

The Effect of Attitudinal Ambivalence on Numerical Anchoring

Research Thesis

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By

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## Abstract

Numerical Anchoring occurs when an arbitrary “anchoring” number influences judgments (Tversky & Kahneman, 1974). A recent approach to anchoring draws parallels between anchoring and persuasion (Wegener et al., 2010). The current study examined these parallels by looking at effects of preexisting attitudes on the effectiveness of anchors and at potential moderating effects of attitude ambivalence. Subsequent analyses showed that Anchors substantially influenced participants’ estimates ( $p < .001$ ). More importantly, when anchors were consistent with pre-existing attitudes, the anchors had larger effects on estimates than when the anchors were inconsistent with pre-existing attitudes ( $p < .001$ ), providing evidence of an effect of attitude on estimates. Finally, results also showed a significant moderating effect of attitude ambivalence (Anchor X Consistency X Ambivalence;  $p = .03$ ). These findings provide support for the hypothesis that attitudes and the relatively univalent or ambivalent knowledge underlying those attitudes influence anchor effectiveness. In addition to advancing understanding of attitudes and anchoring, the results support the notion of extending explanatory principles across disciplines to create a more integrated science and generate new research questions.

## **Introduction**

Psychology is a large field filled with many different disciplines; from Judgement and Decision-Making, to Social Psychology, to Quantitative Psychology. Each of these fields presents a wide variety of unique research and contributions to our understanding of the human mind. Beyond these unique contributions, there is also the unlimited potential for disciplines and research to cross the boundaries between disciplines and combine in new and creative ways. While this cross-discipline concept is not a novel idea, there are still many areas and combinations left to explore. For example, this study examined the implications of attitudes and persuasion research, from the realm of Social Psychology, for the impact of anchors on people's numeric estimates, an effect studied by researchers in many disciplines but with its beginnings in the realms of economics and Judgement and Decision-Making (Tversky & Kahneman, 1974). In particular, I also examined the strength of the attitude, specifically attitudinal ambivalence, and the effect it has on the relation between the attitude and the anchoring effect.

### **Anchoring**

The anchoring effect as we know it today started as the "anchor and adjust" heuristic, one of the heuristics in a list compiled by Tversky and Kahneman (1974). Anchoring is defined as the effect that numbers in the environment have on a person's estimates (Tversky & Kahneman, 1974). Their most famous example involves asking participants to estimate the percent of African nations that are in the United Nations. Before giving the estimates, the participants were asked to spin a number wheel. The participants were then asked if they thought the actual percent was higher or lower than the number that they spun, and then they gave their estimates. The wheel was rigged, and participants were randomly assigned to have the wheel land on either 10 or 65. The median responses to the estimation task were 25% in the low-anchor condition and 45% in the high-anchor condition, showing that even these arbitrary numbers had an effect on

participants' estimates. Many researchers have replicated anchoring effects and examined the possible mechanisms. Tversky and Kahneman (1974) proposed that people see the anchor as a starting point for the overall estimate but adjust up or down until they reach a value they perceive as plausible, hence the labeling of the "anchor and adjust" heuristic.

Strack and Mussweiler (1997) investigated a possible alternative mechanism for the anchoring effect. They suggested that the effect stemmed from confirmatory hypothesis testing when considering whether or not an anchor value might be the correct estimate for the judgment. In the process of this confirmatory hypothesis testing, knowledge consistent with the anchor would be made accessible in memory and used to make the judgment. Hence, their view is called the selective-accessibility model of the anchoring effect. Later, Mussweiler and Strack (2000) investigated a possible mechanism for the selective-accessibility model. By showing that lexical decisions took less time for anchor-consistent than for anchor-inconsistent words after the comparative task, they concluded that the comparative task selectively increases the accessibility of anchor-consistent information in memory. This anchor-consistent knowledge is then used to make an estimate during the absolute task. Because the knowledge is anchor-consistent, so too are the absolute estimates.

## **Ambivalence**

Ambivalence is the possession of a mixture of positive and negative thoughts about or reactions towards an object (Bell & Esses, 2002, Newby-Clark, McGregor, & Zanna, 2002, Priester, Petty, Park 2007). Ambivalence has been measured both indirectly and directly. For instance, Newby-Clark et al. (2002) examined what they referred to as "potential ambivalence" by separately asking research participants about their positive versus negative thoughts, reactions, and evaluations of an attitude object. The overall amount of ambivalence was then calculated using one of a number of formulas developed to relate the positive and negative

reactions to an overall amount of ambivalence (Priester & Petty, 1996). In general, the more balanced the mixture of positive and negative reactions and the more reactions there are on both sides, the higher the ambivalence. Direct measures typically ask people about their subjective sense of how mixed or conflicted they feel (Priester & Petty, 1996). To the extent that this “felt ambivalence” taps into the subjective discomfort that this combination of positive and negative reactions causes in the person, felt ambivalence is thought to be similar to the discomfort experienced in cognitive dissonance (Newby-Clark et al., 2002).

These two types of measures have been used by many researchers and have been referred to by different names. For example, Refling, Calnan, Fabrigar, MacDonald, Johnson, and Smith (2012) referred to them as structural and subjective ambivalence. Structural ambivalence has been traditionally measured by asking participants to list either their positive reactions while ignoring their negative and then their negative reactions while ignoring their positive or vice versa. Refling (2012) compared this measure with a non-partitioned measurement, where participants are asked for their positive/negative reactions without asking them to ignore the opposite valence reactions. Refling concluded that non-partitioned measurement of structural ambivalence is a significantly better predictor of subjective ambivalence than partitioned measurement. For this reason, I used a non-partitioned measurement of structural ambivalence.

### **Attitudes and Persuasion/Present Research**

The attitudes and persuasion literature addresses how people form, maintain, and change their attitudes and how they resist and defend against such changes (Petty & Wegener, 1998). In the last 10-15 years, a number of studies have been conducted to examine the potential relations between the JDM and attitudes literatures. One example of this is a paper by Wegener, Petty, Detweiler-Bedell, and Jarvis (2001). In this paper, the authors examined anchor extremity. They proposed that anchoring effects would diminish after a certain level of extremity of the anchor,

whereas the anchor-and-adjust model (Tversky & Kahneman, 1974) and selective accessibility model (Strack & Mussweiler, 1997) would suggest that people's estimates would continue to become more extreme along with the anchor until the point at which the anchor became more extreme than the highest or lowest plausible values the person could imagine. Past that point, the anchor-and-adjust and selective accessibility approaches predicted that effects of anchors should asymptote, regardless of how extreme the anchors become. Wegener et al. (2001) hypothesized that they would find that people's estimates would form an "inverted-U" pattern, with implausibly extreme anchors having less impact on estimates than more plausible anchors. This pattern would be similar to the pattern seen in effects of persuasive message extremity (e.g., Bochner & Insko, 1966). Wegener et al. (2001) found less anchoring with extreme than moderate anchors and concluded that persuasive processes can be used to explain some variability in the anchoring effect.

Another paper by Blankenship, Wegener, Petty, Detweiler-Bedell, and Macy (2008), treated anchoring in the traditional paradigm as reflecting relatively high levels of elaboration (consistent with the selective accessibility view, Mussweiler & Strack, 2001). In the same paper, Blankenship et al. describe this "confirmatory hypothesis testing" as being similar to "elaboration" described in theories of attitude change. Blankenship et al. also proposed that anchors can serve multiple roles in their influence on judgements, similar to mood being able to bias processing when people are thinking about the problem a lot but serving as a heuristic when people are not engaged in much thought (Petty, Schumann, Richman, & Strathman, 1993). The 2008 study provided evidence of a "high-elaboration" anchoring effect under low cognitive load/high capacity conditions by finding that the anchoring effect was greater in this condition when the provided background information was consistent with the direction of the anchor as compared to when the information was inconsistent with the direction of the anchor. The study

also showed that, under high cognitive load/low elaboration, anchors can serve as “cues” to what the “correct” estimate is. That is, Blankenship et al. (2008) found that, under high cognitive load/low capacity for thought, participants were equally affected by both anchors, regardless of whether the direction of the anchor was consistent with the direction of the background information. These findings support the idea that anchors can fulfill multiple roles, similar to various persuasion factors in attitudes literature (Petty & Wegener, 1998).

These works serve as the inspiration for the current research. The first aspect of this study is looking at the effect of attitude on the strength of the anchoring effect. Attitudes for or against an object can change the way a person uses information that is known about the object. I see this as similar to the selective accessibility model proposed by Strack and Mussweiler (1997). The valence of the attitude can influence the valence of information that is made accessible when one is required to make an estimate. I hypothesize that participants’ estimates will be more affected by anchors that are consistent with their attitudes about the object, and less affected by attitude-inconsistent ones. Cavazza and Butera (2008) have also suggested that attitude ambivalence (underlying ambivalent knowledge) would moderate the effects of pre-existing attitudes. If attitudes are based on only attitude-consistent knowledge, attitude-consistent anchors should have a strong effect regardless of the level of ambivalence. However, when the anchor is inconsistent with one’s attitude, higher ambivalence means that the person should have at least some anchor-consistent knowledge that can be activated (whereas people low in ambivalence should not). Thus, ambivalence should extend the range of anchors that could have an impact beyond anchors that are more consistent with the person’s attitude.

### **Main Study**

This study served to test my two primary hypotheses: Estimates will be less affected by an anchor if that anchor is inconsistent with pre-existing attitudes towards the object, and higher

levels of ambivalence will extend the influence of anchors of less consistency with attitudes (because ambivalent knowledge provides greater support for inconsistent anchors than univalent knowledge; cf. Mussweiler & Strack, 2000).

## **Methods**

**Participants.** One hundred and forty-five participants were recruited from The Ohio State University undergraduate Psychology 1100 classes through the Research Experience Program (REP) during Autumn Semester 2016.

**Procedure.** Participants were brought into the computer lab and completed a preloaded survey. The survey began by measuring the participants' attitudes towards fourteen food objects, each on a 1-9 scale, from "Very Unfavorable" to "Very Favorable." The participants were then given four items to measure their structural ambivalence toward each food object: they were shown two items asking for the number of positive/favorable reactions (also a 1-9 scale, from "No positive/favorable thought/feelings" to "many positive/favorable thoughts/feelings"), and two asking for negative/unfavorable reactions (1-9 scale, from "No negative/unfavorable thoughts/feelings" to "many negative/unfavorable thoughts/feelings"). The similar measures were averaged, then positive and negative reactions were combined using the negative acceleration model (Priester & Petty, 1996) to provide a structural ambivalence score for each food item. All four items for each food were completed in sequence before moving on to the next food item. After the ambivalence and attitude measures, the participants were put through the traditional anchoring paradigm for each food article. That is, the participant was first asked a comparative question ("Would you be willing to pay more or less than X for <Food Item>?"), then asked for an absolute estimate ("How much would you be willing to pay?").



Two surveys were created. Each included all fourteen food items, but because it was not plausible to present both the high and low anchor for each food item, each survey included either the high or the low anchor for each item, balanced so that each survey had seven high and seven low anchors. For example, the first survey may have paired a high anchor with French fries, followed by a low anchor for ice cream, followed by another high anchor food item, etc., whereas the second survey had the opposite anchors for each food item. Each participant was randomly assigned to a survey before starting.

## **Analysis**

I calculated the attitude-consistency of the anchor by multiplying the attitude score (scaled from -4 = very unfavorable to +4 = very favorable) times the anchoring condition (coded as -1 for the low-anchor condition, and +1 for the high-anchor condition). General Linear Models examined main effects and interactions among Anchor, Attitude-Consistency of the Anchor, and Attitude Ambivalence. The first model included all of the main effects and interactions among Ambivalence, Attitude-Consistency of the Anchor, and Anchor. All of the predictor variables varied within-subjects, so the appropriate error term for tests of each predictor in the model consists of the variation across participants in the relation of interest. To obtain those error terms, a second model included all the terms from the first model along with main effect and interaction terms treating Subject as a factor. I used the mean square for interactions including Subject (in model 2) as the error term when calculating the F statistics for each predictor (using the mean square from that predictor as the numerator for the F statistic). For example, when testing the main effect of Anchor, I used the mean square from the Anchor main effect in the first model as the numerator, then used the Subject X Anchor interaction from the second model as the denominator. This type of approach would mimic a multi-level model in which responses to each item are nested within each research participant.

## Results

There was an overall main effect of Anchor,  $F(1,134)= 153.814$ ,  $p<001$ , with participants reporting higher willingness to pay in the high-anchor condition than in the low-anchor condition. There was also an interaction between Anchor and the Attitude-Consistency of the Anchor,  $F(1,134)=189.998$ ,  $p<.001$ . When anchors were highly consistent with participants' attitudes, there was more of a difference in willingness to pay between the high- and low-anchor conditions than when the same anchors were inconsistent with participants' attitudes (see Figure 1). Most importantly, I also found an Anchor X Attitude-Consistency X Ambivalence three-way interaction [ $F(1,134)= 4.96$ ,  $p=.03$ ]. Table 1 shows the relevant F statistics and significance values to break down the overall three-way interaction. There was not a difference in effects of attitude-consistent anchors across levels of attitude ambivalence [ $F(1,134)= 161.3$  and  $99.2$  for low and high ambivalence, respectively,  $p's<.001$ ]. However, there was a significant difference between anchoring effects across levels of attitude ambivalence at low levels of attitude-consistency of the anchor [ $F(1,134)= 6.4$  and  $2.0$ ,  $p's= .01$  and  $.16$  for low and high ambivalence, respectively].

Another way to break down the overall pattern of effects would be to examine the level of attitude-consistency of the anchor at which anchor effects are no longer significant. With low levels of attitude ambivalence, I determined that Anchor condition stops having a significant effect on reported willingness to pay at approximately .5 standard deviations below the mean on the scale of attitude-consistency of the anchor. In contrast, higher levels of ambivalence extend that significant impact of anchors to approximately .9 standard deviations below the mean on attitude-consistency of the anchor. This corresponds to  $-1.34$  and  $-2.37$ , respectively, on the bipolar attitude-consistency scale ranging from  $-4$  to  $4$ . This shows that the anchor can still have

an effect at an entire scale point lower when the attitude is associated with a relatively high rather than low level of ambivalence. Put another way, ambivalence extended the influence of anchors to lower levels of attitude-consistency with the anchor. This result is consistent with my hypotheses.

## **Discussion**

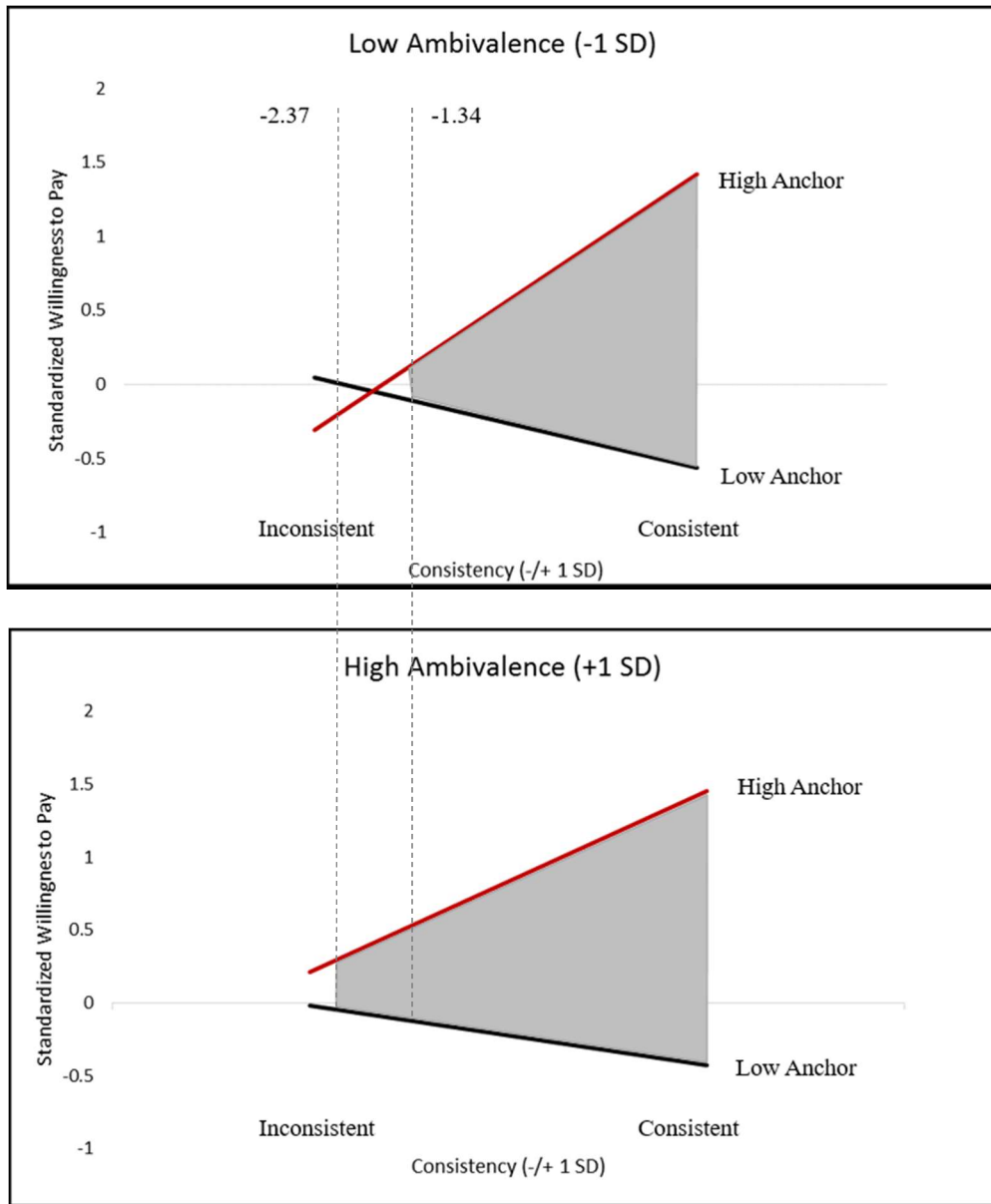
Results supported both of the primary hypotheses. Across levels of ambivalence, participants' attitudes tend to overwhelm the effect of the anchor when the anchor is inconsistent with the attitude. The relative absence of anchor differences may result from the outcome measure of willingness to pay for foods being driven strongly by being willing to pay more for foods one likes than for foods one dislikes. The significant three-way interaction, however, cannot simply be driven by a strong link between willingness to pay and attitudes, because the consistency of the anchor with the overall attitudes is equated across levels of ambivalence in the regressions. The ambivalence effects show that the anchor has more of an effect (and by the same token, attitude has less of an effect) at lower levels of attitude-consistency when attitudes are associated with high levels of ambivalence rather than low levels of ambivalence. It is possible that this is due to the varying levels of anchor-consistent versus anchor-inconsistent knowledge held by the participant. With a low level of ambivalence, the participant will have knowledge that is mainly consistent with his/her attitude. When an anchor is inconsistent with the attitude, then, no knowledge can be found to support the anchor, so judgments are more consistent with the attitude than with the anchor. This leads to significantly anchor-inconsistent estimates when the attitude-consistency of the anchor is low. With a higher level of ambivalence, however, the participants hold a more balanced mixture of attitude-consistent and attitude-inconsistent knowledge. This means that there is more anchor-consistent knowledge that can be activated by the anchor, even when the anchor is inconsistent with the overall valence of the

attitude. Such effects would seem consistent with the selective-accessibility approach to anchoring (Mussweiler & Strack, 1999; Strack & Mussweiler, 1997). Such results also point to additional parallels with attitude change, where ambivalence can increase susceptibility to counter-attitudinal messages (Armitage & Conner, 2000; Cavazza & Butera, 2008). In the current setting, ambivalent attitudes set people up to be more influenced by attitude-inconsistent anchors.

Continuing forward, one way to improve on the current study would be by using judgment targets whose estimates are not so directly related to attitudes. I would also like to get more experimental evidence by manipulating attitude and/or ambivalence. It could be a challenge, though, to manipulate one's ambivalence towards an object without affecting the extremity of attitudes toward the object.

These findings would have important implications for the field of numerical anchoring, as most models of anchoring have not addressed attitude-related concepts as determinants of anchor effectiveness. We have learned that strong attitudes can overwhelm an anchor's effect on numeric estimates, and that ambivalence can extend the effectiveness of an anchor into greater levels of attitude-inconsistency. In addition to adding to the general knowledge about attitudes and anchoring, these results support the notion of applying findings and principles from one field to another for the purposes of creating a more integrated science and generating new research questions.

## Appendix



**Figure 1:** Graphing the 3-Way Interaction

The shaded region indicates where the anchor was significant. The dotted line represents the cut-off where anchor becomes insignificant. As can be seen here, anchor still has an effect at lower levels of attitude consistency under high ambivalence compared to lower ambivalence.

<b>Simple Effect/Interaction</b>	<b>F(1,134)</b>	<b>Significance (p-value)</b>
Anchor Main Effect (from the overall model)	153.814	<.0001**
Anchor X Attitude-Consistency (from the overall model)	189.998	<.0001**
Overall 3-way (Anchor X Attitude X Ambivalence)	4.96	.03*
Anchor X Ambivalence (at High Attitude –Consistency)	.21	.35
Anchor X Ambivalence (at Low Attitude –Consistency)	7.31	.008**
Simple Anchor Effect (at Low Ambivalence, High Consistency)	161.25	<.0001**
Simple Anchor Effect (at High Ambivalence, Low Consistency)	1.99	.16
Simple Anchor Effect (at High Ambivalence, High Consistency)	99.16	<.0001**
Simple Anchor Effect (at Low Ambivalence, Low Consistency)	6.40	.01**

**Table 1:** F statistics and p-values for the relevant main effects and interactions

\*indicates significance at .05 level, \*\* indicates significance at .01 level

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