Influence of Anchoring and Adjustment Heuristic on both Perceived Belief and Performance of Problem-Solving

Yihong Liu

Oregon State University

**Abstract**

Anchoring and adjustment heuristic allow individuals to understand the capability within themselves and with the people in different environment. This study intends to examine the influence of anchoring and adjustment heuristic on both perceived belief and performance of problem-solving in high and low anchoring condition. A sample of 30 participants were participated in this research. Participants were randomly assigned to a high or low anchoring condition and were asked to complete a 16-word anagram task. It was hypothesized that those in the high anchoring condition would be more efficacious and confident in their ability to complete the word anagram task, and that they would complete more word anagrams, than those in the low anchoring condition. The results suggest that the anchoring condition did not have an impact on perceived belief or the actual accuracy in completing the anagram. Though there were little differences of perceived belief in the high and low anchoring condition, the findings were deemed not important for the current research.

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Everyday social interaction requires humans to judge the source of information and adjust accordingly in their decision making, while such adjustments will infer their decision making in daily behaviors. Such insight named anchoring and adjustment heuristic. Various study has been conducted over time that explore the idea of anchoring and heuristic adjustment and the way of adjustment heuristic used in daily life. These studies have found out that anchoring arises not only in answering questions but also in making consequential judgement such as in purchasing, selling of item and goods, financial decision making, problem solving in daily life, as well as negotiation. Further study has investigated the perceived belief and how may anchoring affect the perceived belief of the individuals. Current research is to examine anchoring setting condition and its correlation relationship with perceived belief and actual accuracy in performance. Having such knowledge of relationship on anchoring, heuristic adjustment and perceived belief provides insight into the adjustment made in task.

**Anchoring and Adjustment Heuristic**

Tversky and Kahnman (1974) first proposed an explanation for anchoring and adjustment heuristic. In this literature, researchers described anchoring as reference point and decision making were adjusted based on a reference point given. Whereby people will then adjust their estimation under uncertainty in task whether in upward or downward, which is close to the desired value of estimation. First, people will make estimation of value based on anchor value. Then, people will decide whether the correct value is lower or higher than the value and adjust according to the anchor value until people satisfied with the adjusted value. This research of anchoring and adjustment heuristic provided the understanding of mechanism between the anchoring and adjustment heuristic.

The research of anchoring and adjustment heuristic has been widely extended after the seminal of Tversky and Kahnman (1974). However, the research after Tversky and Kahnman (1974) also left a dispute in the psychological history research where different researchers have varied understandings on Anchoring. This dispute has been differentiated into two different anchors: anchors that are provided by an external source or anchors that are self-generated (Epley & Gilovich 2001).

**External Anchoring and Adjustment Heuristic**

The original formulation of external anchoring and adjustment heuristic is an experiment to find out whether anchoring setting plays an important role in the task performance. The experiment had asked a question and participant was required to answer the question “the actual number of populations at Chicago whether it is exceeding 200,000 people” (Jacowitz & Kahneman, 1995). ). By looking into the value of estimation with anchored condition compared with non-anchored condition, the researcher can examine the anchoring effect in an estimation task. In this literature, external anchoring was concluded as a phenomenon while the process of adjusting the value of population was described as heuristic adjustment. This research provides the insight into the mechanism of external anchoring and the way of external anchoring can affect the task performance.

Further research by Strack & Mussweiler (1997) provides a different dimension of anchoring and adjustment heuristic by providing the explanation of selective accessibility model. The experiment is to examine whether the estimation value is equal to the anchor and the necessity of increase the availability of anchor consistent information. In this article, it was found that under anchored condition, there was a significant change in estimation value when following the anchor-consistent information. It was determined that people tend to generate an estimated value which is close to the anchor value. With this knowledge of how external anchoring can affect the way of problem solving rather than a process of insufficient judgement which is lack of accessible to information.

**Self-generated Anchoring and Adjustment Heuristic**

The process of adjustment based on external anchors condition tends to be insufficient because people might adjust their value of estimation based on one’s belief and perceived ability. Research on the anchoring and adjustment heuristic left a gap in the history to help understand the common source of inaccuracy judgement and how such anchors will affect or be affected by perceived belief. Present research was designed to fill the gap.

The research by Epley & Gilovich (2001) discussed the differential between the processing of provided anchors and self-generated anchors. The experiment first tested the adjustment of self-generated anchors then tested the adjustment by providing anchor-consistent information. It was found that when provided anchor-consistent information, the number of adjustments is lesser in external anchor condition. The result suggest that it is time to reconsider self-generated anchor and adjustment for judgement under uncertainty. This research provides insight into the way of interaction and connection between the provided anchors and self-generated anchors.

Further research by Nelson (2010) explore the differential of accuracy motivation on provided anchor and self-generated anchoring. In this study, research wanted to understand the gap between accuracy and motivation between self-generated anchor and provided anchor. By looking into the direction of self-generated anchor adjustment, people were more certain the direction of adjustment toward true value in estimation. Additionally, motivation was more likely to increased adjustment in self-generated anchor condition than in provided anchor condition. This research has provided the knowledge of how self-generated anchor could affect the adjustment heuristic and this allows a better understanding of how the self-generated anchor affect motivation in adjustment heuristic.

**The Current Study**

There are two conditions which perceived belief evaluated during social interaction and social comparison. As proposed by Bandura (1986), self-appraisal occurs when one’s relied on piece of information when making decision or could be explained as they do not know their capability for the task. In such situations, individuals will rely on other’s experience to help evaluate themselves. Another type of self-appraisal happens when there was a lack of anchoring to measure one’s performance (Bandura, 1986). The study was examined by the academic perceived belief of students at risk for attrition in higher education in Israel. Additionally, the participant was required to participate in a learning marathon to test their perceived belief in a few months’ classes. The study examines the perceived belief, emotional intelligence and stress coping and the results shows that anchoring promoted the emotional intelligence, academic perceived belief ,and coping strategies. However, the relationship between perceived belief, anchoring influence and task performance are yet to be answered.

Anchoring and adjustment heuristic are an intriguing ideal that continues to be research. The goal of the current research was to examine the influence of anchoring and heuristic adjustment on both perceived belief and performance of problem-solving. Anchoring as used the workplace, classes as well as in everyday life when making judgement. This study also tested the link between anchoring, perceived belief and performance of problem solving. This study will help us understand why anchoring affect perceived belief and their performance in task (or may not). We assumed that the anchoring setting predict the level of confident and participant adjust their estimation. When in high anchoring condition, participant would be more efficacious and confident in ability to achieve better result than in low anchoring condition .

**Method**

**Participants**

For conducting this experiment, thirty students were randomly recruited from Oregon State University through online personal invitation or random interview while stopping participant on campus. There were thirty participants and these participants were participated on a volunteer basis and no participants were compensated, persuaded or forced into completing the experiment. All the participant was solely helping to complete an undergraduate study for Oregon State University student.

**Material and Measure**

**Perceived belief.** We needed a series of question that would able to determine the change in belief in responses to the anchoring in later experiment. We developed 16 statement in the questionnaire. All the participants were accessed the questionnaire through their own smart phone or through a printed survey form. Perceived-belief was measured by a 5-point scale survey. A score has been calculated for each respondent by averaging their ratings. The scale or the response format is 1=strongly disagree, 2=disagree, 3= neither agree nor disagree, 4=agree, 5= strongly agree. An example of one of the survey questions is “ how well do you believe you will be performed on the task”, “ how many do you think you can answer correctly”. To calculate a score, one would take the average of all the responses.

**Heuristic Adjustment**. The second part of the experiment required all the participant to complete the anagrams which is a one-word anagram from the Sporcle website. The anagram has required student to complete 16 anagrams in 8 minutes where all the word had arranged incorrectly. Sample of question include, “Petals=\_\_\_”, or “Listen=\_\_\_\_” and the correct answer for Petals is Staple while Listen is Silent. The anagram requires participants to answer in the provided blank space. The accuracy was responses to the factor as at below.

**Anchoring.** The accuracy of anagram was informed before the anagram begin to measure change in perceived belief and task performance. The participant was informed the average score answered correctly in two different anchor setting, high and low anchors.

**Design**

This is a quasi-experimental design as there is no random task assigned to the respondent. The first predictor variable for the experiment is the perceived belief and second predictor variable is the anchor condition. The outcome variable was the true accuracy of the anagram and the number participants believed they would answer correctly (perceived belief). Once collected, data will be organized by perceived belief and true accuracy of the anagram. An independent t-test was used on each sub section of the belief, true accuracy of the anagram and the anchor condition. Coefficient of correlation was performed on each section of belief, anchor condition and true accuracy of the anagram.

**Procedure**

Participants were arrived at the hall in Oregon State University and each respondent were answered questionnaire and anagram separately. Thirty respondents are divided into two groups, respondents were required to answer survey and rank their perceived-belief level in a questionnaire. This questionnaire measures their self-belief level in relation to the anagram activity. The five-point measure scale assesses one’s belief and their level of confident for the next activity. A higher score indicates a greater perceived belief, vice versa, a lower score indicated a lower perceived belief.

After completing the perceived-belief question, respondents were asked to answer 16 anagrams questions. Each Participants were randomly assigned to one of two anchoring condition whereby the anchoring effect took place. In first condition, first group was given a low anchoring setting, these participants were told that on average people tend to answer 5/16 correctly in the allotted time. In a second condition, second group was given a high anchoring setting participant were told that average people tend to answer 13/16 correctly.

After completed the experiment, each participant returned to the hall and were thoroughly debriefed about the nature of the experiment and were thanked for their participant as well as reassured that their personal information would be kept confidential and anonymous.

**Result**

The descriptive statistics of the 5-point scale survey indicated that the group of participants with the low anchoring condition setting belief average response is (*M*=2.93,*SD*=0.96), and the second group participants with high anchoring condition setting belief is (*M*=3.47, *SD*=1.30). Then the independent samples *t*-test was conducted to test if participants’ perceived belief levels would differ based on anchoring setting. The result suggests that belief,(*t*(28)=-1.28, *p*=0.21>0.01) did not differ by anchoring setting and there is no insignificant difference.

The first group of participants exposed to the high anchoring condition completed an average of 8.73(*SD*=3.17) anagrams correctly, while second group of participants exposed to the low anchoring condition completed an average of 9.47(*SD*=4.0) anagrams correctly. An independent samples t-test determined there was no significant difference in the number of anagrams completed based on anchoring condition, (*t*(28)=-0.56,*p*=0.58)

A linear regression was conducted to test the correlation between the anchoring setting condition and actual accuracy, perceived belief. The correlation coefficient between the anchoring setting condition and belief is *R*=0.23, the correlation coefficient between anchoring setting condition and actual accuracy is the *R*=0.11.

After testing the hypothesis, the anchoring influence was not significant to accuracy (*t* (28) = -0.56, *p* = 0.58 > 0.01) and belief (*t* (28) = -1.28*, p* = 0.21 > 0.01). There is no evidence to show that anchoring will influence participant performance from my data sample. The result support the null hypothesis that although higher belief occurs in the high anchor condition than in low anchor condition (refer to Table 2), however, anchoring setting have no significant different in belief and the anagram have similar actual accuracy; this is further considered inconsistent with the hypothesis.

**Discussion**

It was hypothesized that those in the high anchoring condition would be more efficacious and confident in their ability to complete the word anagram task, and additionally that they would complete more word anagrams, than those in the low anchoring condition. An unbiased set of statements in the survey designed to elicit adjustment from self-generated belief. The statement that estimate that the anagram accuracy tended to fall between the anchor value and the target being estimated. The results show that anchoring influence was not significant to accuracy and perceived belief (Table 2). From the descriptive statistics, the average of belief and anagram accuracy in high anchoring setting was higher than low anchoring setting. However, due to the limitation of the experiment analyzed at below, the correlation relationship of anchoring, perceived belief and accuracy could not be found.

These results set up a critical precondition for our research that adjustment tends to be insufficient for self-generated belief to active consequential judgement. Anchoring influence could be obtained in the standard anchoring paradigm; however, it is presented as an element of the enhanced accessibility of anchor-consistent information, but not for the serial adjustment document in the second test. Independent-samples *t* tests were used to determine whether the participants' anchoring influence participants' actual accuracy and belief with statically significance. Independent samples with *t* test was conducted to test participants’ belief levels would differ based on the anchoring setting and the result suggested perceived belief did not differ by anchoring setting.

The results in this study were also critically important due to insufficient adjustment in determining anchoring settings being used for many social psychological researchers like Gilovich & Savtisky (1999) and Tversky (1997). Surprisingly, all existing psychological research shows that judgement for task does not involve heuristic adjustment under self-generated anchor condition. The research by Epley & Gilovich (2006) provided that one of the possible ways to make judgement under uncertainty is to refer on information provided until plausible estimation has been made. In this literature, the researcher further explained that adjustment from self-generated anchor is insufficient because self-adjustment terminated once a plausible estimation has been made unless one’s individual willing to make further self-adjustment. Recent research has added the context that anchoring setting might affect belief in the judgement. However, there was no evidence found that anchoring will influence belief and participant performance on the task. The result in this study has proven that people do not adjust from provided anchors (Epley & Gilovich 2005). It is important to notice that not to heavily rely on the firsthand information encountered (external anchoring), and vice versa, perceived belief (internal anchoring) was performed better when they believed they had associate skill to success (Barling et al., 1983).

There is evidence to show that perceived belief would motivate employee effort and performance, impact the workplace sustainability environment, the occurrence of self-efficacy, and even increase the task-performance (Mustafa, 2019). Weinberg et al. (1979) demonstrated that the performance in competitive situation is mediated by perceived belief in the experiment of the study. The higher the illusory beliefs of performance, the higher accuracy displayed during on the task performance (Table 2). To the extent that perceived belief reflected a higher accuracy in task performance (Table 2), this study demonstrated that students who were able to motivate themselves instead of relying on external anchoring may have been more motivated and gained better insights about how to solve the task or the exam question. The self-motivated anchoring tool offered a better opportunity to accelerate student’s capability to build their own understanding and gained new knowledge.

**Limitation**

A limitation of this study was a minimal of sample size (30), it required a larger sample size to find out the anchor value. Another limitation is the questions in the questionnaire not being designed to assess the participant familiarity for anagrams, if the participant was familiar with the anagram the setting of anchoring would not have much effect on its belief and participant performance. The participant that playing anagram often might turned into a factor that affecting the accuracy of the anagram. A major limitation was recent research did not determine the intelligence level and education background of participants, as the intelligence level and education background might affect the knowledge of knowing more words. An example, if the participant is a professor, the intelligence level and education level might allow him to solve a task faster and obtained a higher accuracy in anagram than others participant. Further, recent research was uncertain on the ceiling effect in this experiment, where the experiment did not set the difficulty level for the anagram and it was the possible reason that caused study unable to determine the gap of performance. Pervin(2015) stated that anchoring would not have any impact on motivation when the self-efficacy is controlled. The external influences only exerted its influences through the mediation of changes in self-efficacy belief (Pervin,2015). The experiment in this study has failed to weaken or raised the perceived belief of participants, whereas failure could have impacted the result of performance when setting the anchoring value in anagram. The confident level for the participants in this research did not motivated nor de-motivated by other factor like increasing the difficulty level of the task. An example is participant were told that all the previous participant had failed all the anagram, none of the anagram has been answered correctly. Such external anchoring will weaken the perceived belief of the participants and able to help determine the gap of the performance in the task.

**Future Research**

This research and these findings stipulate material and platform for further research. In the future research, a larger sample size, familiarity of anagram, and the difficulty level of anagram should be used to help understand the relationship between anchoring, adjustment heuristic and task performance. A future study could be more revealing if it was designed to specifically measure performance outcome in term of perceived belief and anchoring setting. Specific of both types of mediation of change in perceived belief, anchoring-adjustment would provide improved and more in-depth understanding of the way that lead to improved performance in task. Furthering research and knowledge of anchoring-adjustment offers the potential for better understanding of what heuristic adjustment are best suited per individual based on their perceived belief, in knowing this, decision making would become more precise. Additionally, as anchoring-adjustment provides awareness in way of problem-solving rather just relies on insufficient judgement (lack of information) as better judgement was made due to information provided, regardless source of information was obtained based on external anchor information or self-knowledge.

Regardless of anchoring in term of psychology, other area to explore are marketing: whether people’s belief be challenged if given specific anchoring by strengthening the level of anchoring. An example is using specific amount of implicit and explicit amount of anchoring in marketing advertisement to induce people to buy the product. The findings and material in this research could be further explore the relationship between the strength of anchoring and perceived belief and a way to measure the strength of anchoring in the experiment. It is possible that examine mediation of change of perceived belief associate with the strength of anchoring in everyday life.

**Conclusion**

This study found no significant differences between anchoring and adjustment heuristic, perceived belief and accuracy of anagram, thus not supporting the hypothesis that high anchoring condition would be more efficacious and confident in their ability to complete the word anagram task, and additionally that they would complete more word anagrams, than those in the low anchoring condition. Although most of the scores were non-significant, there was a marginal significant in the perceived belief. By this marginal difference of perceived belief, it is determined that the perceived belief in high anchoring condition higher than the perceived belief in low anchoring condition. Although this research has not much significant finds, however, it delves deeper into the differential between the anchoring and adjustment heuristic, perceived belief and task performance. Such differential could be utilized in the real-world application as this study explored that self-motivated anchoring tool offered a better opportunity to accelerate student’s capability to build their own understanding and gained new knowledge. Such tools could be applied in the education and motivate student in academic performance. Additionally, better understanding of what heuristic adjustment are best suited per individual based on their perceived belief, in knowing this, decision making would become more precise. Being able to better understand how an individual make judgement and act based on external and external anchoring to exert self-improvement and possess a critical thinking mindset that think twice before making associate decision in everyday life.

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Appendices

*Graph 1*

Descriptive result with belief and expected accuracy in 5-point scale Survey

*Graph 2*

Mean of actual accuracy and belief in low and high condition setting

*Graph 3*

Standard Deviation of actual accuracy and belief in low and high condition setting

*Graph 4*

Min of actual accuracy and belief in low and high condition setting

*Graph 5*

Max of actual accuracy and belief in low and high condition setting

*Table 1*

Results with initial belief and expected accuracy in anagram

|  |  |  |
| --- | --- | --- |
|  | **Belief** | **Actual Accuracy** |
| Valid | 30 | 30 |
| Missing | 0 | 0 |
| Mean | 3.2 | 9.1 |
| Standard Deviation | 1.157 | 3.566 |
| Minimum | 1.0 | 3.0 |
| Maximum | 5.0 | 16.0 |

*Table 2*

Result 2 with belief and actual accuracy in low and high anchoring setting (1= low anchoring setting, 2 = high anchoring setting)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Belief  (1) | Belief  (2) | Actual  Accuracy (1) | Actual  Accuracy (2) |
| Valid | 15 | 15 | 15 | 15 |
| Missing | 0 | 0 | 0 | 0 |
| Mean | 2.933 | 3.467 | 8.733 | 9.467 |
| Std  Deviation | 0.9612 | 1.302 | 3.173 | 3.998 |
| Minimum | 1.000 | 1.000 | 3.000 | 3.000 |
| Maximum | 5.000 | 5.000 | 15.00 | 16.00 |