - real_val))
```

What type of statistical methods can be used to test our hypothesis and what type of data might help prove or disprove the hypothesis?

Anchoring Effect:
Prediction: The group exposed to the endogenous anchor will demonstrate a stronger anchoring effect compared to the control group. Over rounds, the anchor group's guesses should cluster around the average provided anchor, showing a clear anchoring effect. The control group's guesses should lack this clustering.

Description: The anchor group's guesses converge towards the anchor value, indicating that the social anchor influenced their estimates.

Cognitive Load Interaction:
Predictions: The anchoring effect in the anchor group should be more pronounced under high cognitive load compared to low cognitive load. The control group may show no significant difference.

Description:
The anchor group's anchoring effect is more prominent when participants are under high cognitive load, supporting the idea that cognitive load enhances the impact of the anchor.

We can perform a two-way ANOVA for group (anchor vs. control) and cognitive load (high vs low), assessing the interaction effect. A non-significant term in ANOVA will disprove the claim.

Accuracy of Guesses:
Prediction: Both groups might have similar overall accuracy, but the anchor group's guesses should be more accurate compared to the control group.

Description: Despite cognitive load, the anchor group tends to provide more accurate estimates compared to the control group.

We can use t-test to find if the estimates made by the two groups are at all differen or their is a reduced error rate at all.