Chapter 13

Anchoring effect

Štěpán Bahník, Thomas Mussweiler, and Fritz Strack

Imagine you are the judge in a legal case of rape. The prosecutor and the defense attorney have given their final speeches and the court hearing has just been interrupted for lunch. Thus, you have roughly an hour to make up your mind about the sentence. All the necessary information is right in front of you. Once again, you go through the most important facts: The victim's account of what happened that night, the expert's assessment of how likely it is that the defendant will commit rape again, the prosecutor's and the attorney's pleas. Upon close inspection, the evidence seems mixed, and you are uncertain about the sentence. In thinking about the core facts, the words of a journalist, asking you a question some days ago, echo in your mind "Do you think that the sentence for the defendant in this case will be higher or lower than three years?" You start to think about the journalist's question: "Three years of prison confinement, is this an appropriate sentence? Or is it too severe, or too lenient?" Will the journalist's question influence your sentencing decision?

If so, your decision may be biased by one of the most pervasive and robust influences on human judgment, namely the anchoring effect (Tversky & Kahneman, 1974). As a legal judge you do not want to be directly influenced by a journalist's question. But if you were, you would be in good company. A study by Englich, Mussweiler, and Strack (2006) showed that accomplished trial judges with an average of more than 10 years of experience were influenced by a journalist's question containing a sentencing demand. In fact, the magnitude of this influence proved to be dramatic. Judges who considered a high demand of three years embedded in the journalist's question gave final sentences that were almost 8 months longer than judges who considered a low demand of one year. A difference of 8 months in prison for the identical crime.

Similar effects were shown for the prosecutor's sentencing demand, even if the demand was explicitly made by a layman – a computer science student in the role of the prosecutor (Englich & Mussweiler, 2001) or if the prosecutor's sentencing demand was determined at random by throwing dice (Englich et al., 2006). Furthermore, the prosecutor's sentencing demand seems not only to influence the final judgment, but also the defence attorney's counter demand (Englich, Mussweiler, & Strack, 2005).

THE ANCHORING PHENOMENON

As it was illustrated in the legal settings, human judgment is often influenced by biased values (for a classroom demonstration, see Text box 12.1). Such judgmental "anchoring" is defined as the assimilation of a judgment to a previously considered standard. For at least two reasons, anchoring is a remarkable influence on human judgment. First, anchoring effects are pervasive and robust. Second, its underlying

mechanisms are still a matter of lively debate even after many years of investigation.

Pervasiveness and robustness

Anchoring effects pervade a large variety of judgments, from the trivial (e.g., estimates of the mean temperature in the Antarctica; Mussweiler & Strack, 1999a) to the momentous (e.g., estimates of the likelihood of nuclear war; Plous, 1989). They have been also observed in a broad array of different domains, such as general knowledge questions (Jacowitz & Kahneman, 1995; Tversky & Kahneman, 1974), price estimates (Mussweiler, Strack, & Pfeiffer, 2000; Northcraft & Neale, 1987), estimates of self-efficacy (Cervone & Peake, 1986), probability assessments (Plous, 1989), estimates of task duration (Lorko, Servátka, & Zhang, 2019), valuation of products (Ariely, Loewenstein, & Prelec, 2003; Yoon, Fong, & Dimoka, 2019), legal judgments (Bystranowski, Janik, Próchnicki, & Skórska, 2021; Englich & Mussweiler, 2001; Englich et al., 2005, 2006), and negotiations (Galinsky & Mussweiler, 2001).

Not only is the anchoring effect influential in a plethora of settings, its influence is also remarkably robust. For one, anchoring occurs even if the anchor values are clearly uninformative for the critical estimate, for example because they were randomly selected (e.g., Tversky & Kahneman, 1974). Moreover, even implausibly extreme values can yield the effect (e.g., Chapman & Johnson, 1994; Strack & Mussweiler, 1997). For example, in one study (Strack & Mussweiler, 1997) estimates for Mahatma Gandhi's age were assimilated in the direction of an unreasonably high anchor value of 140 years. Furthermore, anchoring may be in some cases uninfluenced by manipulations of accuracy motivation. Specifically, even a substantial financial incentive for being accurate did not appreciably reduce the anchoring effect (Enke et al., 2021). In addition, it has been demonstrated that anchoring is often largely unaffected by knowledge and expertise (Cheek, Coe-Odess, & Schwartz, 2015; Englich & Mussweiler, 2001; Englich et al., 2006; Northcraft & Neale, 1987; but see Smith, Windschitl, & Bruchmann, 2013). In the above-mentioned study in the legal domain (Englich & Mussweiler, 2001), for example, experienced judges and inexperienced law students were similarly influenced by the anchor sentencing demand if it was given by a computer science student with no legal knowledge. Furthermore, anchoring effects can persist even over fairly long periods of time. For example, anchoring effects were still noticeable eight weeks after the anchoring had occurred (Yoon & Fong, 2019). While the above examples show that anchoring is a robust phenomenon, its robustness depends on the mechanism that led to it in a given judgment.

Relevance

Anchoring has not only been shown to be robust and pervasive in various domains, but it has also been suggested to play a role in a wide array of seemingly unrelated judgmental phenomena. For example, anchoring has been used to explain hindsight bias – the assimilation of a recollected estimate towards an observed outcome (Hawkins &

Hastie, 1990; see also Chapter 27). The egocentricity of social judgments has also been attributed to an anchoring mechanism (Gilovich, Medvec, & Savitsky, 2000). Specifically, it was found that people may overestimate the extent to which they are noted by others, because they use their own rich experiences as an anchor when estimating the experience of others. Similarly, the illusion of transparency – the tendency to underestimate ambiguity in communication when intentions are known – also shares some similarities with anchoring (Keysar & Barr, 2002).

In the psychology of judgment and decision making, anchoring has been primarily applied to probabilistic inferences. Thus, preference-reversal effects (Lichtenstein & Slovic, 1971), the distortion of estimates for the probability of disjunctive and conjunctive events and of the assessment of subjective probability distributions (Tversky & Kahneman, 1974) have been all attributed to judgmental anchoring.

Finally, applications of the anchoring concept are also found in applied contexts, such as negotiations, consumer behavior, and sentencing decisions (see the example at the beginning). For example, first offers in negotiations may serve as anchors and thus influence the final outcome (Galinsky & Mussweiler, 2001). In consumer research, it has been suggested that price claims in advertisements influence behavior because they function as anchors in product evaluation (Biswas & Burton, 1993). Like anchoring effects on criminal sentencing decisions, research in the civil context of damage awards has shown that the higher a plaintiff's request, the higher the awarded damage (Hastie, Schkade, & Payne, 1999; Malouff & Schutte, 1989; Marti & Wissler, 2000). In personal injury verdicts, the requested compensation was found to systematically influence the compensation awarded by the jury as well as the judged probability that the defendant caused the plaintiff's injuries (Chapman & Bornstein, 1996). Ironically, even limits on damage awards serve as anchors and increase the awards (Hinsz & Indahl, 1995). While the applied research has clearly demonstrated anchoring in the laboratory, the effect seems to be more fragile in the field (Jung, Perfecto, & Nelson, 2016).

These accounts stand witness to the great diversity of phenomena that have been connected to judgmental anchoring. It is important to note however that these phenomena are not sufficiently explained by invoking an unspecific notion of anchoring. By itself, the anchoring notion does not illuminate the underlying mechanisms, but only describes the direction of the observed influence (assimilation). In this respect, the term “anchoring” constitutes a descriptive rather than an explanatory concept which does not go beyond the terms “assimilation” and “contrast” (Strack, 1992). To be used as an explanatory concept, the underlying psychological mechanisms have to be sufficiently understood.

Paradigms

Anchoring effects are typically examined in the standard paradigm introduced by

Tversky and Kahneman (1974). In this paradigm, anchors are explicitly provided by having judges compare the target to the anchor value. This is usually achieved by posing a comparative anchoring question and asking participants to indicate whether a characteristic of the target is larger or smaller on the judgmental dimension than the anchor value. To avoid inferences about the intention that led to the selection of a particular anchor value (see Grice, 1975), it is typically presented as randomly generated. This may be achieved by spinning a wheel of fortune (Tversky & Kahneman, 1974), by emphasizing the random selection in the instructions (Strack & Mussweiler, 1997), by throwing dice (Mussweiler & Strack, 2000b), or by generating the value as the outcome of a clearly irrelevant process (Ariely et al., 2003).

In what is probably the best-known demonstration, Tversky and Kahneman (1974) asked their research participants two consecutive questions about the percentage of African nations in the UN. In a first *comparative* anchoring question, participants indicated whether the percentage of African nations in the UN was higher or lower than an arbitrary number (the anchor) that had ostensibly been determined by spinning a wheel of fortune (65% or 10%). In the subsequent *absolute* anchoring question, participants gave their best estimate of the correct percentage. As a result of the anchoring procedure, absolute judgments were assimilated to the provided anchor value, so that the mean estimate of participants who received the high anchor was 45%, compared to 25% for participants who received the low anchor.

Alternatively, the anchor may be provided to the participants in cases in which it is clearly informative for the judgment at hand. For example, Northcraft and Neale (1987) demonstrated that real-estate pricing decisions depended on the listing price for the property. Real-estate agents and lay subjects were given a 10-page booklet including all the information that is important for real-estate pricing. This booklet also contained the listing price of the house, which constituted the central independent variable. The price provided was either above or below the actual appraisal value of the property (e.g., \$83,900 vs. \$65,900). Replicating the typical anchoring finding, both expert and lay participants' estimates for the value of the property were assimilated toward the provided anchors.

In a third paradigm, anchors are self-generated rather than provided by the experimenter (Tversky & Kahneman, 1974). In one such study, participants were given 5 seconds to estimate the result of a product that was either presented in an ascending sequence ($1 \times 2 \times \dots \times 8$) or in a descending sequence ($8 \times 7 \times \dots \times 1$). Participants' estimates for the ascending sequence proved to be lower than for the descending sequence, presumably because participants based their estimates on the product of the first few numbers (which is lower for the ascending than for the descending sequence), which served as a self-generated anchor to which their final estimate was assimilated. Likewise, numerical estimates may be assimilated to self-generated anchors that are closely associated with

the target quantity. For example, participants who are asked to give their best estimate for the freezing point of vodka, may use the freezing point of water as an anchor and then adjust downwards, because they know that the freezing point of alcohol is lower (Epley & Gilovich, 2001).

The “sequential judgment paradigm” also relies on self-generated anchors. However, an anchor is self-generated by answering an unrelated question in this paradigm. For example, answering a question about the weight of a raccoon influences subsequent judgments of the weight of a giraffe. The estimated weight of a giraffe is assimilated to the anchor self-generated by estimating the weight of a raccoon. Importantly, the first answer influences the subsequent judgment only if it is made using the same response scale (Frederick & Mochon, 2012; Mochon & Frederick, 2013).

Finally, anchoring effects may be obtained by surreptitiously increasing the accessibility of the anchor value (Critcher & Gilovich, 2008; Wilson, Houston, Etling, & Brekke, 1996). For example, in one experiment (Wilson et al., 1996) demonstrating such a “basic” anchoring effect, participants were first asked to copy either 5 pages of numbers ranging from 4,421 to 4,579 or 5 pages of words and subsequently estimated the number of students at their university, who will contract cancer within the next 40 years. The participants who had copied 5 pages of high numbers estimated this number to be higher than those who had copied 5 pages of words. Thus, the irrelevant high anchor presented in the preceding task influenced the judgment. While some studies have suggested such basic anchoring effects, more recent studies (Brewer & Chapman, 2002; Klein et al., 2018; Röseler et al., 2021; Shanks, Barbieri-Hermitte, & Vadillo, 2020) failed to replicate them, showing that subliminal anchoring is weaker and more fragile than other forms of anchoring.

In sum, anchoring effects have been demonstrated using five different experimental paradigms, in which the anchor values are either explicitly or implicitly provided by the experimenter, self-generated, or made more accessible by their mere presence. Most of the anchoring research, however, first asks participants a comparative and then an absolute question following the standard paradigm introduced by Tversky and Kahneman (1974).

THEORETICAL ACCOUNTS

To date five main theoretical accounts of anchoring effects have been proposed. In particular, it has been suggested that anchoring effects result from (1) insufficient adjustment from an anchor, (2) conversational inferences, (3) numerical priming, (4) mechanisms of selective accessibility, and (5) distortion of the response scale.

(1) Insufficient adjustment

In their initial description of the phenomenon, Tversky and Kahneman (1974) described

anchoring in terms of insufficient adjustment from a starting point. They argued that “[...] people make estimates by starting from an initial value that is adjusted to yield the final answer [...]. Adjustments are typically insufficient. That is, different starting points yield different estimates, which are biased toward the initial value.” (p. 1129). The adjustment may be insufficient because it terminates once it reaches a region of acceptable values for the estimate (Epley & Gilovich, 2006; Quattrone et al., 1984). For example, participants who are asked whether the percentage of African nations in the UN is higher or lower than 65% may use this anchor value as a starting point, determine whether it is too high or too low and then adjust in the appropriate direction until the first acceptable value is found. Such insufficient adjustment is only possible if the anchor value falls outside of the distribution of acceptable values – that is, it constitutes an unacceptable value itself. This may be the case because the anchor value is extreme, or because it is known to be wrong. For example, participants may generate the duration of Earth’s orbit as an anchor to estimate the number of days it takes Mars to orbit the Sun. They are likely to know that 365 days constitutes an unacceptable value because Mars’ orbit takes longer than Earth’s (Epley & Gilovich, 2001). Therefore, they may adjust from this unacceptable value until an acceptable value is reached.

However, anchoring effects are not obtained only for clearly implausible and unacceptable anchor values (e.g., Strack & Mussweiler, 1997). It seems difficult to explain the effects of plausible and acceptable anchors by insufficient adjustment because for such anchors, there is no reason to adjust in the first place. The anchoring-and-adjustment account also cannot explain why an anchor influences the proportion of people generating judgments that are higher versus lower than the anchor. That is, people should know the direction of adjustment from the anchor. Instead, the direction is influenced by the comparative question (Jacowitz & Kahneman, 1995).

The insufficient adjustment thus appears to contribute to anchoring effects mainly if the critical anchor values are unacceptable and self-generated rather than acceptable and externally provided. Consistent with this assumption, participants’ answers are more likely to be closer to the anchor within the range of acceptable values if the anchor is self-generated than if it is externally provided (Epley & Gilovich, 2001). Furthermore, adjustment is an effortful process, and the availability of cognitive resources should therefore influence the size of the anchoring effect. Consistently, anchoring is reduced under cognitive load as well as after previous alcohol consumption in case of self-generated anchors (Epley & Gilovich, 2006). Similarly, forewarning and incentives reduce anchoring in case of self-generated anchors, but the results are mixed for externally provided anchors (Enke et al., 2021; Epley & Gilovich, 2005; Simmons, LeBoeuf, & Nelson, 2010).

Another explanation of insufficient adjustment argues that adjustment may be

insufficient because people are averse to extreme corrections. Consistently, when predicting a stock price, participants were more likely to adjust from the current stock price by at least 5 dollars if the maximum allowable adjustment was “14 or more” than when it was “5 or more” (Lewis, Gaertig, & Simmons, 2019). The adjustment by 5 dollars or more was extreme in the latter case, but not when the maximum adjustment was 14 dollars or more. There is currently little research that would suggest under what circumstances extremeness aversion causes the anchoring effect and what are its limitations. Its contribution to anchoring effects is therefore not currently clear.

(2) Conversational inferences

A second account attributes anchoring to conversational inferences. According to this reasoning, applying implicit rules of natural conversations (Grice, 1975) to standardized situations (e.g., Schwarz, 1994) allows participants to use the anchor value to infer the actual range of possible answers. Participants who expect the experimenter to be maximally informative (Grice, 1975) in asking his or her questions may assume that the provided anchor value is close to the actual value and consequently position their estimate in its vicinity. Such conversational inferences may well underlie the effects of considering anchor values that are of clear relevance for the estimate to be made (e.g., Northcraft & Neale, 1987). Conversational inferences may also explain some other effects found in the anchoring literature. For example, more precise anchors (e.g., 4.85 rather than 5) lead to larger anchoring effects (Janiszewski & Uy, 2008). Importantly, precision influences the size of the anchoring effect only if the anchor may be perceived as informative. In one study (Zhang & Schwarz, 2013), precision of an anchor influenced anchoring only if the anchor was allegedly created by a person and not if it was generated by a computer program. The conversational account also explains why people show weaker anchoring effects on their estimation of the population of Chicago if a high anchor is presented as a part of a question (“Do more or less than 5 million people live in Chicago?”) than if it is a part of a statement (“The population of Chicago is less than 5,000,000.”; Klein et al., 2014). Presumably, it is easier to infer that the anchor is informative in case of the statement than in case of the question. Another study shows that conversational inferences may play some role in anchoring paradigms even if experimenters try to make the anchor uninformative. In particular, Frederick, Mochon, and Savary (2014) found that the anchoring effect was smaller if participants took part in the random generation of the anchor than if the randomness of the anchor was conveyed by the experimenter. Additionally, while anchoring is present even in cases where the anchor is clearly irrelevant, relevance can increase the size of anchoring at least in an applied context (Glöckner & Englich, 2015).

It is important to note that this account presupposes that the anchor value is indeed seen as informative for the judgment. Anchoring effects, however, also occur if the anchor values are clearly uninformative because they were randomly selected (Frederick et al., 2014; Tversky & Kahneman, 1974), are implausibly extreme (Strack & Mussweiler,

1997), or are not related to the question at all (Frederick & Mochon, 2012). Thus, although conversational inferences are potential determinants of anchoring in natural situations, they are not a necessary precondition.

(3) Numeric priming

A third theoretical account assumes that anchoring can be rather superficial and purely numeric in nature (Critcher & Gilovich, 2008; Wilson et al., 1996; Wong & Kwong, 2000). In particular, an anchor may simply render the anchor value itself more accessible, which influences the subsequent absolute judgment. From this numeric-priming perspective, the sole determinant of anchoring effects is the anchor value itself, regardless of its context, the target with which it is compared, and the judgmental operations in which it is involved. A study by Oppenheimer, LeBoeuf, and Brewer (2008) further suggests that numeric priming may be only a specific example of a more general magnitude priming. According to the study, magnitude may be primed cross-modally – for example, drawing a long line increased subsequent numeric judgment.

However compelling such a simple numeric account may appear, a careful analysis of anchoring research reveals that focusing exclusively on the numeric value of an anchor is insufficient to explain most of anchoring effects. Abundant evidence demonstrates that semantic content associated with the anchor has to be taken into account to understand the complete pattern of findings in the standard paradigm. For example, a purely numeric account cannot explain why anchoring effects depend on changes of the response scale (Frederick & Mochon, 2012) or the target of the comparative judgment (Bahník & Strack, 2016; Mussweiler & Strack, 2001). If anchoring effects were evoked by the anchor value itself, then identical effects should result irrespective of the semantic associations with the anchor. For example, comparing the average *annual* and *summer* temperature in New York City to a given anchor value should both have identical effects on subsequent judgments of the average *summer* temperature in New York City because the numeric properties of the anchor are left unchanged by changing the target of the comparative judgment. This, however, is not the case. Rather, the anchoring effect disappears if the comparative anchoring question pertains to the average *annual* temperature (Bahník & Strack, 2016).

The temporal robustness of anchoring effects is also at odds with a purely numeric account which implies that anchoring effects are transient and short-lived. Because we are constantly exposed to arbitrary numbers, our daily routines (e.g., calling a friend, paying a bill) should immediately wipe out the effects of solving a comparative anchoring task. The fact that anchoring effects can prevail for eight weeks (Yoon & Fong, 2019) is clearly in conflict with this implication and further renders a purely numeric conceptualization of the standard anchoring paradigm unconvincing.

While numeric priming offers a parsimonious explanation for some outcomes (Critcher

& Gilovich, 2008; Wilson et al., 1996; Wong & Kwong, 2000), these effects are not robust (Brewer & Chapman, 2002; Klein et al., 2018; Röseler et al., 2021; Shanks et al., 2020), and numeric priming thus does not seem to play a significant role in most anchoring effects (Newell & Shanks, 2014).

(4) Selective accessibility

The fourth theoretical account is the selective-accessibility model of anchoring. It claims that anchoring is the result of an increased accessibility of information consistent with an anchor (Mussweiler & Strack, 1999a, 1999b; Strack, Bahnik, & Mussweiler, 2016; Strack & Mussweiler, 1997; for a related account, see Chapman & Johnson, 1994, 1999). The model attempts to explain anchoring by linking it to two fundamental principles of social cognition research: (1) *hypothesis-consistent testing* and (2) *semantic priming*. More specifically, the model postulates that comparing the judgmental target to the anchor changes the accessibility of knowledge about the target. In particular, the accessibility of knowledge that is consistent with the anchor is selectively increased because judges compare the target with the anchor by testing the possibility that the target's value is equal to the anchor value. For example, judges who are asked whether the percentage of African nations in the UN is higher or lower than a high anchor of 65% test the possibility that this value is 65%. To do so, they selectively retrieve knowledge from memory that is consistent with this assumption (e.g., "Many African nations that are probably members of the UN come easily to mind.", etc.). Such hypothesis-consistent testing is a general tendency that contributes to a variety of judgmental processes (Klayman & Ha, 1987; see Chapter 5 in this volume). To subsequently generate the requested numeric estimate, judges then rely primarily on easily accessible information (Higgins, 1996), so that their estimate is heavily influenced by the anchor-consistent knowledge that they had generated before. In our example, absolute estimates of the percentage of African nations in the UN would be based on the subset of target knowledge that was retrieved specifically because it was consistent with the assumption that this percentage is fairly high. Conceivably, using this knowledge leads to high estimates, and the final estimate is thus assimilated to the anchor value.

The role of hypothesis-consistent testing in anchoring has been supported by Mussweiler and Strack (1999a), who showed that absolute judgments in the standard anchoring paradigm are higher when the comparative question asks whether the target value is larger than the anchor than when it asks whether the target value is smaller than the anchor. The tested hypothesis is influenced by the wording of the comparative question and the hypothesis-consistent testing thus activates different information depending on the wording. Another study showed that the anchoring effect is not affected by a prompt to consider similarities of the target and the anchor, but it is reduced when the prompt asks to consider differences (Chapman & Johnson, 1999). According to hypothesis-consistent testing, the default response to the comparative

question is consideration of similarities to the anchor, which explains the results. The selective-accessibility model argues that hypothesis-consistent testing leads to activation of the information compatible with the anchor. Accordingly, when instructed to list features that came to mind in the standard anchoring paradigm, participants were more likely to list thoughts consistent with the anchor value (Mussweiler & Strack, 1999a).

Additional support comes from a study that tested a prediction derived from the selective-accessibility model (Bahnik & Strack, 2016). In particular, the model implies that an anchor should not influence the absolute judgment if it activates information that would have been used for the judgment even without the anchor. For example, if the comparative judgment makes information about summer in New York City more accessible, it should not influence the judgment of the average summer temperature in New York City, because the information overlaps with information that is used for making that judgment in any case. Bahnik and Strack (2016) achieved the informational overlap by using a different target for the comparative and absolute judgment. As already mentioned, the study showed that the judgment of the average summer temperature in New York City was assimilated to a high anchor if the comparative question asked about the average *summer* temperature, making especially hot periods of summer more accessible, but not if it asked about the average *annual* temperature, which presumably activates information about summer. Importantly, a low anchor compared with the average annual temperature led to assimilation of the anchor in judgment of the average summer temperature. The low anchor presumably activates information about winter which does not overlap with information normally used for making the absolute judgment of the average summer temperature and which therefore exerts influence on the judgment.

The selective-accessibility model is also consistent with other findings. For example, the time that is needed to generate a given judgment depends on the degree of accessibility of judgment-relevant knowledge (Neely, 1977). Accordingly, response latencies for the absolute anchoring judgment have been shown to depend on the extent to which the accessibility of judgment-relevant knowledge had been increased during the comparative judgment (Mussweiler & Strack, 1999a, 2000a, 2000b; Strack & Mussweiler, 1997). For example, judges were faster in giving absolute judgments if they had ample time to generate knowledge during the preceding comparison than when they had made the comparison under time pressure – a condition that is likely to limit the accessibility increase (Mussweiler & Strack, 1999a). Different levels of accessibility do not influence only response latencies for absolute judgments, but also the content of these judgments. In particular, larger anchoring effects occur under conditions which promote the extensive generation of anchor-consistent target knowledge and thus lead to a more substantial accessibility increase. For example, judges who have more target information available during the comparative task show more anchoring than those who

have little information available (Chapman & Johnson, 1999).

Some studies (Frederick & Mochon, 2012; Mochon & Frederick, 2013) suggest that anchoring can occur even when the targets of the comparative and absolute judgment are largely dissimilar. For example, the absolute judgment of annual rainfall at the driest place in the US (Death Valley) is influenced to a similar degree by a comparative question related to the wettest place in the US (Mount Waialeale) as to Death Valley (Frederick & Mochon, 2012). According to the selective-accessibility model (Mussweiler & Strack, 2000a), the size of the anchoring effect should be influenced by the applicability of the information made accessible by the comparative question to the absolute judgment. Presumably, the applicability is lower when the target of a judgment changes between the comparative and absolute question. Accordingly, more recent evidence shows that anchoring is stronger when the targets of the comparative and absolute judgment questions are more similar (Sailors & Heyman, 2019). While some studies suggest that the selective accessibility mechanism may not be necessary for producing anchoring in the standard paradigm, the evidence indicates that it is a potent theoretical account.

(5) Scale distortion

A more recent theoretical account argues that anchoring may result from distortion of a response scale. The scale distortion theory argues that contrast effects that can be seen in perception are also present in the use of response scales (Frederick & Mochon, 2012). As water appears to be warmer if judges had previously put their hand in cold water, they also feel that 100 kilograms is heavier if they previously thought about 5 kilograms. This contrast effect can easily lead to an assimilation effect as a result of anchoring. For example, considering 10% of African states results in the feeling that 45% percent of states is relatively a large number. People would then choose a lower number as the answer for the absolute question because the lower number would be perceived as subjectively larger due to the comparison with 10%. The anchor may thus be assimilated to a subsequent judgment by distorting the response scale for that judgment.

The scale distortion theory of anchoring was studied mainly using the sequential judgment paradigm. The results of experiments using this paradigm support several predictions of the scale distortion theory. Anchoring was demonstrated, for example, by having participants estimate the weight of a raccoon and subsequently estimate the weight of a giraffe (Frederick & Mochon, 2012). While the participants who estimated the weight of a raccoon subsequently answered that the weight of a giraffe is on average 709 pounds, those who did not estimate the weight of a raccoon estimated the weight of a giraffe to be on average 1254 pounds. The anchor in a form of the estimated weight of a raccoon was therefore embedded in the subsequent judgment. Presumably, by answering a question about the weight of a raccoon, large numbers on the response

scale felt even larger in comparison. The participants thus mapped the same representation of a giraffe to a smaller number if they previously estimated the weight of a raccoon. Since scale distortion operates only on a given response scale, anchoring should not occur if the response scale is changed between the two judgments. Consistently, participants who judged the weight of a raccoon on a 7-point heaviness scale were not influenced by this judgment and estimated the weight of a giraffe to be on average 1265 pounds (Frederick & Mochon, 2012).

Apart from the assimilation of an anchor value in the sequential judgment paradigm, the scale distortion theory predicts a contrast effect when objects are mapped to a certain value on the response scale. For example, participants that were first asked to estimate the weight of a wolf chose a heavier animal when asked afterwards which animal has its weight closest to 1000 pounds than participants that did not estimate the weight of a wolf. Apparently, the same 1000 pounds felt heavier in comparison after the judgment of the weight of a wolf (Frederick & Mochon, 2012). Scale distortion should not be influenced by what is the target of the comparative judgment. For example, the scale should be similarly distorted if the judgment of a price of a camera is preceded by the comparison of an anchor with a price of the camera or of a GPS device. The prediction was supported by some experimental data (Mochon & Frederick, 2013), but other research is inconsistent with it (Bahník & Strack, 2016; Sailors & Heyman, 2019).

Additionally, even in the sequential judgment paradigm, the second judgment can be influenced differently by a similar anchor value depending on the target of the first judgment. For example, Chernev (2011) found that asking about a calorie estimate of a *salad* leads to a contrast effect in a subsequent estimate of calories in a cheesesteak while an estimate of calories in a *cake* leads to assimilation. As the calorie estimates of a salad and cake are both lower than that of a cheesesteak, they should lead to a lower judgment of calories for a cheesesteak. This prediction follows from the scale distortion theory, which assumes that anchoring should be largely independent of the target of judgment. An anchor should also influence absolute judgments through scale distortion, but only if the scale is still distorted when making the judgment. Contrary to this prediction, Bahník (2021) showed that a comparative question in the standard anchoring paradigm influences an answer to the absolute judgment question even if the two questions are interposed by other judgments on the same scale. These judgments should have overridden any scale distortion effect of the anchor by the time the absolute judgment is made. Contrary to the scale distortion theory, anchoring can also occur under certain circumstances even if the anchor is on a different scale than the absolute judgment (Harris & Speekenbrink, 2016).

In summary, while scale distortion theory explains parsimoniously some findings in the sequential judgment and standard anchoring paradigms, other findings are inconsistent with its predictions. The specific conditions under which scale distortion operates are

yet to be explored.

CONCLUSIONS

Anchoring effects are among the most robust and ubiquitous psychological phenomena in judgment and decision making. Different underlying mechanisms were traditionally used to explain anchoring effects in different anchoring paradigms. Anchoring and insufficient adjustment is used to explain assimilation of judgment to an anchor in case of unacceptable and self-generated anchors. Conversational inferences may particularly play a role when the anchor itself or the context of its presentation are perceived as informative. Selective accessibility seems to lie behind anchoring in case of externally provided anchors. Scale distortion explains most of the effects in the sequential judgment paradigm. Its role in the standard anchoring paradigm is not yet known, but it may be relatively more prominent in case of little knowledge about the judgmental domain.

While the evidence suggests operation of different processes under different circumstances, there is little evidence that multiple processes cannot operate simultaneously. Indeed, the theoretical accounts invoked to explain anchoring effects are not mutually exclusive, even though they are often described as such in the literature. However, their interaction is not thoroughly explored and may stimulate future research. Given the broad definition of anchoring, it is not surprising that there is not a single mechanism that can explain it under all circumstances. Focusing on the judgmental processes rather than on judgmental effects, we may discover that the assimilation of numeric judgments toward a previously considered value may be the result of different psychological mechanisms. Identifying the concomitant determinants may transform the “anchoring heuristic” into a psychologically rooted phenomenon with rich conceptual and applied implications.

SUMMARY

- An assimilation of an estimate towards a previously considered standard is defined as judgmental anchoring.
- Anchoring constitutes a ubiquitous phenomenon that occurs in a variety of laboratory and real-world settings.
- Anchoring effects are remarkably robust. They may occur even if the anchor values are clearly uninformative or implausibly extreme, are sometimes independent of participants’ motivation and expertise, and may persist over long periods of time.
- There are different underlying mechanisms that may contribute to the generation of anchoring effects. Specifically, anchoring may result from insufficient adjustment, from the use of conversational inferences, from selective accessibility of information consistent with an anchor, or from the distortion of a response scale.

FURTHER READINGS

The main accounts of anchoring are explored in more detail in Strack et al. (2016), Epley and Gilovich (2001), and Frederick and Mochon (2012).

REFERENCES

- Ariely, D., Loewenstein, G., & Prelec, D. (2003). "Coherent arbitrariness": Stable demand curves without stable preferences. *Quarterly Journal of Economics*, 118, 73-105.
- Bahník, Š. (2021). Anchoring without scale distortion. *Judgment and Decision Making*, 16, 131-141.
- Bahník, Š., & Strack, F. (2016). Overlap of accessible information undermines the anchoring effect. *Judgment and Decision Making*, 11, 92-98.
- Biswas, A., & Burton, S. (1993). Consumer perceptions of tensile price claims in advertisements: An assessment of claim types across different discount levels. *Journal of the Academy of Marketing Science*, 21, 217-229.
- Brewer, N. T., & Chapman, G. B. (2002). The fragile basic anchoring effect. *Journal of Behavioral Decision Making*, 15, 65-77.
- Bystranowski, P., Janik, B., Próchnicki, M., & Skórska, P. (2021). Anchoring effect in legal decision-making: A meta-analysis. *Law and Human Behavior*, 45, 1-23.
- Cervone, D., & Peake, P. K. (1986). Anchoring, efficacy, and action: The influence of judgmental heuristics on self-efficacy judgments and behavior. *Journal of Personality and Social Psychology*, 50, 492-501.
- Chapman, G. B., & Bornstein, B. H. (1996). The more you ask for, the more you get: Anchoring in personal injury verdicts. *Applied Cognitive Psychology*, 10, 519-540.
- Chapman, G. B., & Johnson, E. J. (1994). The limits of anchoring. *Journal of Behavioral Decision Making*, 7, 223-242.
- Chapman, G. B., & Johnson, E. J. (1999). Anchoring, activation, and the construction of values. *Organizational Behavior and Human Decision Processes*, 79, 1-39.
- Cheek, N. N., Coe-Odess, S., & Schwartz, B. (2015). What have I just done? Anchoring, self-knowledge, and judgments of recent behavior. *Judgment and Decision Making*, 10, 76-85.
- Chernev, A. (2011). Semantic anchoring in sequential evaluations of vices and virtues. *Journal of Consumer Research*, 37, 761-774.
- Critcher, C. R., & Gilovich, T. (2008). Incidental environmental anchors. *Journal of Behavioral Decision Making*, 21, 241-251.
- Englich, B., & Mussweiler, T. (2001). Sentencing under uncertainty: Anchoring effects in the courtroom. *Journal of Applied Social Psychology*, 31, 1535-1551.
- Englich, B., Mussweiler, T., & Strack, F. (2005). The last word in court – A hidden disadvantage for the defense. *Law and Human Behavior*, 29, 705-722.
- Englich, B., Mussweiler, T., & Strack, F. (2006). Playing dice with criminal sentences: The influence of irrelevant anchors on experts' judicial decision making. *Personality and Social Psychology Bulletin*, 32, 188-200.
- Enke, B., Gneezy, U., Hall, B., Martin, D. C., Nelidov, V., Offerman, T., & van de Ven, J. (2021). *Cognitive Biases: Mistakes or Missing Stakes?* (NBER Working Paper No. 28650). National Bureau of Economic Research.
<https://www.nber.org/papers/w28650>

- Epley, N., & Gilovich, T. (2001). Putting adjustment back in the anchoring and adjustment heuristic: Differential processing of self-generated and experimenter-provided anchors. *Psychological Science*, *12*, 391-396.
- Epley, N., & Gilovich, T. (2005). When effortful thinking influences judgmental anchoring: Differential effects of forewarning and incentives on self-generated and externally provided anchors. *Journal of Behavioral Decision Making*, *18*, 199-212.
- Epley, N., & Gilovich, T. (2006). The anchoring-and-adjustment heuristic: Why the adjustments are insufficient. *Psychological Science*, *17*, 311-318.
- Frederick, S. W., & Mochon, D. (2012). A scale distortion theory of anchoring. *Journal of Experimental Psychology: General*, *141*, 124-133.
- Frederick, S., Mochon, D., & Savary, J. (2014). The role of inference in anchoring effects. *Yale University working paper*.
- Galinsky, A. D., & Mussweiler, T. (2001). First offers as anchors: The role of perspective-taking and negotiator focus. *Journal of Personality and Social Psychology*, *81*, 657-669.
- Gilovich, T., Medvec, V. H., & Savitsky, K. (2000). The spotlight effect in social judgment: An egocentric bias in estimates of the salience of one's own actions and appearance. *Journal of Personality and Social Psychology*, *78*, 211-222.
- Glöckner, A., & Englich, B. (2015). When relevance matters: Anchoring effects can be larger for relevant than for irrelevant anchors. *Social Psychology*, *46*, 4-12.
- Grice, H. P. (1975). Logic and conversation. In P. Cole & J. L. Morgan (Eds.), *Syntax and semantics. Vol. 3: Speech acts* (pp. 41-58). New York: Academic Press.
- Harris, A. J., & Speekenbrink, M. (2016). Semantic cross-scale numerical anchoring. *Judgment and Decision Making*, *11*, 572-581.
- Hastie, R., Schkade, D. A., & Payne, J. W. (1999). Juror judgments in civil cases: Effects of plaintiff's requests and plaintiff's identity on punitive damage awards. *Law and Human Behavior*, *23*, 445.
- Hawkins, S. A., & Hastie, R. (1990). Hindsight: Biased judgments of past events after the outcomes are known. *Psychological Bulletin*, *107*, 311-327.
- Higgins, E. T. (1996). Knowledge activation: Accessibility, applicability, and salience. In E. T. Higgins & A.W. Kruglanski (Eds.), *Social psychology: Handbook of basic principles* (pp. 133-168). New York: The Guilford Press.
- Hinsz, V. B., & Indahl, K. E. (1995). Assimilation to anchors for damage awards in a mock civil trial. *Journal of Applied Social Psychology*, *25*, 991-1026.
- Jacowitz, K. E., & Kahneman, D. (1995). Measures of anchoring in estimation tasks. *Personality and Social Psychology Bulletin*, *21*, 1161-1166.
- Janiszewski, C., & Uy, D. (2008). Precision of the anchor influences the amount of adjustment. *Psychological Science*, *19*, 121-127.
- Jung, M. H., Perfecto, H., & Nelson, L. D. (2016). Anchoring in payment: Evaluating a judgmental heuristic in field experimental settings. *Journal of Marketing Research*, *53*, 354-368.
- Keysar, B., & Barr, D. J. (2002). Self-anchoring in conversation: Why language users

- don't do what they "should." In T. Gilovich, D. Griffin, & D. Kahneman (Eds.), *Heuristics and biases: The psychology of intuitive judgment* (pp. 150-166). Cambridge, England: Cambridge University Press.
- Klayman, J., & Ha, Y. W. (1987). Confirmation, disconfirmation, and information in hypothesis testing. *Psychological Review*, 94, 211-228.
- Klein, R. A., Ratliff, K. A., Vianello, M., Adams, R. B., Jr., Bahník, Š., Bernstein, M. J., ... & Nosek, B. A. (2014). Theory building through replication response to commentaries on the "Many labs" replication project. *Social Psychology*, 45, 307-310.
- Klein, R. A., Vianello, M., Hasselman, F., Adams, B. G., Adams, R. B., Jr., Alper, S., ... & Nosek, B. (2018). Many Labs 2: Investigating variation in replicability across samples and settings. *Advances in Methods and Practices in Psychological Science*, 1, 443-490.
- Lewis, J., Gaertig, C., & Simmons, J. P. (2019). Extremeness aversion is a cause of anchoring. *Psychological Science*, 30, 159-173.
- Lichtenstein, S., & Slovic, P. (1971). Reversal of preference between bids and choices in gambling decisions. *Journal of Experimental Psychology*, 89, 46-55.
- Lorko, M., Servátka, M., & Zhang, L. (2019). Anchoring in project duration estimation. *Journal of Economic Behavior & Organization*, 162, 49-65.
- Malouff, J., & Schutte, N. S. (1989). Shaping juror attitudes: Effects of requesting different damage amounts in personal injury trials. *The Journal of Social Psychology*, 129, 491-497.
- Marti, M. W., & Wissler, R. L. (2000). Be careful what you ask for: The effect of anchors on personal-injury damages awards. *Journal of Experimental Psychology: Applied*, 6, 91.
- Mochon, D., & Frederick, S. (2013). Anchoring in sequential judgments. *Organizational Behavior and Human Decision Processes*, 122, 69-79.
- Mussweiler, T., & Strack, F. (1999a). Hypothesis-consistent testing and semantic priming in the anchoring paradigm: A selective accessibility model. *Journal of Experimental Social Psychology*, 35, 136-164.
- Mussweiler, T., & Strack, F. (1999b). Comparing is believing: A selective accessibility model of judgmental anchoring. In W. Stroebe & M. Hewstone (Eds.), *European review of social psychology* (Vol. 10; pp. 135-167). Chichester, England: Wiley.
- Mussweiler, T., & Strack, F. (2000a). The use of category and exemplar knowledge in the solution of anchoring tasks. *Journal of Personality and Social Psychology*, 78, 1038-1052.
- Mussweiler, T., & Strack, F. (2000b). Numeric judgment under uncertainty: The role of knowledge in anchoring. *Journal of Experimental Social Psychology*, 36, 495-518.
- Mussweiler, T., & Strack, F. (2001). The semantics of anchoring. *Organizational Behavior and Human Decision Processes*, 86, 234-255.
- Mussweiler, T., Strack, F., & Pfeiffer, T. (2000). Overcoming the inevitable anchoring effect: Considering the opposite compensates for selective accessibility.

- Personality and Social Psychology Bulletin*, 26, 1142-1150.
- Neely, J. H. (1977). Semantic priming and retrieval from lexical memory: Roles of inhibitionless spreading of activation and limited-capacity attention. *Journal of Experimental Psychology: General*, 3, 226-254.
- Newell, B. R., & Shanks, D. R. (2014). Prime numbers: Anchoring and its implications for theories of behavior priming. *Social Cognition*, 32, 88-108.
- Northcraft, G. B., & Neale, M. A. (1987). Experts, amateurs, and real estate: An anchoring-and-adjustment perspective on property pricing decisions. *Organizational Behavior and Human Decision Processes*, 39, 84-97.
- Oppenheimer, D. M., LeBoeuf, R. A., & Brewer, N. T. (2008). Anchors aweigh: A demonstration of cross-modality anchoring and magnitude priming. *Cognition*, 106, 13-26.
- Plous, S. (1989). Thinking the unthinkable: The effects of anchoring on likelihood estimates of nuclear war. *Journal of Applied Social Psychology*, 19, 67-91.
- Quattrone, G. A., Lawrence, C. P., Warren, D. L., Souza-Silva, K., Finkel, S. E., & Andrus, D. E. (1984). *Explorations in anchoring: The effects of prior range, anchor extremity, and suggestive hints*. Unpublished manuscript.
- Röseler, L., Schütz, A., Blank, P. A., Dück, M., Fels, S., Kupfer, J., ... & Seida, C. (2021). Evidence against subliminal anchoring: Two close, highly powered, preregistered, and failed replication attempts. *Journal of Experimental Social Psychology*, 92, 104066.
- Sailors, J. J., & Heyman, J. E. (2019). Similarity, multiple estimations, and the anchoring effect. *The Journal of General Psychology*, 146, 200-215.
- Schwarz, N. (1994). Judgment in a social context: Biases, shortcomings, and the logic of conversation. In M. P. Zanna (Ed.), *Advances in experimental social psychology* (pp. 123-162). San Diego, CA: Academic Press.
- Shanks, D. R., Barbieri-Hermitte, P., & Vadillo, M. A. (2020). Do Incidental Environmental Anchors Bias Consumers' Price Estimations? *Collabra: Psychology*, 6(1).
- Simmons, J. P., LeBoeuf, R. A., & Nelson, L. D. (2010). The effect of accuracy motivation on anchoring and adjustment: Do people adjust from provided anchors? *Journal of Personality and Social Psychology*, 99, 917-932.
- Smith, A. R., Windschitl, P. D., & Bruchmann, K. (2013). Knowledge matters: Anchoring effects are moderated by knowledge level. *European Journal of Social Psychology*, 43, 97-108.
- Strack, F. (1992). The different routes to social judgments: Experiential versus informational strategies. In L.L. Martin & A. Tesser (Eds.), *The construction of social judgment* (pp. 249-275). Hillsdale, NJ: Erlbaum.
- Strack, F., Bahník, Š., & Mussweiler, T. (2016). Anchoring: Accessibility as a Cause of Judgmental Assimilation. *Current Opinion in Psychology*, 12, 67-70.
- Strack, F., & Mussweiler, T. (1997). Explaining the enigmatic anchoring effect: Mechanisms of selective accessibility. *Journal of Personality and Social*

- Psychology*, 73, 437-446.
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases. *Science*, 185, 1124-1130.
- Wilson, T. D., Houston, C., Etling, K. M., & Brekke, N. (1996). A new look at anchoring effects: Basic anchoring and its antecedents. *Journal of Experimental Psychology: General*, 126, 387-402.
- Wong, K. F. E., & Kwong, J. Y. Y. (2000). Is 7300 m equal to 7.3 km? Same semantics but different anchoring effects. *Organizational Behavior and Human Decision Processes*, 82, 314-333.
- Yoon, S., & Fong, N. (2019). Uninformative anchors have persistent effects on valuation judgments. *Journal of Consumer Psychology*, 29, 391-410.
- Yoon, S., Fong, N. M., & Dimoka, A. (2019). The robustness of anchoring effects on preferential judgments. *Judgment & Decision Making*, 14, 470-487.
- Zhang, Y. C., & Schwarz, N. (2013). The power of precise numbers: A conversational logic analysis. *Journal of Experimental Social Psychology*, 49, 944-946.

TEXT BOX

Text box 12.1

Anchoring experiment

Anchoring effects are among the most robust and easily replicated findings in psychology. The experimental design we outline as a basis for classroom demonstrations follows the standard anchoring paradigm (Tversky & Kahneman, 1974).

Method

Participants

A total of 20 participants should be sufficient to produce reliable effects.

Materials

Four pairs of difficult general knowledge questions pertaining to different content domains are used as materials. The anchors are typically set one standard deviation above and below the mean estimates of a calibration group that answered only absolute questions. However, more extreme values should also produce the effect.

Each question pair consists of a comparative and an absolute judgment. In the *comparative* judgments, participants indicate whether the target quantity is higher or lower than the anchor value (e.g., “Is the mean winter temperature in Antarctica higher or lower than -17°C ?”). In the subsequent *absolute* judgments, participants provide their best estimate of the target quantity (e.g., “How high is the mean winter temperature in Antarctica?”). Two questionnaires are constructed such that two comparative questions contain a high anchor and the other two contain a low anchor in the first questionnaire, and complementary anchors are used in the second questionnaire. Each of the questionnaires is then given to half of the participants.

Comparative anchoring questions and high (and low) anchor values may be:

1. Is the mean winter temperature in Antarctica higher or lower than -17 (-43) $^{\circ}\text{C}$?
2. Was Leonardo da Vinci born before or after 1698 (1391) A.D.?
3. Was Albert Einstein’s first visit to the US before or after 1939 (1905)?
4. Was Mahatma Gandhi older or younger than 79 (64) years when he died?

Procedure

The questionnaires can be administered in groups. However, participants should not communicate with each other during the experiment. The questionnaire is handed to a participant with an instruction to read it carefully. To reduce the perceived informativeness of the anchors and thus to discourage conversational inferences, participants may be informed that they are taking part in a pretest for the construction of a general-knowledge questionnaire. The purpose of the pretest is ostensibly to find the best wording for general-knowledge questions. Instructions should emphasize that the

comparison values were randomly selected. It may be further pointed out that this random selection is necessary to minimize the impact the values have on the answers and to thus identify the impact of different question formats. Finally, participants are instructed to answer all of the questions in the given order and to do so as accurately as possible.

Analysis

To pool answers across different content domains, absolute estimates are transformed into z-scores across participants, separately for each question. These scores reflect participants' average deviation from the question mean in units of the pertinent standard deviation. A simple analysis can be conducted with a paired t-test using averaged z-scores for the two questions in the high-anchor condition and averaged z-scores for the two questions in the low-anchor condition. (More elaborate analyses of non-averaged data can be done by using multilevel modelling.)

Results and discussion

Absolute estimates should be assimilated towards the provided anchor values, so that higher mean estimates result for those targets that were compared to high anchors than for those that were compared to low anchors.