Introduction to Neuroeconomics

Project Report – Anxiety impairs decision making

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Abstract

Using the Iowa Gambling Task (IGT) and a non-gambling task, we tested the effect of trait anxiety (TA) on decision-making. This study is an attempt to replicate a study from 2008. We linked tiny financial prizes proportionate to achievement in IGT to enhance the technique. The preliminary studies observed that human beings with specifically High Trait Anxiety (HTA) demonstrated worse choice-making in comparison to Low TA participants and that the psychophysiological correlates of TA (heart rate and skin conductance) were connected with trait anxiety they generally reflect the sensitivity to rewards and punishments of participants. This can considerably have an effect on the neuropsychological decision theory. In this study, the variations were significant, and we were able to replicate part of the original study's findings. Also along with that, we tried to see how TA affects decision-making in terms of risky choices.

Introduction

Current research has shown that emotions do play a significant role in human decision-making (for review see Bechara et al., 2000; Dunn et al., 2006). In this study, we explicitly examine the function of trait anxiety (TA) in decision-making. Anxiety is frequently linked to heightened reactions to circumstances like threats. s. TA reflects individual differences in sensitivity to threat (Spielberger, 1966: Endler and Kocovski, 2001). TA has also been linked to increased risk aversion and "pessimistic risk evaluations" (Maner et al. 2007; Mitte, 2007).

According to several studies, TA is linked to changes in the brain's morphology, neurochemistry, and function of neuronal networks s (regions such as the prefrontal cortex, and amygdala) (Yamasue et al., 2008). Memory, executive skills including decision-making, selective attention, and fluid intelligence are all attributed to the prefrontal cortex. Therefore, further research into the function of TA in decision-making is necessary.

The Iowa Gambling Task (IGT) is used in this study to evaluate a subject's decision-making. IGT is a gambling game that successfully simulates the unpredictability of premises and results s (Bechara et al., 1994). Behavioral studies have widely utilized it to evaluate a person's decision-making abilities.

Scope

This study seeks to duplicate the findings of Miu et al (2008). The original study specifically looked at how TA affects judgment and anticipatory physiological (somatic) reactions (heart rate and skin conductance) before such events.

However, due to time constraints, we could not measure factors such as heart rate and skin conductance (skin conductance has been shown to increase arousal by either internal or external stimuli).

Hypothesis is that trait anxiety significantly impairs decision-making.

Participants

There were 21 participants in this study, 12 of whom were men and 9 of whom were women. We had a total of 20 participants (mean age 23.11 years, SD 1.67) after cleaning the data by disqualifying partial replies and responses that took less than 4 minutes (expected duration was 6-8 minutes). Of these, 11 were males (mean age 23.87 years, SD 1.75) and 9 were females (mean age 23 yrs., SD 1).

Nine men and seven women were chosen from among the 20 participants (mean age 23.37 years, SD 2.11) based on their STAI scores that were > 0.5 S.D. above or below average. For better resolution between high and low scores, the original study chose participants based on their scores that were at least one standard deviation above or below average. However, doing so on our rather small sample size led to the selection of roughly 10 participants. We recruited a broader spectrum of people because the sample size was so small.

The distribution that resulted looked like this (High TA indicates scores over 0.5 S.D. above average and Low TA indicates scores over 0.5 S.D. below average scores in trait anxiety)

	Male	Female	Total
High TA	3	5	8
Low TA	6	2	8
Total	9	7	16

Table 2: Number of participants

Male		Female	
Low TA	High TA	Low TA	High TA
32.33 ± 5.44	56.66 ± 5.03	32.5 ± 4.94	66 ± 6.72

Table 1: Scores on the trait portion of State-Trait Anxiety Inventory (STAI) of participants included in this study. The data are reported as mean standard deviation. . The unusually high standard deviations of scores other than TA and anxiety/neuroticism are justified by the specific selection of the participants for opposing extreme scores of TA and anxiety/neuroticism

Experiment – 1

Procedure

Participants in our assessment were initially asked to state their age and gender. Participants' other personal information was not gathered. Participants were then presented with a software version of IGT hosted on Psytoolkit. The task composed of 50 trials and expected to take 4 to 5 minutes. After IGT, participants were asked to complete a well-being questionnaire, which was the State-Trait Anxiety Inventory (STAI) (which was expected to take about 3 minutes).

Iowa Gambling Task (IGT)

Participants in IGT are given 4 decks of cards with the labels A, B, C, and D. A loan of 2000 points was given to each participant at the beginning. They were told how to play the game in order to reduce their losses. The participants were not informed beforehand that there would be a total of 50 card selection trails. Each chance had a 50% chance of drawing either a reward card or a punishment card from each deck. In the case of A and B, the prize was set at 100 points, and 50 points (in case of C and D). The punishment card was set to 0 points for C and D and -250 points for A and B. Both A and B and

C and D were comparable to one another. Playing primarily from the unfavourable deck (A and B) resulted in an overall loss, but playing primarily from the favourable (C and D) deck resulted in an overall gain. The (C+D)-(A+B) score served as an indicator of the participant's performance.

Additionally, we aimed to make the study better in order to recreate a more accurate scenario in IGT. To do this, we informed the participant that they would receive a minimal economic bonus based on their IGT earnings. Participants received 10 INR for every 1500 IGT points they achieved. No participant received more than 3000 points in the results, and the highest payout per participant was 10 INR.

State-Trait Anxiety Inventory (STAI)

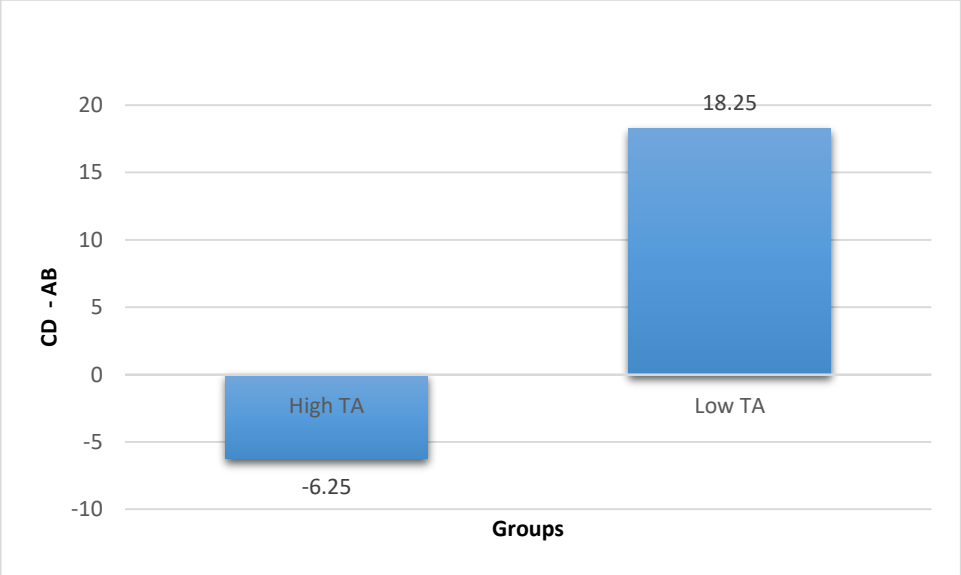
The State-Trait Anxiety Inventory is a test/questionnaire given to adults that shows how strong a person's feelings of anxiety are. The full form X of the STAI consists of 40 questions. It has two parts: a 20-item state-anxiety measure, and a 20-item trait-anxiety measure. For this study, we have used 20-item trait anxiety (TA) questionnaire.

Results

A 2 (TA: high vs low) X 2(sex: male vs female) ANOVA of CD – AB score indicates that TA ($F [1, 14] = 4.31$, $p<0.05$) has a statistically significant effect on IGT performance. High TA participants show decreased IGT performance compared to low TA participants.

We do not observe any statistically significant main effects of sex or TA X sex interaction. The amount of time needed to complete 50 trials in IGT is not significantly correlated with either TA or the TA x sex interaction (mean ± standard deviation: 8.00 ± 1.09 min).

The figure below illustrates how the IGT performance of the High TA and Low TA groups differs:



In our study we, got high TA participants showing much poorer IGT performance with negative CD-AB measure.

Discussion and Conclusions

We attempted to duplicate the original study and were successful in reproducing certain findings. A significant difference between performances on the IGT task was observed between high and low TA groups. Few mechanisms could account for the link between high TA and poor decision-making. One is associated with the tendency to use fewer signals and inefficiently separate relevant from irrelevant stimuli in reasoning tasks that have been linked to anxiety (Leon and Revelle, 1985). Participants with high TA may have focused on a small number of data points, especially on the rewards that were easy to comprehend. This might have influenced people to select the disadvantageous high-reward decks more frequently.

In the previous attempt, the group was not able to replicate the results probably because they collected data through online mode and did not use the full STAI scale. Our participants completed the task in a controlled lab environment.

Experiment – 2

One of the first domains in which researchers explored the origins of our behavioural biases was in the domain of choice under uncertainty. In addition to avoiding choices that are framed as losses, there is also evidence that our risk preferences are affected by framing.

To see how transient anxiety affects the risk-taking behavior of individuals. They were given the following questionnaire. From these two questions, they had to choose one option from each question.

Problem statement: Imagine that you face the following pair of concurrent decisions. First, examine both decisions, then indicate the options you prefer.

Decision (1) Choose between:

A. a sure gain of $240

B. 25% chance to gain $1000 and 75% chance to gain nothing

Decision (ii) Choose between:

C. a sure loss of $750

D. 75% chance to lose $1000 and 25% chance to lose nothing

Hypothesis

We expected Transient Anxiety to have no effect on the risk-seeking behaviour of participants

Results Observed:

We had 8 participants who belong to high TA and 8 participants belonging to low TA.

- In Decision(1) :
  4 out of 8 High-TA participants (50.0%) chose **option B**
  7 out of 8 Low-TA participants (87.5%) chose **option A**

- In Decision(2):
  6 out of 8 High-TA participants (75%) chose **option-C**
  7 out of 8 Low-TA participants (87.5%) chose **option- C**

Discussion

Our hypothesis in the situation where the participants had nothing to lose, is not supported by the responses that we got. Low TA participants chose sure gain over gaining nothing, but High TA participants showed more risk-seeking behaviour when they had nothing to lose.

Our hypothesis for the situation where the decisions were made the participants had something to lose, is supported by the responses that we got. Decision (2) shows the risk aversive nature of humans in a loss environment. That is why 14 out of all 16 participants chose Option C. Risk Aversion is the general bias toward safety (certainty vs. uncertainty) and the potential for loss.

Limitations:

Despite two earlier studies finding that males performed better than women in IGT, we did not find a significant sex effect on performance (Reavis and Overman, 2001; Bolla et al., 2004). Our relatively small sample size and the fact that we only chose subjects with extremely high TA scores are potential explanations for our lack of findings.

Due to time restrictions, we were also unable to take into consideration physiological elements like skin conductance and heart rate. Measurements of physiological variables may shed more light on the study's potential confounds.

Our study only included university students between the ages of 21 and 24, therefore the diversity of our data is lacking. This lack of diversity might prevent us from getting the whole picture and understanding of how anchoring impacts people from various age groups and characteristics.

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