

The Role of Anchoring Bias Play on Human Thinking and Decision Making

Xiang Yao¹, Guangming Zhao²

¹Western Academy of Beijing, Beijing, 100102, China.

²Nanjing Foreign Language School British Columbia Academy, Nanjing, 210008, China.

Abstract

The present research provides an investigation on anchoring effect (bias), about how high anchor and low anchor may affect the estimation differently in the anchoring bias, also with research and data analysis on the affection of gender, had previous knowledge before or not, and the educational level of the participants on their estimation under the anchoring bias. Participants are Chinese who have WeChat installed on their phones. Online questionnaires were separated from the participants, which were then collected as the resource of the result of this research. Together, this research demonstrates that in anchoring bias, a high anchor has a larger influence comparing to low anchor. Anchoring bias is also proven to be independently affecting people's decisions, not easily influenced by other influencing factors by the present research. Future directions are also given that can be done based on the present research.

Keywords

Anchoring bias, Anchors (high and low), Human estimation.

1. Introduction

In the study done by Jacowitz & Kahneman in 1995, there were two experiments and an anchoring effect of the misestimation of future task duration was tested [1]. This account suggests that this type of misestimation occurs because the previous task serves as an anchor for further and future predictions, causing an underestimation or overestimation depending on the order of the longer task and shorter task. Furthermore, their hypothesis was underestimation occurs when a longer task follows a shorter one and overestimation when a shorter task follows a longer one. Before estimating, participants were asked to select a figure (anchor) of a longer or shorter duration produced by other participants in earlier research on the same task (the first experiment) or a completely different task (the second experiment). In both experiments, misestimation differed according to the figure that they chose before estimating (the anchor). The result was underestimation occurred with the shorter anchor and overestimation occurred with the longer anchor which suggests that the estimation process was influenced by the anchors [1]. That was how the idea of anchoring bias evolved from an experiment.

Later on, Jacowitz & Kahneman concluded that anchoring bias represents the situations where humans tend to rely overly on the first piece of information that they received. A typical day to day example, which shows how anchoring bias is so common, that one person sees in the markets around us is bargaining. When someone walks into the shop and see that beautiful lamp that he/she never knew they had always wanted, it is time to start bargaining. The price that the store gives you becomes an anchor for your negotiation. People may bargain from 200 USD to 160 USD or from 100 USD to 70 USD. But the reality is unless they are experts on the quality of the lamp, they have no personal understanding of the lamp [2]. Their decision to buy

the lamp, and your subsequent sense of satisfaction with the price, all comes down to the first piece of information they received - the original price quoted by the shop owner.

The dual-process model, proposed by Stanovich and West (2000) refer to as "System 1" and "System 2" thinking, provides a fundamental derive of heuristic. System 1 is an automatic, intuitive, and effortless way of thinking [2]. System 1 thinking often involves heuristics - that is, a "rule" used to make decisions or form judgments. Furthermore, this has been proven by Lewis, 2008, and Gilbert and Gill, 2000. By contrast, System 2 thinking is the opposite of System 1 thinking. Including the anchoring bias, all the biases that humans have are called heuristics, which is a psychological term that describes the assumptions that a person made when he or she is doing the system 1 thinking, or a mental short cut [3].

Strack and Musweiler 1997 investigated the role of anchoring bias in human estimation in 1997. In their study, they recruited 69 undergraduate students in Germany and asked them to do the paper questionnaires with consent. There were four types of questions but separated into two groups (implausible and plausible groups). Furthermore, there was a high anchor and low anchor group in each of the big groups. Each question had two components: in the first component, participants were asked to make a comparative judgment about something. This question acted as the anchor. However, due to each group has its purpose, the differences between these four groups, consequently, the first component of their questionnaire, were the difference of the anchors (high and low anchors in both implausible and plausible conditions). In the second component, participants were then asked to estimate an absolute guess for the target information.

Table 1. The differences and reasons why this study is not exactly the same as the original study, Strack and Musweiler,1997.

Aspects	The Work	Strack and Musweiler (1997)	Reason Why
Target Person	Rabindranath Tagore	Muhammad Gandhi	This work thought Germans are unfamiliar but know Gandhi. Therefore, the work picked a man who has a similar situation
Target Population	Chinese who have WeChat installed on their phone	German college students	Due to the limited access and the location this work are at, Chinese is the population that this study can easily get access to. Therefore, the Chinese would be more applicable to us
Procedure	Online questionnaire	Hardcopies	Due to the COVID-19 outbreak, this work could only get in touch with the participants on social media.
Research scope	Implausible anchors	Plausible and implausible anchors	Due to the amount of time and effort in the work (as well as the schedule), this study chose to do implausible anchors only.
Hypothesis/aim	The effectiveness of low and high anchor in gender	The effectiveness of the low and high anchor	This investigation wanted to explore how much does gender play.
Sample group	200 in total	56 in total	COVID-19 outbreak, 200 participants are the number of people that this study has.

1.1. The Present Research

Based on this conceptualization of what triggers the biases, in particular, anchoring bias, the present research tests how does the anchoring bias (high and low implausible anchors) affects

human estimation on age. This work decided to replicate a study that has been done by the previous psychologists Strack and Mussweiler in 1997. To examine this effect, the procedure is similar to that of the original study.

Even though it is a replication of an existing study, there is still some presence of differences between the present research and the original study. The differences, reasons why have been listed in Table 1.

Many research has been done on anchoring bias, about online voting [4], rational use of cognitive resources [5], the role of anchoring bias in equity market [6], the effect of anchoring bias in consensus forecasts and its effect [7]. This research is more focused on investigating the biases on human decision making or estimation, to be more specific, anchoring bias itself. In anchoring bias, there are two types of anchor: high anchor and low anchor, with the high anchor, is a value bigger than the exact value, and the low anchor to be a lower value comparing to the exact value. The research is based on the hypothesis that in anchoring bias, the high anchor has a greater impact than the low anchor.

2. Experiment

2.1. Participants and Overview

In the study, there were 226 participants involved in the experiment that this study did. 103 of which are male and 123 are female. All of the participants are identified as a Chinese who has WeChat installed on their phone. Furthermore, 100 participants received the questionnaire focused on the low anchor. On the other hand, 126 samples were in the high anchor group. Within the questionnaire, everyone received the same questions if they are in the same anchor group. Furthermore, they were all randomly assigned to the two implausible groups. The two questionnaires, one high and one low anchor was being sent by different group members to ensure that independent measure was independent (no one has participated in the questionnaires twice).

2.2. Material

The required materials were a phone that has WeChat installed, a website or app that allows us to create questionnaires, Microsoft Excel, R language as well as its code for the Wilcoxon and Mann-Whitney test since the procedure needs nonparametric test to evaluate the results.

2.3. Measurement

To complete this investigation, a few of the questions are related to the basic information about the participant's background. The main goal is to evaluate the anchors. However, this study also want to see whether there is an influence from gender, educational levels, whether read Tagore's work before or not, as well as their age, in the final results.

2.4. Procedure

Similar to the procedure done by Strack and Mussweiler, the procedure is separated in specific and detailed steps. After deciding and stating the basic information of the studies such as hypothesis, target population, and the type of bias that the work are focusing on, use an online website to create two separate questionnaires. Specifically, the questions inside are first, "whether Tagore died in the age of 8/152 (depending on the high or low anchor group)"; second, the estimation of when Tagore died in terms of age; third, sample's gender; fourth, sample's age; fifth, sample's educational level; and last but not least, whether they have read Tagore's work before. The next step is to collect all data into an excel sheet and analyze the data by using the T-test. Furthermore, the exact age of the death of Tagore was 80. To avoid any confounding variables and factors that could influence the results, this study mentioned at the very beginning of each questionnaire that searching and asking other people for help are not allowed.

3. Result

Based on the Questionnaire, 125 samples for the High Anchor and 106 samples for the Low Anchor group were collected based on the method. For the remaining 200 samples that are selected based on the method, they were first analyzed separately using the Wilcoxon test to test their relationship with the exact estimation age of 80.

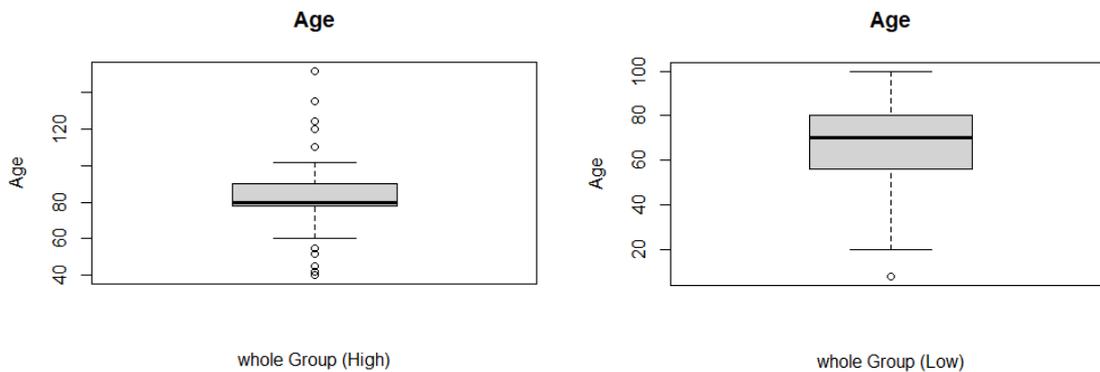


Figure 1. Results of the Wilcoxon test for the relationship between the estimation and the actual value

For both high and low anchor, as Figure 1 shown, a mu number of 80 was set to compare to the whole group. The p-value for the high anchor is 0.01126, which is a number smaller than 0.05. For low anchor, the p-value tested was $8.654e^{-0.9}$, which is a number smaller than 0.05. This difference was statistically significant thus can be inferred that the age guessed was both influenced by the anchors that gave to the questionnaire takers, and since the data is not normal, so instead, the Wilcoxon test’s median value and p-value are needed to compare what had been collected on the graph.

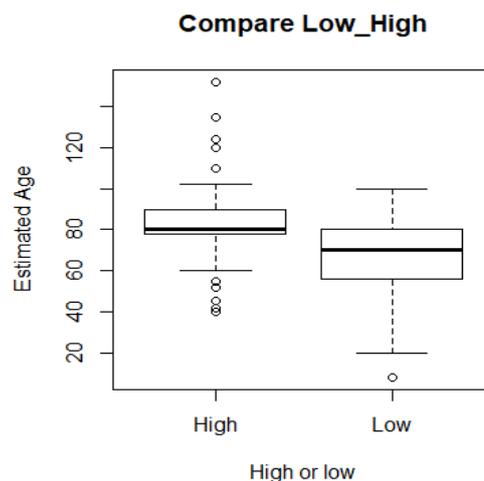


Figure 2. A direct comparison between the two independent variable groups

Then, the two groups’ guessing age were compared with each other than analyzed, using the Wilcoxon Test also, getting the p-value of $3.208e^{-0.9}$, which is a number smaller than 0.05. The statistic result shows that there is a significant difference between the low anchor group’s estimation and the high anchor group’s estimation, which can be seen both by the value and also by the error bar’s range, the median value and the main data area based on Figure 2.

Based on the data analysis done above, the group with the high anchor (152 years old) has a range that is generally higher than the low anchor's group. The median number is also higher than the group that was presented, low anchor. Compared to the p-value calculated before, the high anchor is less effective for people when doing estimation comparing to the low anchor, in this experiment, which conforms to the hypothesis.

$$AI = \frac{\text{Median (high anchor)} - \text{Median (low anchor)}}{\text{High anchor} - \text{Low anchor}}$$

Figure 3. Method to calculate the effectiveness of the anchor

Based on the calculation introduced by Karen and Daniel, shown in Figure 3, the calculation how strong the anchor is, by the calculation format of (AI), is required. The index is about 0.0694, which is an anchor that is not that strong but effective when estimation.

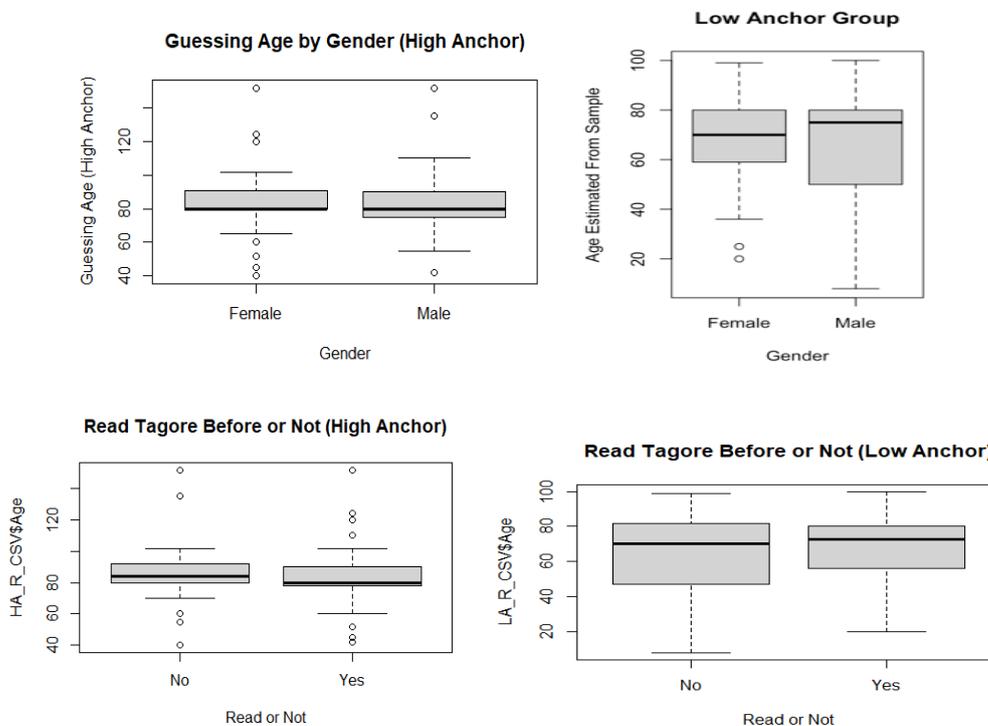


Figure 4. Evaluating the confounding variables

Other data that were collected were also analyzed, based on the affection of gender, whether read Tagore's poem before and the Education Degree the participants have, using the Wilcoxon test, see Figure 4. Based on the statistic calculation of the p-value, affection by gender has the p-value for the high anchor to be 0.492, low anchor to be 7.663e^-0.5. Affection by whether read Tagore's poem before has the p-value for the high anchor to be 0.2753, low anchor to be 0.9094. All the p-value for these two affections is ns.

However, based on the Chi-square calculation on standard deviation and standard deviation error, this work found that people with lower educational levels tend to have a more extreme estimation that has a larger standard deviation range and error range, closer to the anchor that the questionnaire provided. But the result might be caused because there was not a large

enough sample group in some of the educational levels, especially for Doctoral degree and Primary School in High anchor, see Figure 5.

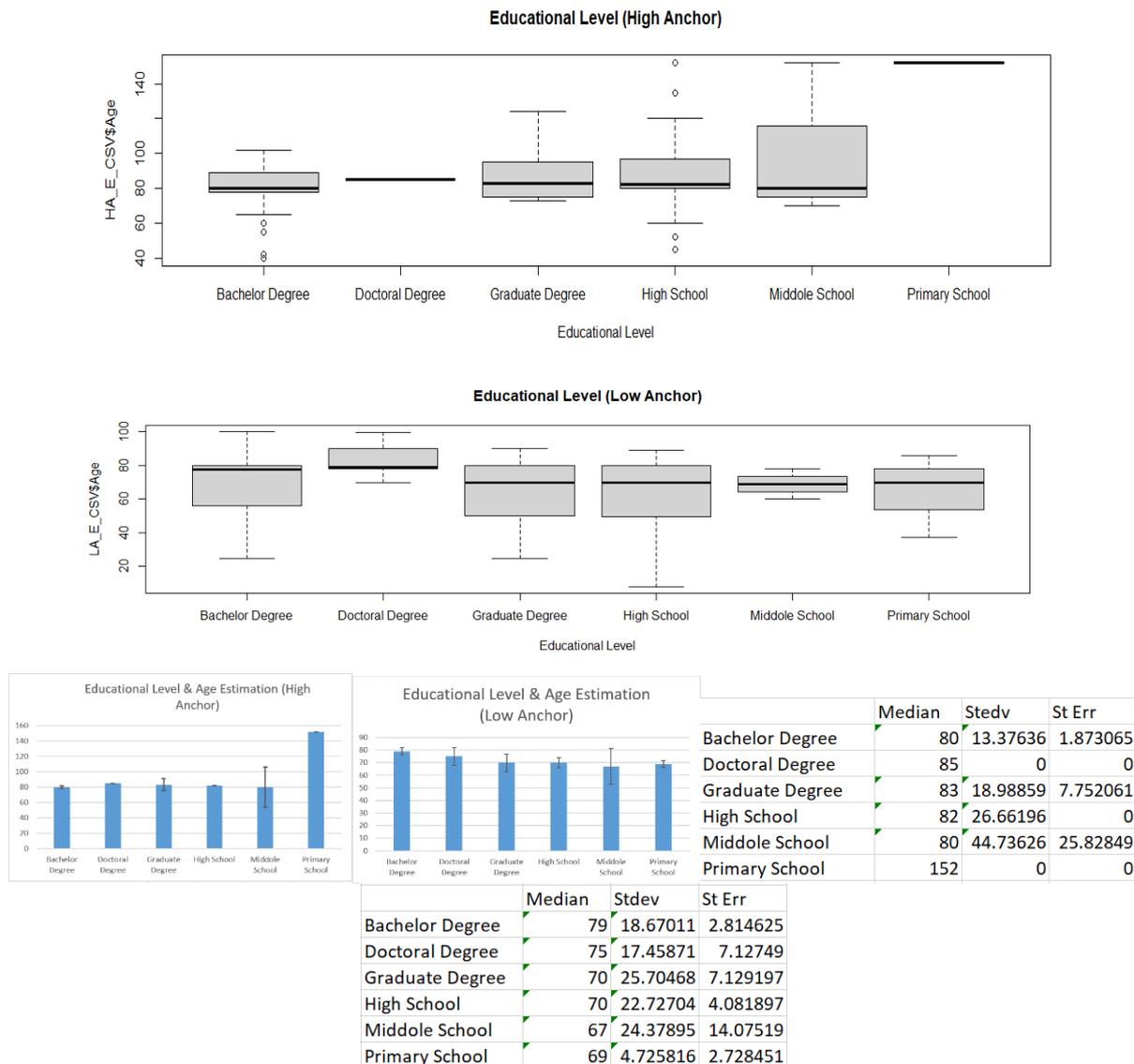


Figure 5. Evaluating one of the possible confounding variables and its effectiveness to the results of this work

4. Discussion and Conclusion

Based on the result and the questionnaires collected, hypothesis for this research that in anchoring bias, the high anchor has a greater impact than low anchor is relatively accurate, according to the analysis of data. Also, though the statistic comparison, other variables such as gender, educational level or had previous knowledge about the anchor all not have much influence on the estimation that people make.

Scientists have got briefly ideas about how anchoring bias is caused, even though it is really clear and often used as a primitive concept. By Starting-point of adjustment, conversational hint [8] [9] [10], Suggestion or prime [11] [12] are the main three explanation for the cause of anchoring bias. Also, by Gilbert’s idea, people respond to any statement initially by believing it. This is also probably one of the reasons why anchoring bias may occur.

Based on the discussion above, a conclusion can be made that the anchoring bias in this research is an affection for people’s decision making that is independently affecting people’s

decisions, not easily influenced by other influencing factors. No matter gender, educational level, or whether had previous knowledge before. So viewpoints such that women often show more precise decisions or people with previous knowledge would have fewer possibilities of making wrong decisions are all wrong.

This research may not represent all case of anchoring bias when decisions are made but can be representing those of Chinese people who are using WeChat that has basic education in all age range.

4.1. Limitations

In terms of the limitations, there are a few aspects that this study need to take a closer look. For example, the degree in which a sample knows the exact age of the death of Tagore and it is unknown whether the samples searched online for the answer or not. The consequence is also influential, leading to more people will know the answer and the anchoring bias will not play a significant role. Two of the possible solutions to these problems would be either do opportunity sampling to unify the degree in which every participant's knowledge of Tagore and experiment in a real-life situation where the samples need to answer questions on a paper without using any electrical devices or books. Furthermore, the ethical considerations. This work also failed to achieve the strand "debriefing" and "deception". Other than those, the work achieved "anonymous", "right to withdraw", "participants should be protected from stress/harm", and "leave as entered". One of the possible solutions is to inform the participants that "this study/questionnaire will be evaluating the anchoring bias play on the samples". However, some participants will go against the intention, called "screw you effect" [2]. Therefore, it is possible to tell the participants what they should do before the "test" and inform them of the aim afterward.

4.2. Further Directions

This work could focus on the other types of biases such as framing effect and peak-end rule effect on the same or similar sample. Furthermore, it is also plausible to change the target population to multi-cultural samples. In addition to these further directions, it is also possible to investigate not only the implausible anchors, but also the extent to which the effect of how plausible anchors influence the estimation.

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