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Research Dialogue

Elaboration and numerical anchoring: Implications of attitude theories for consumer judgment and decision making

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Abstract

Researchers across many domains have examined the impact of externally presented numerical anchors on perceiver judgments. In the traditional paradigm, "anchored" judgments are typically explained as a result of elaborate thinking (i.e., confirmatory hypothesis testing that selectively activates anchor-consistent information in memory). Consistent with a long tradition in attitude change, we suggest that the same judgments can result from relatively thoughtful or non-thoughtful processes, with more thoughtful processes resulting in judgments that have more lasting impact. We review recent anchoring research consistent with this elaboration-based perspective and discuss implications for past anchoring results and theory in judgment and decision making.

People are confronted with hundreds of decisions every day ranging from the mundane (e.g., *which beverage will I select from the vending machine?*) to the consequential (*how much life insurance will I purchase?*). What determines these choices? Two prominent domains of research in psychology have made this topic a specialty: (1) research on judgment and decision making (JDM) and (2) research on attitudes and persuasion (A&P). Although each area has much to say about why people make the particular choices that they do, the areas generally do not share specific theories or research paradigms. Indeed, scholars in each area often attend different conferences and typically publish in different journals.

Although researchers in these two areas have worked mostly in isolation from each other, much would be gained from a closer relationship and sharing of methods and ideas (see also Gilovich & Griffin, 1998). To illustrate the potential benefits of convergence, we take a well known JDM phenomenon—numerical anchoring—and show how principles and findings from A&P (our own area of training and expertise) might generate research questions (and provide understanding related to those questions) that have not been generated by existing JDM theories. Although our approach in this paper is to examine implications of attitude theory for anchoring and JDM, we are confident that use of JDM theories might similarly generate research questions and insight for A&P that have not been generated using existing A&P theories.

A strong common interest across the JDM and A&P areas is in the many "irrationalities" that shape perceptions and judgments. People's perceptions are biased by the presence of pleasant or unpleasant environmental stimuli (Griffitt, 1970), likeability of the source of a persuasive message (Petty, Wegener, & White, 1998), the incidental or even subliminal presentation of words that activate mental concepts (Bargh & Pietrimonico, 1982; Srull & Wyer, 1980), and the presence of standards of comparison (Mussweiler, 2003; Sherif, Taub, & Hovland, 1958), and even the weather (Schwarz & Clore, 1983). Within the JDM area, however, perhaps no judgmental bias is more "prototypic" than the consistent and powerful bias created by numerical anchoring (Tversky & Kahneman, 1974).

In typical studies of numerical anchoring, research participants are first asked to consider whether a target judgment is higher or lower than a high or low anchor value. After stating whether the true value of the target is higher or lower than the

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anchor value, participants provide their estimates of the true value for the target judgment (Jacowitz & Kahneman, 1995; Strack & Mussweiler, 1997). In some studies, anchor values are simply said to have been randomly generated (Mussweiler & Strack, 1999). In other studies, participants are exposed to numerical values that are clearly random or otherwise irrelevant to the correct target estimates (e.g., social security numbers or phone numbers of participants, Ariely, Loewenstein, & Prelec 2003; Russo & Schoemaker, 1989; a spin of a "wheel of fortune," Tversky & Kahneman, 1974).

Regardless of how anchor values are generated or presented, their effects can be stunning. Numerical anchors influence just about any type of judgment. After considering and rejecting high rather than low numbers as potential values for the judgment at hand, people think that nuclear war is more likely (Plous, 1989), that their own abilities are higher (Cervone & Peake, 1986), that consumer products or gambles are worth more (Ariely et al., 2003; Chapman & Johnson, 1999), and that defendants in civil cases are liable for larger damage awards (Chapman & Bornstein, 1996).

As noted earlier, the primary purpose of the current paper is to apply principles and findings from the A&P area to further our understanding of numerical anchoring. Researchers in A&P focus on the construct of attitudes (i.e., people's global evaluations of objects and issues) including how attitudes develop and how they influence behavior (see Eagly & Chaiken, 1993; Petty & Wegener, 1998). An attitudinal perspective on numerical anchoring therefore speaks to what anchoring effects might be observed, what variables would serve as moderators of anchoring, and the extent to which anchored judgments will be consequential (the topic to which we devote the most attention in the current paper). As explained in more detail later, we will see that numerical anchors, like other variables studied in persuasion settings (e.g., the credibility of the person delivering a message) can serve in "multiple roles." That is, anchor values sometimes serve as simple cues that influence judgments rather directly, but at other times they serve to bias more effortful thinking about a judgment (see Petty & Wegener, 1998, 1999). Thus, the attitudinal approach incorporates both relatively thoughtful and non-thoughtful processes to account for the effects of numerical anchors. These different processes and the different circumstances in which they occur are important because according to contemporary attitude theory, judgments produced by relatively thoughtful processes have more lasting impact (i.e., they are more consequential) than judgments produced by relatively non-thoughtful processes.

A brief history of explanations

Anchoring and adjustment

The most widely cited explanation of numerical anchoring up through the mid-1990s was operation of an anchor-and-adjust heuristic (Tversky & Kahneman, 1974). That is, people use the anchor value as an initial starting point for the judgment and then insufficiently adjust their assessment away from the anchor value toward an answer that appears more plausible (see Jacowitz & Kahneman, 1995; Quattrone, Lawrence, Warren, Souza-Silva, Finkel, & Andrus, 1984). According to Quattrone et al. (1984; discussed in Plous, 1993), this "anchoring-and-adjustment" process is explained by people having a range of plausible answers for any given question. Anchors outside that range lead people to adjust their estimates until they reach the nearest boundary of the range of plausible values. People give this boundary value as their estimate of the requested value.

The anchor-and-adjust perspective was taken to predict that implausibly extreme anchors lead to the largest possible anchoring effects compared to plausible anchors because one's boundary values are always the most extreme values of the plausibility range (Quattrone et al., 1984; Strack & Mussweiler, 1997). When anchors fall outside the range of plausible values, however, increases in extremity of the anchor should have no additional effect; people will adjust their estimates until they reach the boundary values, which remain constant regardless of how far an anchor lies outside that range.

Although anchoring and adjustment formed the basis for initial conceptions of numerical anchoring, more recent work of the past 10–15 years suggests that adjustment per se (i.e., starting with an anchor value and moving toward the range of plausible values) is relatively infrequent in the traditional anchoring paradigm (e.g., Epley & Gilovich, 2001, 2005; see Chapman & Johnson, 2002). Instead, the anchoring literature has shifted to an account of anchoring that rests more heavily on the knowledge that becomes activated as people consider the anchor and formulate their answers.

Selective accessibility/anchoring as activation

In recent years, most research on numerical anchoring has been based on the assumption that anchoring results from the activation of anchor-consistent knowledge that occurs during judges' testing of hypotheses about potential target estimates (e.g., Chapman & Johnson, 1999, 2002; Mussweiler & Strack, 1999, 2001b). When a person considers a plausible anchor, he or she (implicitly) tests the hypothesis that the anchor is the correct answer to the judgment at hand. In doing this, the person looks for ways in which the real answer to the question is similar to the anchor value. As a result of this "confirmatory search" process (Chapman & Johnson, 1994; Klayman & Ha, 1987), aspects of the target that are similar to the anchor become accessible and disproportionately influence judgments of the target (Chapman & Johnson, 1999; Mussweiler & Strack, 1999; Strack & Mussweiler, 1997). Hence, the "selective accessibility" or "activation" of anchor-consistent knowledge leads to the anchoring effect.

According to this view, however, anchors that are too extreme are dealt with somewhat differently. According to Mussweiler and Strack (1999), people encountering implausibly extreme anchors are thought to test a modified hypothesis. Instead of testing the hypothesis that the real answer is equal to the anchor, judges test the hypothesis that the boundary of the range of plausible values is the correct answer to the judgment. That is, "participants may process implausible anchors by first

adjusting to the boundary value of a distribution of plausible values and then testing the hypothesis that the [judgment value] is equal to this boundary value" (Mussweiler & Strack, 1999, pp. 158–159). As a result, although the proposed mechanisms are different when comparing the traditional anchoring and adjustment and more recent selective accessibility views, predictions regarding anchor extremity are the same. Implausibly extreme anchors should lead to larger anchoring effects than more plausible (moderate) anchors, but increases in anchor extremity beyond the range of plausible values should not increase the anchoring effect any further because a fixed boundary value will form the basis of the modified hypothesis test (Mussweiler & Strack, 2001a; Strack & Mussweiler, 1997; but see Chapman & Johnson, 1994; Kahneman, 1992).[1]

The process of confirmatory hypothesis testing has been characterized as relatively effortful. For example, Mussweiler and Strack (2001b) noted that "larger anchoring effects occur under conditions which promote the extensive generation of anchor-consistent target knowledge" (p. 238). They concluded that anchoring in the standard paradigm "appears to involve a relatively elaborate process of testing the hypothesis that the target quantity may be similar to the comparison standard" (p. 252). As noted earlier, our elaboration-based approach to anchoring incorporates both relatively thoughtful and non-thoughtful processes to account for the effects of standard numerical anchors. Thus, although selective activation of anchor-consistent knowledge might capture one important aspect of numerical anchoring, we believe that our "attitudinal" approach provides a more complete picture. At the very least, distinguishing between thoughtful and non-thoughtful processes allows us to make predictions that do not follow naturally from previous anchoring theories.

Elaboration and anchoring: Multiple roles for numerical anchors

Our elaboration-based view of anchoring is based directly on theories of attitude change in which persuasion variables can take on different roles at different levels of elaboration (see Petty & Wegener, 1998, 1999). In the elaboration likelihood model (ELM; Petty & Cacioppo, 1986), a given persuasion factor, such as a credible source or a positive mood state, can influence attitudes in relatively non-thoughtful (peripheral or heuristic) ways or in relatively thoughtful (central or systematic) ways. For example, when not thinking carefully about a persuasive message, a message recipient can develop a favorable attitude toward an advertised product because his or her current positive mood becomes associated with the product (Gorn, 1982; Stayman & Batra, 1991) or because of a simple mood heuristic (i.e., positive mood signals liking; Petty & Cacioppo, 1983; Schwarz & Clore, 1983). However, when thinking more carefully about the ad, the positive mood can bias the thoughts that come to mind and create the same favorability bias in judgments (Petty, Schumann, Richman, & Strathman, 1993; Wegener, Petty, & Klein, 1994; see Chaiken & Maheswaran, 1994, for similar findings with respect to source credibility). In evaluating relatively thoughtful and non-thoughtful effects of mood, assessing the resulting judgments alone could make it seem like the amount of elaboration (thinking) about the message makes no difference. However, by measuring the processes at work (e.g., by assessing cognitive responses, Petty et al., 1993) or by examining the different consequences linked to high- versus low-elaboration processes (Petty, Haugtvedt, & Smith, 1995), it becomes clear that there are meaningful differences between high- and low-elaboration effects of persuasion variables.

Similarly, our elaboration-based approach to anchoring suggests that numerical anchors could take on multiple roles (Blankenship, Wegener, Petty, Detweiler-Bedell, & Macy, 2008; Wegener, Petty, Detweiler-Bedell, & Jarvis, 2001). In some cases, numerical anchoring may result from relatively thoughtful, high-elaboration processes, but in other cases, numerical anchoring may result from relatively non-thoughtful, low-elaboration processes.

High-elaboration anchoring

Persuasion theories have long characterized people as assessing the merits of an advocacy by comparing the advocacy with their existing knowledge and beliefs (see Hovland, Janis, & Kelley, 1953; McGuire, 1985). That is, people *elaborate* on a persuasive claim by comparing it with their existing knowledge and by using that knowledge to interpret related information in order to determine what a reasonable perception of the object might be (Petty & Cacioppo, 1986). As people assess the merits of a claim, their reactions can have many dimensions, including viewing the claim as relatively acceptable or unacceptable, correct or incorrect, unbiased or biased (e.g., Petty, Ostrom, & Brock, 1981; Sherif & Hovland, 1961). High levels of elaboration are most likely to occur when the person is both motivated and able to put cognitive effort into assessing the central merits of the claim and corresponding attributes of the issue or target object (Petty & Cacioppo, 1979, 1986).

Elaboration can also occur when people generate a persuasive message themselves (Janis & King, 1954) or simply think about the attitude object (Tesser, 1978). Thus, it seems quite reasonable for elaboration to occur when thinking about a target after receiving a numerical anchor (cf., Mussweiler & Strack, 2001b). Some high-elaboration processes could include syllogistic or probabilistic reasoning (e.g., Petty & Wegener, 1998; Wegener & Carlston, 2005; cf., Kruglanski & Thompson, 1999). Thus, conceptions of elaboration in contemporary theories of attitude change seem very similar to the process of hypothesis testing that forms the core of current anchoring theories (e.g., Chapman & Johnson, 1994, 1999; Mussweiler & Strack, 1999). However, attitude theorists would be more likely

[1] Attitude theories contemporary with the original anchor-and-adjust view predicted curvilinear effects of message extremity (see Bochner & Insko, 1966; Brock, 1967; Sherif & Hovland, 1961). Wegener, Petty, Detweiler-Bedell, and Jarvis (2001) produced results consistent with this approach by showing smaller anchoring effects with extremely implausible anchors than with more moderate anchors. Similarly, Wegener, Blankenship, Detweiler-Bedell, and Petty (2009) found smaller anchoring effects with low- and high-extremity anchors than with anchors of moderate extremity.

to refer to these effects as *biased processing* effects of anchors on judgments (see Petty & Wegener, 1999). That is, when people are motivated and able to engage in effortful thinking, a numerical anchor can bias thoughts about a target just as a positive mood or a credible source can bias the thoughts about a product or advocacy.

Low-elaboration anchoring

Although the notion of elaboration (in persuasion theories) and the notions of hypothesis testing and selective accessibility (in anchoring theories) share some similarities, an elaboration-based approach to anchoring differs from prominent anchoring theories in important ways. Chief among these differences is that our elaboration-based approach suggests that thinking is not always elaborative (cf., Mussweiler & Strack, 2001b). When people lack motivation or ability, changes in attitudes can result from the relatively effortless use of *heuristics* or other *cues* to determine judgments (Chaiken, Liberman, & Eagly, 1989; Petty & Cacioppo, 1986). For example, people might accept a claim, regardless of how the claim is supported, if the person making the claim is an expert or is attractive, if the message recipient is in a good mood, or if people simply count the number of arguments presented in a message rather than evaluate the merits of the arguments (Petty & Cacioppo, 1984; Petty, Cacioppo, & Goldman, 1981; Petty, Cacioppo, & Schumann, 1983; Petty et al., 1993; see Petty & Wegener, 1998, for discussion of these potential cue effects).

Likewise, numerical anchors should be capable of serving as judgment cues when motivation or ability to elaborate is lacking. Low-effort anchoring could result from a number of possible non-thoughtful processes. Numerical anchors might prime the number (e.g., Jacowitz & Kahneman, 1995; Wilson et al., 1996; see also Wong & Kwong, 2000) or a general sense of the "magnitude" of the target judgment being relatively large or small (Oppenheimer, LeBoeuf, & Brewer, 2008). When the comparative (higher/lower) judgment and the estimate of the true value refer to the same target (as they do in the standard anchoring paradigm), participants lacking ability or motivation to elaboratively might be inclined to treat the anchor as a "hint" to a reasonable judgment (Schwarz, 1994) without recognizing and making use of the fact that the anchor was generated randomly and is irrelevant (as the anchor is typically described in the standard paradigm). We could also imagine that there might be relatively non-thoughtful versions of selective accessibility (in which people use few rather than many anchor-consistent reactions activated by cursory confirmatory hypothesis tests), though no such simplified versions of selective accessibility have been described in selective accessibility articles.

The incorporation of relatively non-thoughtful processes by which anchoring can occur differentiates our elaboration-based approach from prominent anchoring theories that propose relatively elaborative versions of confirmatory search/selective accessibility as the sole process responsible for anchoring in the standard paradigm. Those same prominent anchoring theories suggest that alternative processes, such as serial adjustment or numeric priming, only influence judgments outside the standard anchoring paradigm (see Epley, 2004, p. 246; Mussweiler & Strack, 2001b, pp. 241, 252).

Consequences of anchored estimates

According to the ELM, attitudes and other judgments resulting from differing amounts of target-relevant elaboration should have different consequences (Petty & Cacioppo, 1986; Petty et al., 1995). When a variable such as mood brings about attitude change through a relatively thoughtful mechanism (e.g., biased processing), the new attitude should persist longer over time, resist future attempts at change to a greater extent, and provide stronger guides to future thoughts and behaviors than when the same variable produces the same extent of change, but through a less thoughtful mechanism (e.g., a mood heuristic; see Petty et al., 1995; Petty & Wegener, 1998).

These differential consequences could occur for a number of reasons. Higher levels of elaboration could be associated with cognitive changes surrounding the attitude or judgment, such as increased accessibility (Fazio, 2001), integration with relevant knowledge (Petty et al., 1995), or increased structural consistency of judgment-related knowledge (e.g., Chaiken, Pomerantz, & Giner-Sorolla, 1995). Higher levels of elaboration could also create metacognitions, such as higher levels of confidence that the attitude or judgment is correct or that it reflects what the person really believes (e.g., Barden & Petty, 2008; Chaiken et al., 1989; Petrocelli, Tormala, & Rucker, 2007), making a person more motivated to defend or act upon the attitude.

Summary

Our elaboration-based approach to numerical anchoring suggests that there could be relatively thoughtful and non-thoughtful versions of anchoring in the standard paradigm, rather than only an elaborative form of selective accessibility. It also suggests that relatively thoughtful versions of anchoring should have more lasting effects than non-thoughtful anchoring. These differential consequences are particularly important because previous anchoring theories have not specified moderators of the *consequences* of anchored assessments in the standard anchoring paradigm.

Empirical evidence

In our anchoring research, we have demonstrated the existence of relatively thoughtful and relatively non-thoughtful versions of numerical anchoring. We also have demonstrated that these differences in elaboration lead to different consequences as predicted by attitude theory (especially the ELM, Petty & Cacioppo, 1986). In the following sections, we briefly describe the existing data to date, including some research that has already been published and other work that is described in print for the first time here. Across these studies, we have attempted to assess different types of process indicators and different potential consequences of the anchored judgments. The data presented herein also suggest that there is still

considerable work to be done, especially regarding the potential processes at work in relatively non-thoughtful versions of anchoring. Thus, we also note some potential processes that have not yet been studied and present initial evidence of some processes that might contribute to low-elaboration anchoring, a critical component to our elaboration-based view of numerical anchoring.

Thoughtful versus non-thoughtful versions of anchoring

Use of background knowledge

As mentioned earlier, elaboration is traditionally defined as scrutinizing available judgment-relevant information in light of existing knowledge (cf., Petty & Cacioppo, 1986). The traditional persuasion literature addressed such questions most directly by manipulating the quality of arguments present in the persuasive message so that, when elaboration is high, there is substantially more agreement with strong (compelling) arguments than with weak (specious) arguments for the same persuasive claim. However, when elaboration is low, there is less difference (or sometimes even no difference) in reactions to these same strong versus weak arguments (see Petty & Cacioppo, 1986, for extensive discussion of argument quality manipulation). In the traditional anchoring paradigm, however, no information is presented to support the anchor, so the strategy of comparing strong versus weak arguments does not translate easily to the study of numerical anchoring. Nevertheless, if high-elaboration anchoring occurs anchor values must bias the reactions that people have to the target. Of course, these reactions must also come, in part, from existing knowledge about the target, so high-elaboration anchoring biases should reflect this knowledge (cf., Mussweiler & Strack, 2000).

Thus, in our initial research aimed at creating relatively high- versus low-elaboration versions of anchoring, we manipulated the judgment-relevant knowledge participants had prior to the anchoring task. If anchoring results from relatively high elaboration, then the qualities of this background knowledge should also be brought to bear on the target judgments. However, if people are not thinking carefully about the target during the anchoring task, then they might consult this target-relevant background knowledge to a lesser degree or not at all.

Blankenship et al. (2008, Experiment 1) provided research participants with a number of written passages supposedly related to a study of reading comprehension. Within those passages, four of the topics provided information indirectly related to targets in a later anchoring task. For example, one of the passages described "little known facts" about astronauts implying either that astronauts tended to be relatively old (because many of them had previous military experience and advanced degrees) or relatively young (because they needed quick reflexes and physical fitness to meet the demands of space). This information was related to a later question in the anchoring task asking how old Neil Armstrong was when he first walked on the moon. The background knowledge did not provide direct information about Neil Armstrong but about astronauts more generally. Then, in order to create relatively high- or low-elaboration settings for the anchoring task, some research participants completed a secondary task designed to increase cognitive load during the anchoring task (counting the number of vowels in a string of vowels and consonants). Other participants did not complete this secondary task.

Results were consistent with anchoring in the traditional paradigm being relatively elaborative (cf., Mussweiler & Strack, 2001b). Among participants who were free from increased cognitive load, significantly larger anchoring effects occurred when background knowledge was consistent with the anchor than when the background knowledge was inconsistent with the anchor. However, the results also showed significant anchoring in low-elaboration settings, when research participants were under high cognitive load because of the secondary task. In these conditions, anchoring occurred to the same extent regardless of whether background knowledge was consistent or inconsistent with the anchor. This difference in the impact of background knowledge in high- but not low-elaboration settings (even though each group learned about the background information equally before any manipulation of cognitive load) provides more direct evidence for the role of knowledge in elaboration (cf., Petty & Cacioppo, 1986; see also See, Petty, & Evans, 2009) than when argument quality manipulations are used in persuasion studies. When new information is presented under cognitive load, lack of impact of that information can be attributed to the information not "getting in" to the mind of the message recipient. However, in the current case, all participants received the background knowledge prior to the manipulation of cognitive load. Therefore, each group should have possessed the knowledge equally, but the low-load group used the background knowledge to a greater extent than the high-load group. This evidence also adds to previous data suggesting that high versus low numerical anchors activate different material in memory, especially because indices of the content of the activated material have not been used to predict the anchored judgments.

Differential role of numeric or magnitude priming

Anchoring in the absence of use of background knowledge provides little information about which low-elaboration processes might be at work when cognitive load is high. As noted earlier, we believe that non-thoughtful anchoring can result from a variety of processes that do not require effortful consideration of background knowledge. Numeric priming is one candidate process that has been discussed for some time as a possible mechanism for some anchoring effects (e.g., Jacowitz & Kahneman, 1995; Wilson et al., 1996; see also Wong & Kwong, 2000). An anchor might activate a number or a sense of "bigness" or "smallness" that remains in mind when the target estimate is formed (cf., Oppenheimer et al., 2008).

A common paradigm for examining such effects is to ask the comparative question (i.e., the higher/lower question) about one object, but to ask for target estimates about a different object (e.g., Mussweiler & Strack, 2001b; Wong & Kwong, 2000). When the comparative question and target estimate pertain to different objects, the semantic knowledge activated by the comparative question is not applicable to the target estimate. Thus, according to Mussweiler and Strack (2001b), semantic

influences of the anchor should be eliminated (or at least substantially reduced) and the alternative, numeric priming influences are left to influence judgments.

Blankenship et al. (2008, Experiment 4) presented research participants with the same high or low anchors used in the background knowledge study. However, similar to previous research on numeric/magnitude priming, the anchors were presented in a comparative question that pertained to a different object. For example, participants were asked whether the age of the oldest person alive was higher or lower than 128 years (high anchor) or 68 (low anchor) years. Afterwards, participants were asked to estimate the record high temperature for Seattle, Washington. Thus, although the target judgments were the same as in the background knowledge experiment, the comparison (higher/lower) question now asked about an object unrelated to the target judgment. Research participants completed the anchoring task either alongside the same secondary task as in the high cognitive load conditions of the background knowledge study or, alternatively, with no secondary task.

Results showed that significant cross-object anchoring occurred only when cognitive load was high (i.e., under low-elaboration conditions), but not when cognitive load was low (i.e., under high-elaboration conditions). This makes sense because, to the extent that people are using their own target-relevant knowledge in high-elaboration settings, there should be little or no anchoring when the anchors pertain to semantically unrelated objects (because target-relevant knowledge should be the same across high versus low anchor conditions). However, when unable to use their target-relevant knowledge (under low-elaboration conditions), research participants produced judgments that were more in line with the number (or perhaps magnitude) primed by the anchors given just prior to the target judgment even though those anchors pertained to unrelated objects. Therefore, it seems that numeric (or magnitude) priming might constitute a relatively non-thoughtful means by which anchoring can occur when elaboration is relatively low.

In this experiment, increased elaboration decreased the impact of numeric (or magnitude) priming on judgments, but presumably increased the impact of target-relevant knowledge on judgments (as in the previous background knowledge study). Decreased elaboration increased the impact of numeric (magnitude) priming and presumably decreased the impact of target-relevant knowledge. This pattern directly paralleled the ELM hypotheses of increased impact of peripheral cues on attitudes and decreased impact of central merits as the amount of elaboration decreases (e.g., Petty & Cacioppo, 1986). This research also constituted the first evidence of *moderation* of numeric (or magnitude) priming effects by social perceivers' ability to elaborate during the judgment task.

Sources of anchors and moderation of thought mediation

The numeric (or magnitude) priming effects in Experiment 4 of Blankenship et al. (2008) were quite a bit smaller than the anchoring effects in the low-elaboration conditions of the Blankenship et al. background knowledge study, in which the anchor pertained to the same target as for the target judgment. Therefore, there may be additional processes other than simple numeric or magnitude priming that help to explain low-thought anchoring. Taking a "conversational" perspective on anchoring research, Schwarz (1994) suggested that at least some anchoring results might be attributable to research participants believing that they are supposed to use the anchor in some way (why else would the experimenter present the anchors?). In other words, Schwarz (1994) suggested that research participants might take the anchor as a more or less direct "hint" regarding what the target judgment might be (or at least what the direction of the appropriate judgment might be).

In the traditional paradigm, great lengths have often been taken to make sure the anchor seems random and irrelevant to the true target value (see Mussweiler & Strack, 2001b; Tversky & Kahneman, 1974). From a conversational perspective, this should undermine use of the anchor as a "hint." Yet, participants might have a hard time properly discounting the usefulness of the anchor as a potential hint, especially when social perceivers are unlikely to think carefully about the target and the judgment task.

Our initial attempt to address the possible influence of anchors as "hints" concerning the correct target judgment was to incorporate a persuasion-oriented variable—a manipulation of the credibility of the source of the anchor (Wegener, Blankenship, Petty, & Detweiler-Bedell, 2009). If an anchor comes from a non-credible (non-expert) source, then people should be less likely to take the anchor as a meaningful indication or hint of the target's true value. If the same anchor comes from a credible (expert) source, however, then people should be more likely to take the anchor as an indication of the true value of the target. As noted earlier, source credibility has been shown to influence attitudes both as a relatively simple cue (when elaboration is low) and by biasing message processing (when elaboration is high; e.g., Chaiken & Maheswaran, 1994). Therefore, in the anchoring domain, we expected that credible sources of anchors could lead to larger anchoring effects, but for relatively direct "cue" kinds of reasons when elaboration is low and for "biased processing" kinds of reasons when elaboration is high.

In a study examining this notion, level of elaboration during the anchoring task was manipulated by using the same cognitive load task that was used in the background knowledge study described earlier. Participants were given an anchor supposedly based on a survey by the Rand Corporation that assessed the perceptions of people from different segments of society. For half of the items, anchors were attributed to a source who was highly credible (expert) for the target topic (e.g., a western mountain-climbing club estimating the height of the tallest mountain in North America). For the other half of the items, anchors were attributed to a source who was non-credible (non-expert; e.g., a group of migrant workers in Florida estimating the height of the tallest mountain in North America). Participants then made the comparative (high/lower) judgment and provided their estimate of the true target value. After the estimate, participants were asked to write down any thoughts they had while formulating their estimates, and the thoughts were each coded as anchor-consistent with a relatively high or low judgment or as irrelevant to the target judgment.

Participants' numeric judgments showed significantly more anchoring when anchors were attributed to credible rather than non-credible sources, regardless of whether cognitive load was high or low. This moderation of anchoring by source credibility is a unique effect suggested by the A&P approach. Furthermore, and as we expected, participants' thoughts about the target showed this same Credibility × Anchor effect when cognitive load was low. However, this interaction was absent when cognitive load was high. Moreover, thoughts significantly mediated the Credibility × Anchor effect on estimates when cognitive load was low but not when load was high. This pattern is consistent with participants taking the anchor as a better "hint" or cue to the correct answer when the anchor is provided by a credible rather than non-credible source. The pattern is also consistent with this "hint" influencing more thoughtful consideration of the target (with stronger relations between target-related thoughts and judgments) when cognitive load is low rather than high. Thus, this research on anchoring provides a conceptual replication of "multiple role" effects of source expertise in persuasion paradigms (Chaiken & Maheswaran, 1994; Petty & Wegener, 1998).

It is true that the anchors in the current study were not described as randomly generated (as in many anchoring studies). However, anchoring has often been given as a mechanism to account for judgments in situations where anchor values come from a particular source (and the anchor is not described—or likely assumed—to be random). For example, anchoring damage claims could come from the plaintiff in a civil case (Chapman & Bornstein, 1996), anchoring initial offers in a negotiation come from one's negotiation partner (Galinsky & Mussweiler, 2001), and anchoring product prices can come from an advertiser or seller (Biswas & Blair, 1991; Kamins, Dreze, & Folkes, 2004). In such cases, similar to many persuasion settings, anchors might have different effects and for different reasons depending on the credibility (or other characteristics) of the source and on the level of elaboration about the target in that setting.

Summary

A number of studies demonstrate relatively high- and low-elaboration versions of numerical anchoring in the traditional paradigm (where research participants first respond to a comparative question and then provide their estimate of the true target value). When elaboration is relatively high, people are more likely to use target-related background knowledge in making their estimates, and thoughts about the target are more likely to correlate with target estimates. But people use target-related background knowledge less and thoughts are less related to estimates when elaboration is lower (cf., Petty & Cacioppo, 1979, 1986).

Effortful use of anchor-consistent background knowledge provides a reasonable account for high-elaboration anchoring (cf., Chapman & Johnson, 1999; Mussweiler & Strack, 2001b), but there may be a number of relatively non-thoughtful processes that contribute to low-elaboration anchoring. Numeric (magnitude) priming is one potential process (see Blankenship et al., 2008), and it also seems plausible that people take at least some anchors as "hints" as to the correct (direction of) target judgment (Wegener et al., 2009). However, evidence related to each of these processes included some variation on the traditional paradigm that makes it unclear just how much of the low-elaboration anchoring in the traditional paradigm comes from these processes. It remains for future research to examine additional processes, such as non-effortful versions of hypothesis testing and selective accessibility/activation.

It is important to note that non-thoughtful effects of cues or heuristics can be just as large as elaboration-based effects. In persuasion settings, thoughtful elaboration of strong arguments can lead to the same favorability of the attitude as use of the mere number of arguments as a cue (Petty & Cacioppo, 1984), for example. Similarly, relatively non-thoughtful cue effects and more thoughtful (biased processing) effects of the same variable can create the same attitude ratings (see Chaiken & Maheswaran, 1994; Petty et al., 1993; Wegener, Clark, & Petty, 2006). Because of this, researchers can compare the lasting impact of attitudes based on relatively high or low elaboration while holding attitude extremity constant (Petty et al., 1995). In the anchoring domain, effortful use of background knowledge can lead to the same amount of anchoring as less-effortful processes (that may include numeric/magnitude priming or use of the anchor as a "hint"). Regardless of which non-thoughtful processes are at work in low-elaboration settings, equal anchoring across levels of cognitive load appropriately set the stage for examination of differences in consequences of anchored judgments.

Consequences of thoughtful vs. non-thoughtful anchoring

Past research has shown that anchoring can occur even when the judgment occurs a week after the anchor (Mussweiler, 2001) and that anchored responses can resist later change (Ariely et al., 2003; cf., Mussweiler, Strack, & Pfeiffer, 2001). However, previous anchoring theories have not provided a rationale for *moderators* of the persistence of anchored judgments over time or of their resistance to change. Thus, evidence of different consequences of high- versus low-elaboration anchoring provides particular support for our elaboration-based perspective.

Differential persistence over time

Attitudes last longer over time when based on high rather than low levels of thinking even when the initial attitudes are equally favorable across high and low levels of elaboration (see Petty et al., 1995; Wegener et al., 2004). Thus, Blankenship et al. (2008, Experiment 2) directly compared the persistence of thoughtful versus non-thoughtful anchoring effects that are initially of the same magnitude.

Research participants received high or low anchors (said to be randomly generated) across counterbalanced high and low levels of cognitive load. As in the background knowledge study described earlier, initial anchoring was equal across high- and low-elaboration conditions. A week later, research participants returned to the lab and were asked to make the same target

judgments but without the anchors. Consistent with our elaboration-based predictions, persisting anchoring effects were significantly stronger for items initially encountered with low rather than high cognitive load. Thus, anchored estimates were more likely to persist over time when based on high rather than low levels of elaboration.

Differential resistance to social influence

Attitudes formed or changed when elaboration is high are also more likely to resist subsequent (even immediate) attempts at change than attitudes formed or changed under low-elaboration conditions (see Petty et al., 1995; Wegener et al., 2004). Therefore, anchored estimates should also better resist attempts at social influence if the anchored estimates were formed under high- rather than low-elaboration conditions.

Blankenship et al. (2008, Experiment 3) examined resistance to social influence based on the level of elaboration during the initial anchoring task. The initial anchoring task and conditions were the same as in the persistence experiment described earlier. However, after an unrelated filler task, research participants encountered an attack on their initial anchored estimates. They were told that previous participants had provided estimates for the same items that were quite different from their own initial estimates. Specifically, they were told that 10% of participants had provided an estimate that was either substantially higher (in low anchor conditions) or lower (in high anchor conditions) than the estimate the participants had provided. For example, for a question about the age of Ernest Hemingway when he wrote his first successful novel, participants' average initial anchored responses were 23 years when the anchor was low and 43 years when the anchor was high. With the low initial anchor, the attack stated that 10% of previous participants had said that Hemingway was 50 years old or older. With the high initial anchor, the attack stated that 10% of previous participants had said that Hemingway was 16 years old or younger. After the attack, participants provided a second estimate of the target value.

As in the persistence study, initial anchoring was equal across high- and low-elaboration conditions. However, high-elaboration responses changed less after the attack than did low-elaboration responses so that there was an Anchor × Cognitive Load interaction on post-attack responses. That is, on items initially encountered while under high cognitive load, post-attack responses were more influenced by the attack than for items initially encountered under low cognitive load. Thus, participants were more susceptible to post-anchoring social influence when initial anchoring occurred under low- rather than high-elaboration conditions. This was true even though the initial anchoring effect was equally large across levels of elaboration during the anchoring task.

Summary

When people had high rather than low ability to think during the anchoring task, their anchored assessments lasted longer over time and resisted social influence to a greater extent despite starting out at the same point (i.e., with equal initial judgments). One could easily imagine a variety of other consequences that could also differ across elaboration conditions. For example, anchored estimates could be more likely to inform related judgments, such as willingness to pay for a product, or could be more likely to influence judgment-related behaviors (cf., Petty et al., 1995). These results provide important support for our elaboration-based view of anchoring derived from attitude theory because previous anchoring theories have not made predictions about moderators of the consequences of anchored estimates.

In many anchoring studies, researchers tested whether the effects of anchors can be removed by getting social perceivers to think more carefully about judgments (e.g., see Brewer, Chapman, Schwartz, & Bergus, 2007; Chapman & Johnson, 1999; Tversky & Kahneman, 1974; Wilson et al., 1996). In these studies, incentives for accuracy have typically failed to decrease anchoring. However, such manipulations might have successfully increased the amount of thinking that occurred during creation of the anchoring effect. If so, then our elaboration-based approach suggests that these incentives might have created changes in the resulting *consequences* of the initial judgments, consequences that were not tested in the initial studies. If the persistence and resistance studies of Blankenship et al. (2008) had ended after the initial judgments, it would have looked like the manipulation of cognitive load had no effect on anchoring. But the load manipulation did influence the persistence of anchored estimates over time and on resistance to change in the face of contrary information. Amount of thinking can be influenced by both motivation and ability (see Petty & Wegener, 1998), so it could be that incentive manipulations not only failed to remove anchoring effects in prior research, but they also might have created anchoring effects that have more lasting impact than the anchoring effects created in the absence of incentives. These implications await future study.

Discussion

When people are asked to make target estimates in the traditional anchoring paradigm, they attempt to generate a correct answer. In so doing, they sometimes think carefully and use target-relevant knowledge. At other times, however, they might think less extensively about target-relevant knowledge and base their responses on other input. In many ways, these processes parallel the cognitive processes at work when people attempt to arrive at correct attitudes (Petty & Cacioppo, 1986; Petty & Wegener, 1998, 1999; Wegener & Carlston, 2005; Wegener et al., 2001). Interestingly, this elaboration-based view of numerical anchoring provides a number of insights into the operation and lasting impact of numerical anchoring.

The results of the current experiments are consistent with the idea that anchors can influence people's estimates by taking on multiple roles (Petty & Cacioppo, 1986; Petty & Wegener, 1998, 1999; see Wegener et al., 2001). In the current context, the notion of multiple roles suggests that the same anchor can produce the same judgment via relatively thoughtful or non-

thoughtful processes (Blankenship et al., 2008). Past discussions of "shallow" versus "systematic" anchoring processes have predicted different sizes of the initial anchoring effects and have described the processes as applicable to different anchoring paradigms (Mussweiler & Strack, 2001b). However, the concept of multiple roles for anchors suggests, and we have found, that high and low levels of elaboration can create similar initial judgments in the traditional anchoring paradigm where target estimates follow an initial comparative (higher/lower) question.

Perhaps most importantly, these differences in elaboration create differences in the consequences of the resulting anchored estimates. When anchored estimates go unchallenged, anchored estimates last longer over time when initially formulated under high- rather than low-elaboration settings. When anchored estimates are challenged, high-elaboration estimates are less affected than low-elaboration estimates by the "attacking" information. It could well be that high-elaboration anchoring would also create target reactions that are more likely to influence later thoughts about the target and actions related to the target.[2]

In addition to understanding the consequences of high and low-elaboration anchoring, our application of an A&P (elaboration-based) approach has also led to insights into how other variables can affect anchoring. For example, unlike the effects predicted by prominent anchoring theories, which assume that increasingly extreme anchors would either produce increasingly extreme anchoring effects or at least reach a ceiling (e.g., Mussweiler & Strack, 1999; Strack & Mussweiler, 1997), it is possible to obtain curvilinear (decreasing absolute) effects with increasingly extreme anchors (Wegener et al., 2001; cf., Chapman & Johnson, 1994; Kahneman, 1992) and for these downturns in anchor effectiveness to occur at lower levels of extremity when people have high rather than low knowledge about the target (Wegener et al., 2009). We have also seen that variables not considered by anchoring theories, such as the credibility of the source of the anchor, can have an impact on anchoring. Finally, it seems worth noting that many of the existing moderators of anchor effects on judgments are consistent with A&P theories. For example, persuasion research has shown that it is not only the direction and valence of thoughts that affect attitudes when elaboration is high, but also the confidence people have in the validity of their thoughts (Petty, Briñol, & Tormala, 2002). It is noteworthy, therefore, that just as head nodding has been shown to validate a person's thoughts to a persuasive message leading to increased persuasion when thoughts are favorable (Briñol & Petty, 2003), it has also been found to increase anchoring effects in response to self-generated anchors (e.g., Epley & Gilovich, 2001). The broader use of the A&P notion of self-validation would suggest that a whole host of additional variables (such as happiness, power, self-affirmation, and others) might enhance anchoring effects by increasing confidence under the right circumstances (see Briñol & Petty, 2009, for a review).

Other links between JDM and A&P

Dual-system approaches and implications for judgment and decision making

A detailed discussion would go beyond the scope of the current paper, but it seems reasonable to briefly comment on relations between the current approach and general dual-system approaches to judgment and decision making. It is true that our elaboration-based approach bears some resemblance to a generic dual-system approach. Indeed, in the 30+ years since the development of the ELM (Petty, 1977; Petty & Cacioppo, 1981), a number of dual-process or dual-system approaches have been developed (see Chaiken & Trope, 1999; Evans, 2007; Kahneman & Frederick, 2002; Sloman, 1996). These theories have some common features, such as sets of processes that are considered as relatively effortful and relatively non-effortful. But, over the years, the emphases of the various approaches have differed.

In many settings, dual-system approaches have emphasized that intuitive/associative "System 1" processes create biases that can be "corrected" by more reflective/rule-based "System 2" processes (Gilbert, 1999; Kahneman & Frederick, 2002; i.e., that the two systems can generate different answers to the same question, Sloman, 1996, 2002). Of course, early studies testing the elaboration likelihood perspective also showed that the impact of easily processed simple peripheral cues to judgment can be overcome by effortful thinking about target-relevant information (e.g., Petty & Cacioppo, 1979; Petty et al., 1981). However, the multiple roles aspect of the ELM (Petty, 1977; Petty & Cacioppo, 1986) emphasized that a given variable can have several different effects on information processing, depending on the background levels of motivation and ability to think carefully about the target. Variables (e.g., source credibility) can serve as simple cues when motivation or ability is lacking (most similar to typical descriptions of "System 1" processes). But, the very *same* variables can also act as information about the central (primary) qualities of the target object, can bias processing of target-relevant information, or can validate thoughts, especially when motivation and ability to think are high. And these same variables can affect the level of motivation or ability to think and determine how much people think about target-relevant information especially if motivation and ability are not constrained to be particularly high or low. This concept of "multiple roles" anticipated the later acknowledgement that relatively intuitive/associative (System 1) processes can provide simple answers to the judgment at

[2] To this point, our discussion of multiple roles for numeric anchors and of high- and low-elaboration processes would be expected to hold when the issue of potential bias is not salient (Wegener et al., 2006; Wegener, Sawicki, & Petty, 2009). If potential biases do become salient, then processes related to bias-correction should come into play (e.g., Wegener & Petty, 1997, 2001b; see also Petty, Briñol, Tormala, & Wegener, 2007). In many cases, it seems likely that people would underestimate anchoring biases, perhaps believing that the numerical anchors had little or no impact on estimates (Wegener & Petty, 1997, 2001b). Yet, variability across social perceivers in attempts to correct for potential effects of anchors might still be captured, at least in some circumstances, by perceptions of anchor-related biases.

hand or can influence more reflective/rule-based (System 2) reasoning (Gilovich & Griffin, 1998; Kahneman & Frederick, 2002).[3]

The implications of this elaboration-based approach go far beyond the persuasion domain in which the approach was originally developed, and also beyond the numerical anchoring domain in which we have recently tested the approach. For example, consider research on the "affect heuristic" (Slovic, Finucane, Peters, & MacGregor, 2002) in which people use their immediate, automatic feelings of an object's "goodness" or "badness" as a shortcut to making a decision about the object. Slovic et al. (2002) noted that:

> Using an overall, readily available affective impression can be far easier—more efficient—than weighing the pros and cons or retrieving from memory many relevant examples, especially when the required judgment or decision is complex or mental resources are limited. This characterization of a mental shortcut leads to labeling the use of affect a "heuristic."

Similar to this idea, early social psychological studies of affect conceptualized affective influences on judgment as simple conditioning or use of a "how do I feel about it?" heuristic (e.g., Razran, 1940; Janis, Kaye, & Kirschner, 1965; Petty & Cacioppo, 1983; Schwarz & Clore, 1983). However, as mentioned earlier, elaboration-based studies of affect have identified multiple roles of affect across the elaboration continuum. Moods and emotions can act as simple cues when motivation or ability to think is lacking, can bias processing or act as a salient central quality of the target when motivation and ability are high, and can influence amount of thinking when elaboration is not constrained to be particularly high or low (see Petty, Fabrigar, & Wegener, 2003; Wegener & Petty, 1996, 2001a, for reviews). More recent research on meta-cognitive influences of elaboration also shows that affect experienced after thinking about a target can serve to validate or invalidate one's thoughts about the target (especially when motivation and ability to think are high, Briñol, Petty, & Barden, 2007).

Although social psychologists generally restrict the term "affect" to refer to moods, feelings, and emotions (see Petty et al., 2003), research on the "affect heuristic" often includes influence of overall evaluations (attitudes) on decisions. But attitudes can also serve multiple roles across levels of elaboration. They can serve as cues when elaboration is low, can bias thoughts when elaboration is high, and can affect amount of thinking (often in conjunction with other variables) when elaboration is not constrained to be high or low (see Clark & Wegener, 2009; Petty & Wegener, 1999; Sanbonmatsu & Fazio, 1990; Wegener et al., 2004).

These "multiple role" variations in anchoring processes have not been included in previous anchoring theories, nor have they been widely adopted across the judgment and decision making literatures. We hope, however, that the current results and discussion prompt additional research investigating the utility of A&P theories for understanding classic JDM phenomena (and vice-versa). Doing so might lead to new elaboration-based hypotheses about the impact of numerical anchors, affect, and other "biasing" variables on consumer thoughts, judgments, and actions.

[3] One important misconception is that the ELM represents an "either–or" model in which the relatively thoughtful and relatively non-thoughtful processes cannot co-occur (e.g., Stiff, 1986; Chen & Chaiken, 1999). In all likelihood, this stems from early depictions of the model in flowchart form in which a "central route" and a "peripheral route" were labeled. However, descriptions of the model presented these "routes" as representing the two endpoints of an elaboration continuum (see Petty & Cacioppo, 1981, 1986, pp. 7–10; Petty & Wegener, 1999). At any point along the continuum except the theoretical endpoints, there is likely to be some impact of both thoughtful and non-thoughtful processes (Petty & Cacioppo, 1986; Petty & Wegener, 1999).

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