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ANCHORING EFFECT

Štěpán Bahník, Birte Englich, 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 influences on human judgment, namely the anchoring effect (Tversky & Kahneman, 1974). Although as a legal judge, you definitely do not want to be directly influenced by a journalist's question, 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 defense's counter-demand (Englich, Mussweiler, & Strack, 2005).

The anchoring phenomenon

As is true in a legal setting, 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. Anchoring is a remarkable influence on human judgment, for at least two reasons. First, anchoring effects are very pervasive and robust. Second, the mechanisms that produce anchoring are after many years of investigation still a matter of lively debate.

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 (see Appendix for an example). 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 comparison 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.

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 analysis of variance or multilevel modeling.)

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.

Pervasiveness and robustness

Anchoring effects pervade a large variety of judgments, from the trivial (i.e., estimates of the mean temperature in the Antarctica; Mussweiler & Strack, 1999a) to the apocalyptic (i.e., 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), valuation of products (Ariely, Loewenstein, & Prelec, 2003), legal judgments (Englich & Mussweiler, 2001; Englich et al., 2005, 2006), and negotiations (Galinsky & Mussweiler, 2001; Loschelder, Stuppi, & Trötschel, 2014).

Not only is the anchoring effect influential in a plethora of settings, this 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 to an unreasonably high anchor value of 140 years. Furthermore, anchoring may be in some cases uninfluenced by manipulations of accuracy motivation (e.g., Wilson, Houston, Etling, & Brekke, 1996; but see Simmons, LeBoeuf, & Nelson, 2010). In addition, it has been demonstrated that anchoring is often not affected by knowledge and expertise (Cheek, Coe-Odess, & Schwartz, 2015; Englich & Mussweiler, 2001; Englich et al., 2006; Northcraft & Neale, 1987). 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. Furthermore, anchoring effects can persist even over fairly long periods of time. For example, anchoring effects were still apparent one week after the anchor value had been considered (Mussweiler, 2001). Moreover, anchor values do not need much attention to influence judgments. Even incidental anchors like a number on a football player's jersey (Critcher & Gilovich, 2008) or subliminally presented anchors (Mussweiler & Englich, 2005; Reitsma-van Rooijen & Daamen, 2006) can result in anchoring effects (but see Newell & Shanks, 2014). Probably the most striking demonstration of the robustness of the phenomenon, however, stems from a study showing that explicit instructions to correct for a potential influence of an anchor may not mitigate the effect (Wilson et al., 1996). That is, even explicitly forewarning judges about the potential distortion and informing them about its direction did not diminish the effect in the study. While the examples above show that anchoring is a robust phenomenon, its robustness depends on its underlying mechanism in a given judgment.

Relevance

Anchoring has not only been shown to be a robust judgmental effect that has been demonstrated in a variety of domains, it has also been suggested to play a role in a wide array of judgmental phenomena. For example, anchoring has been used to explain another eminent cognitive illusion, namely, the assimilation of a recollected estimate towards an outcome, which is also known as the hindsight bias (Hawkins &

Hastie, 1990; see also Chapter 23). The egocentricity of social judgment has also been attributed to an anchoring mechanism (Gilovich, Medvec, & Savitsky, 2000). Specifically, people may overestimate the extent to which they are noted by others, because they anchor the estimate on their own rich experiences. 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 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 may serve as anchors and thus influence the final negotiation 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). Similar to anchoring effects on criminal sentencing decisions, research in the civil context of damage awards has shown that the higher the plaintiff's request in court, the higher the damage award that is given (Hastie, Schkade, & Payne, 1999; Malouff & Schutte, 1989; Marti & Wissler, 2000). In personal injury verdicts, the requested compensation systematically influences 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 therefore increase damage awards (Hinsz & Indahl, 1995). While some research clearly points to anchoring effects in the field, the effect seems to be much more fragile than in the laboratory (Jung, Perfecto, & Nelson, 2015).

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 evoking an unspecific notion of anchoring. As such, the anchoring notion does not by itself 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 that does not go beyond the terms "assimilation" and "contrast" (Strack, 1992). In order to be used as an explanatory concept, the psychological mechanisms that underlie anchoring first have to be sufficiently understood.

Paradigms

Anchoring effects are typically examined in the standard paradigm introduced by Tversky and Kahneman (1974). Anchors are explicitly provided there 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. In order 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 selected. 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 of anchoring in this paradigm, 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. 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 ($1 \times 2 \times \ldots \times 8$) or in a descending sequence ($8 \times 7 \times \ldots \times 1$). 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 than that of water (Epley & Gilovich, 2001).

The "sequential judgment paradigm" also relies on self-generated anchors. However, an anchor is self-generated by answering an unrelated question. 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 et al., 1996). 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. In another study (Critcher & Gilovich, 2008), the anchor value was made more accessible by its mere presence in materials. For example, participants judged that an American football linebacker, who was presented on a photo, had a higher probability of registering a sack (i.e., stopping the offensive team in a specific way) in a game if he had the number 94 displayed on a jersey than if the number was 54.

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 a mere presence. Most of the anchoring research, however, first asks participants a comparative and then an absolute anchoring question, employing the standard paradigm introduced by Tversky and Kahneman (1974).

Theoretical accounts

To date five 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 a 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). 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 self-generate the duration of Earth's orbit as an anchor in order 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's orbit takes longer than Earth's (Epley & Gilovich, 2001). As a consequence, 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 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 making judgments higher and lower than the anchor. That is, people should know the direction of adjustment from the anchor; however, 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 anchors are unacceptable and self-generated rather than acceptable and externally provided values. 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 provided externally (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 in case of externally provided anchors (Epley & Gilovich, 2005; Simmons et al., 2010).

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. A recent study also shows that conversational inferences may play some role even in anchoring paradigms where 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 (Critcher & Gilovich, 2008; 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. One account even goes so far as to claim that anchoring effects may be so superficial that not the anchor itself, but only its absolute value (e.g., "50" for an anchor of "–50°C") is represented in memory and exerts the primary anchoring influence (Wong & Kwong, 2000). 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. In particular, 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 content with which the anchor is associated. 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 fairly 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 a week (Mussweiler, 2001) is clearly in conflict with this implication and further renders a purely numeric conceptualization of the standard anchoring paradigm unconvincing.

While numeric priming seems to be able to parsimoniously explain some effects (Critcher & Gilovich, 2008; Wilson et al., 1996; Wong & Kwong, 2000), its influence might be limited to judgment under cognitive load (Blankenship, Petty, Detweiler-Bedell, & Macy, 2008; see also Wegener, Petty, Blankenship, & Detweiler-Bedell, 2010), and it plays only a marginal role in most anchoring effects (Brewer & Chapman, 2002; Newell & Shanks, 2014).

4. Selective accessibility

The fourth theoretical account, the selective accessibility model of anchoring, argues that the anchoring effect is the result of increased accessibility of information consistent with an anchor (Mussweiler & Strack, 1999a, 1999b; Strack & Mussweiler, 1997; for a related account, see Chapman & Johnson, 1994, 1999). The model attempts to explain anchoring by linking it to two principles that are fundamental to social cognition research: (1) *hypothesis-consistent testing* and (2) *semantic priming*. More specifically, the model postulates that comparing the judgmental target to the anchor value 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 actually 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). In order to generate the final numeric estimate, judges then rely primarily on easily accessible knowledge (Higgins, 1996), so that their estimate is heavily influenced by the anchor-consistent knowledge 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 most direct support for this notion stems from a series of studies which directly assessed the accessibility of target knowledge subsequent to the critical comparative judgment (Englich et al., 2006; Mussweiler & Strack, 2000a, 2000b). In one of these studies (Mussweiler & Strack, 2000a), participants were asked to compare the average price for a German car to either a high or a low anchor value (40,000 vs. 20,000 German Marks). Subsequent to this comparative judgment, the accessibility of target knowledge was assessed with a lexical decision task. In particular, participants judged whether presented items are existing words. The items included target words that are closely associated with expensive cars (e.g., Mercedes, BMW) and words associated with inexpensive cars (e.g., VW). Response latencies for these two types of target words clearly depended on the anchoring condition. In particular, judges were faster in recognizing words associated with expensive cars after a comparison with the high anchor than after a comparison with the low anchor. In contrast, words associated with inexpensive cars were recognized faster after a comparison with the low anchor. These findings demonstrate that the accessibility of anchor-consistent semantic knowledge about the target (e.g., knowledge associated with high prices after a comparison with a high anchor) is increased as a consequence of the comparative judgment.

Further evidence suggests that this accessibility increase is specific to the judgmental target itself. That is, the knowledge that is rendered accessible specifically pertains to the judgmental target. In one study demonstrating this specificity, for example, comparing the self as a judgmental target to a high anchor of general knowledge only increased the accessibility of knowledge indicating that the self is knowledgeable, whereas the accessibility of knowledge about a close other remained unchanged (Mussweiler & Strack, 2000a). These findings provide support for the core assumption of the selective accessibility model. Comparing the target to the anchor value does indeed appear to increase the accessibility of anchor-consistent semantic knowledge about the target. Using this knowledge as a basis for the absolute estimate produces the assimilation effect that is known as the typical consequence of anchoring.

Additional support for the selective accessibility model comes from a recent study that tested a prediction derived from the model (Bahník & Strack, 2016). In particular, 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. Bahník 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 that does not overlap with information normally used for making the absolute judgment of the average summer temperature and that 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 that 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). Consistently, anchoring effects do not diminish but get even stronger under sad mood compared to happy mood (Bodenhausen, Gabriel, & Lineberger, 2000; Englich & Soder, 2009). These pronounced anchoring effects under sad mood might be explained by the deeper and more thorough information processing under sad mood (e.g., Schwarz & Clore, 2007).

Recent studies (Frederick & Mochon, 2012; Mochon & Frederick, 2013) showed that anchoring can occur even when the target 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 the same degree by a comparative question related to the wettest place in the US (Mount Waialeale) as to Death Valley (Frederick & Mochon, 2012). Similarly, the estimate of the price of a camera is influenced to the same degree by a comparison question related to a GPS device as to the camera (Mochon & Frederick, 2013). 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. The studies therefore suggest that the selective accessibility mechanism may not be necessary for producing anchoring in the standard paradigm, even though 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 have 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 the anchoring effect. 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 the 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).

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. Both calorie estimates of a salad and cake are lower than that of a cheesesteak, so they should both lead to a lower judgment of calories in a cheesesteak, according to the scale distortion theory, which assumes that anchoring should be largely independent of the target of judgment. 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 cases 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. Numeric priming might contribute to anchoring effects, especially in cases of incidental anchors and under cognitive load. Selective accessibility seems to lie behind anchoring in cases 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 cases of little knowledge about the judgmental domain.

While the evidence suggests operation of different processes under different circumstances, there is little evidence that other 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, the interaction of the various processes 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 a numeric judgment toward a previously considered value (also known as "anchoring") 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, may persist over long periods of time, and are sometimes not reduced by explicit instructions to correct.
- There are various underlying mechanisms that contribute to anchoring effects. Anchoring may under various conditions result from insufficient adjustment from a previously considered standard, use of conversational inferences, numeric priming, selective accessibility of information consistent with an anchor, or distortion of a response scale.

Further readings

A recent review of anchoring research is given by Furnham and Boo (2011). The main accounts of anchoring are explored in more detail in Mussweiler and Strack (1999a), Epley and Gilovich (2001), and Frederick and Mochon (2012).

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APPENDIX

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

1 Is the mean winter temperature in Antarctica higher or lower than −17 (−43) °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?