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The Semantics of Anchoring

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Previous research has demonstrated that judgmental anchoring effects—the assimilation of a numeric estimate to a previously considered standard—are semantic in nature. They result because the semantic knowledge about the target object that is activated during the comparison with the anchor influences the absolute judgment. In addition to this semantic influence, the numeric anchor value itself may also yield an effect under specific conditions. The present research was designed to examine the relative strength of both mechanisms and explore their boundary conditions. Studies 1 and 2 demonstrate that semantic anchoring effects are more potent than purely numeric effects. Study 3 further suggests that purely numeric effects only operate if accessible semantic knowledge is inapplicable to the critical judgment so that semantic influences are incapacitated. The implications of these findings are discussed from the perspective of an integrative model which differentiates between two stages of anchoring. Whereas purely numeric influences appear to be limited to the stage of anchor selection, the actual comparison with the target involves more elaborate semantic processes.

Judgmental anchoring—the assimilation of a numeric estimate to a previously considered standard—may be one of the most remarkable influences on judgment and decision making for at least two reasons. First, anchoring effects are strikingly pervasive and robust. Not only do they influence judgments in a variety of domains such as general knowledge (Chapman & Johnson, 1999; Jacowitz & Kahneman, 1995; Mussweiler & Strack, 1999a, 2000a, 2000b;

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Strack & Mussweiler, 1997; Tversky & Kahenman, 1974; Wilson, Houston, Etling, & Brekke, 1996), probability estimates (Plous, 1989; Switzer & Sniezek, 1991; Tversky & Kahneman, 1974), legal judgment (Chapman & Bornstein, 1996; Englich & Mussweiler, in press), pricing decisions (Northcraft & Neale, 1987; Mussweiler, Strack, & Pfeiffer, 2000), and negotiation (Galinsky & Mussweiler, in press; Neale & Bazerman, 1991; Ritov, 1996) (for a recent review, see Mussweiler & Strack, 1999b), this influence is also virtually immune to corrective attempts (Wilson *et al.*, 1996; but see Chapman & Johnson, 1999; Mussweiler *et al.*, 2000, for exceptions). Second—and in marked contrast to its empirical prominence—the psychological mechanisms that produce anchoring have long remained an enigma.

THE SEMANTICS OF ANCHORING: ANCHORING AS A KNOWLEDGE ACCESSIBILITY EFFECT

To close this theoretical gap, we have recently proposed a Selective Accessibility (SA) model of anchoring (Mussweiler, 1997; Mussweiler & Strack, 1999a, 1999b, 2000a, 2000b; Strack & Mussweiler, 1997; for a related account, see Chapman & Johnson, 1999) which explains anchoring in terms of basic principles of social cognition research. The starting point for the development of this model is a close inspection of the judgmental tasks that are involved in the classic anchoring paradigm (Tversky & Kahneman, 1974). In this paradigm, judges make two consecutive judgments about the same target: a comparative and an absolute one. For example, in what is probably the best known illustration of anchoring effects in this standard paradigm (Tversky & Kahenmanm, 1974), participants were first asked to compare the percentage of African nations in the UN to an arbitrary number (65 or 25%) that was ostensibly determined by spinning a wheel of fortune. Participants' task was to indicate whether the percentage of African nations in the UN is higher or lower than this anchor number. Subsequent to this comparative judgment task, participants received a second absolute task in which they were to give their best estimate of the critical target quality, namely the percentage of African nations in the UN. The typical finding is that absolute estimates are assimilated toward the anchor that was provided in the comparative task. In the classic demonstration, for example, the mean estimate of judges who had received the high anchor was 45% compared to 25% for those who had received the low anchor.

In this standard paradigm, anchoring is a situation where the consequences of comparing a given target to a numeric standard are assessed with a subsequent absolute judgment of this target. Because—as any judgment—absolute target judgments are not made in an informational vacuum but reflect the implications of accessible target knowledge, one has to examine the informational consequences of the comparison to understand the mechanisms that lead to the assimilation of absolute estimates toward the anchor. Absolute judgments are likely to be based on the knowledge that is accessible at the time the judgment is made, so that analyzing the accessibility of target knowledge

promises to be a fruitful path in a quest for a more complete understanding of the anchoring enigma.

Within the SA model, we have attempted to take this path. On the most fundamental level, the basic assumption of the model is that anchoring is in essence a knowledge accessibility effect and is thus semantic in nature (for more detailed accounts of the model, see Mussweiler & Strack, 1999a, 1999b). More specifically, the model postulates that comparing the judgmental target to the provided anchor value changes the accessibility of knowledge about the target. In particular, the accessibility of an anchor-consistent subset of target knowledge is selectively increased. We assume that 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% are assumed to 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., "Africa is a huge continent" and "There are more African nations than I can keep in mind") (Klayman & Ha, 1987; Trope & Liberman, 1996). As a consequence, the accessibility of anchor-consistent knowledge is increased. In order to generate the final numeric estimate, judges then rely primarily on easily accessible knowledge (Higgins, 1996; Wyer & Srull, 1989), so that their estimate is heavily influenced by the anchor-consistent knowledge generated before. In our example, absolute estimates about the percentage of African nations in the UN would thus be based on the specific subset of target knowledge that was deliberately retrieved to be consistent with the assumption that this percentage is fairly high. Conceivably, using this knowledge leads to high estimates, so that the final estimate is assimilated to the anchor value.

Similarities between Anchoring and Knowledge Accessibility Effects

This conceptualization of anchoring as a knowledge accessibility effect is supported by a growing body of evidence which demonstrates that anchoring effects share many of the qualities that are characteristic of knowledge accessibility effects in general (for a review, see Higgins, 1996). For one, anchoring effects critically depend on the applicability of the knowledge that was rendered accessible during the comparative task. It has repeatedly been demonstrated that the extent to which increasing the accessibility of a specific concept in a priming task influences a subsequent judgment is determined by how applicable the activated concept is to this judgment (Higgins & Brendl, 1995; Higgins, Rholes, & Jones, 1977). In much the same way, the magnitude of anchoring depends on how applicable the knowledge that was rendered accessible during the comparative task is to the critical absolute judgment. For example, comparing the *height* of the Brandenburg Gate to a given anchor yields stronger effects on absolute estimates of the *height* of the Gate than on estimates of its *width* (Strack & Mussweiler, 1997; see also Chapman & Johnson, 1994; Mussweiler, Förster, & Strack, 1997). This may be the case because the knowledge generated during the comparative task has more direct implications for estimates of

height than for estimates of width (i.e., it is more applicable to judgments of height) so that the earlier are influenced more strongly. Thus, anchoring effects appear to depend on the applicability criterion (Higgins *et al.*, 1977) in much the same way as is characteristic of knowledge accessibility effects in general.

Applicability, however, is not the only factor that influences knowledge accessibility effects and anchoring effects alike. Research on the judgmental effects of priming has repeatedly demonstrated that the direction of a priming influence depends on how the accessible knowledge is used during the judgment task (Herr, 1986; Herr, Sherman, & Fazio, 1983; for discussions, see Higgins, 1996; Strack, 1992). If an accessible concept is similar to the judgmental target, it is typically used as a basis for the judgment, which leads to assimilation. If an accessible concept differs largely from the target, however, it will be used as a standard of comparison, which produces a contrast effect. Judgments about the ferocity of a fox, for example, are assimilated to a slightly more ferocious (i.e., similar) animal such as a wolf, so that the fox is judged to be more ferocious if wolf has previously been primed. Judgments about the same target, however, are contrasted away from an extremely ferocious animal such as a tiger, so that the fox is judged to be less ferocious if tiger has been activated (Herr *et al.*, 1983). In much the same way, the direction of anchoring effects (i.e., assimilation vs contrast) depends on whether the knowledge that was activated during the comparative task pertains to a target that is similar to the judgmental target of the absolute question or to a target that is largely dissimilar. For example, comparing the mean winter temperature in the Antarctic to a high vs low anchor (−20°C vs −50°C) produces an assimilation effect on absolute judgments of temperatures in the Antarctic (i.e., a maximally similar target). The same comparison, however, produces a contrast effect on absolute judgments of temperatures on Hawaii (a maximally dissimilar target). Here, higher estimates for the mean winter temperature on Hawaii are given if temperatures in the Antarctic had previously been compared to the low rather than the high anchor (Strack & Mussweiler, 1997). Thus, the direction of anchoring effects appears to depend on the similarity of the activated concept and the judgmental target, just as is true for knowledge accessibility effects in general.

A third characteristic anchoring and knowledge accessibility effects appear to share is that the time that is needed to make a given judgment depends on the degree of accessibility of judgment-relevant knowledge. In a classic priming study, for example, Neely (1977) demonstrated that participants were faster in judging whether a given word constitutes a word if a semantically related word had been presented beforehand. For example, participant's were faster in judging the word *robin*, if *bird* had been presented. Paralleling this dependency, response latencies for the absolute anchoring task have been demonstrated to depend on the extent to which the accessibility of judgment-relevant knowledge has been increased during the comparative task (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, however, do not only influence 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). Furthermore, judges who generate more anchor-consistent knowledge during the comparative task because they are in a sad mood—a condition that is typically associated with more elaborate processing (Bodenhausen, 1993)—show larger anchoring effects than judges in a neutral mood (Bodenhausen, Gabriel, & Lineberger, 2000).

Another characteristic of knowledge accessibility effects that is shared by anchoring is temporal robustness. Knowledge accessibility effects typically have fairly long-lasting effects on judgment. For example, it has been demonstrated that increasing the accessibility of a specific trait concept influences person judgments that are made 1 week after the priming episode (Srull & Wyer, 1980). The same temporal robustness also characterizes judgmental anchoring. In particular, it has been demonstrated that anchoring effects still occur, if the comparative and the absolute question are separated by a 1-week delay (Mussweiler, in press).

These parallels between anchoring and knowledge accessibility effects in general provide converging evidence in support of the assumption that anchoring effects are indeed knowledge accessibility effects in essence.

Direct Support for the Selective Accessibility Notion

The most direct support for this notion, however, stems from a series of studies which directly assessed the accessibility of target knowledge subsequent to the critical comparative judgment (Mussweiler & Strack, 2000a, 2000c). In one of these studies (Mussweiler & Strack, 2000a, Study 2), 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, we assessed the accessibility of target knowledge with a lexical decision task. In particular, participants made a series of lexical decisions including target words that are closely associated with expensive cars (e.g., Mercedes and 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, as is apparent from Fig. 1. 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.,

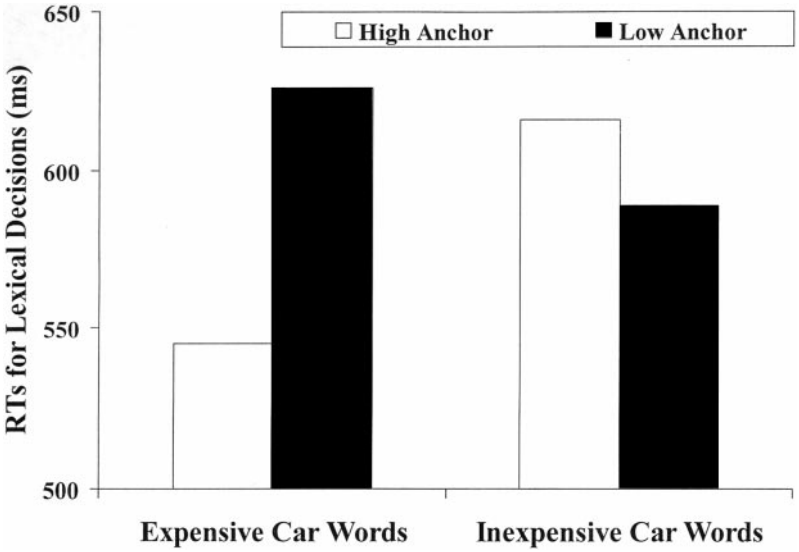

FIG. 1. Response latencies for lexical decisions as a function of word type and anchor (from Mussweiler & Strack, 2000a, with permission).

knowledge indicating high prices after a comparison with a high anchor) is increased as a consequence of the comparative judgment.

Additional evidence further suggests that this accessibility increase is specific to the judgmental target itself. That is, the knowledge that is rendered acccessible specifically pertains to the judgmental target. In one study demonstrating this specificity, 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, Study 3; see also Mussweiler & Strack, 2000c). These findings provide direct support for the core assumption of the SA 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.

Taken together, the described evidence strongly suggest that anchoring effects in the standard paradigm (Tversky & Kahneman, 1974) are in essence knowledge accessibility—as we have assumed—and are thus semantic in nature.

A CONCEPTUAL ALTERNATIVE: NUMERIC PRIMING

As an alternative to this semantic perspective on anchoring, it has been suggested that anchoring effects may be more superficial and purely numeric in nature (Jacowitz & Kahneman, 1995; Wilson *et al.*, 1996; Wong & Kwong, 2000). In particular, solving a comparative anchoring task may simply render the anchor value itself rather than a specific subset of target knowledge more

accessible, so that this value is likely to influence the subsequent absolute judgment. From this numeric perspective on anchoring, 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 recent 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).

Given that any accessible concept can influence judgment (Higgins, 1996), the accessibility of a purely numeric concept such as a numeric anchor representation can also have an effect on absolute estimates. A careful analysis of the previously presented evidence, however, reveals that focusing exclusively on the numeric anchoring value constitutes too narrow a perspective to allow for a complete understanding of the standard anchoring paradigm (Tversky & Kahneman, 1974). In particular, this evidence demonstrates that the semantic content that is associated with the anchor necessarily has to be taken into account to understand the complete pattern of findings in the standard paradigm. A purely numeric account can neither explain the fact that anchoring effects depend on changes in the judgmental dimension or the judgmental target, nor that they are characterized by a striking temporal robustness and also appear to involve a selective increase in the accessibility of semantic knowledge that pertains specifically to the judgmental target itself.

Were anchoring effects indeed 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 *height* of the Brandenburg Gate to a given anchor value should have identical effects on subsequent judgments of the *height* and the *width* of the Gate because the numeric properties of the anchor value are left unchanged by changing the judgmental dimension. Our evidence clearly demonstrates that this is not the case (Strack & Mussweiler, 1997; see also Mussweiler & Strack, 1997).

By the same token, comparing the average temperature in the Antarctic to a given anchor should yield identical effects on subsequent estimates for temperatures in the Antarctic and Hawaii because, again, the numeric anchor value itself remains untouched by the change in judgmental target. The fact that the direction of the influence critically depends on the object to which the comparative and the absolute anchoring tasks pertain (Strack & Mussweiler, 1997) clearly argues against a purely numeric perspective on anchoring.

Note also that the pattern of findings obtained by Strack and Mussweiler (1997) is inconsistent with an explanation that focuses on the absolute value of the anchor as the cause of anchoring effects. It has recently been suggested (Wong & Kwong, 2000) that the contrastive effect that comparing temperatures in the Antarctic to a given anchor has on subsequent estimates of temperatures on Hawaii may be attributed to differences in the absolute value of the specific anchors that were used in this demonstration. Because the absolute value of our low anchor (−50°C), so the argument goes, was higher than the absolute value of our high anchor (−20°C), judges who are superficially influenced by

the absolute value and ignore the sign of the anchor value when generating the absolute estimate may produce lower estimates after a comparison with the high rather than the low anchor (a contrast effect). From such a purely numeric perspective, however, the same contrast effect should also occur if the comparative and the absolute question pertain to the same target (i.e., the Antarctic). Just as is true for the condition in which we changed the judgmental target, the absolute value of our low anchor (−50°C) was larger than that of our high anchor (−20°C) in the condition in which the target remained unchanged. Because the absolute value of the anchor does not depend on the change of target, the same contrast effect should result in both cases. Our data clearly tell a different story and demonstrate that contrast only occurs if the comparative and the absolute question pertain to two targets that differ extremely on the judgmental dimension. If this is not the case and the judgmental target remains unchanged, the typical anchoring assimilation effect prevails. As we have lined out before, this finding is predicted by a semantic account of anchoring. At the same time, it contradicts the implication of a purely numeric account and renders this account implausible.

The temporal robustness of anchoring effects is also at odds with an exclusive focus on the numerics of anchoring. In marked contrast to the empirical evidence, a purely numeric account implies that anchoring effects are fairly transitive and short-lived. Because we are constantly exposed to arbitrary numbers, our daily routines (e.g., calling a friend or paying a bill) should immediately wipe out the effects of solving a comparative anchoring task. The fact that anchoring effects prevail for long periods of time such as a week is clearly in conflict with this implication and further renders a purely numeric conceptualization of the standard anchoring paradigm unconvincing.

Finally, the data that most directly demonstrates an increase in the accessibility of semantic knowledge about the judgment target (Mussweiler & Strack, 2000a) is difficult to reconcile with a numeric account. First, these data show an increase in the accessibility of semantic knowledge about the target using the standard method to examine semantic priming effects (i.e., a lexical decision task). Second, our data demonstrate a striking specificity of the selective accessibility effect. In particular, the accessibility of semantic knowledge that specifically pertains to the target of the comparative judgment rather than general concepts associated with the anchor value appear to be increased. Again, this finding directly contradicts the implications of a numeric account of anchoring.

Taken together these findings clearly demonstrate that anchoring effects in the standard paradigm cannot be explained by focusing exclusively on the numeric anchor value. Rather, it appears necessary to take the semantics of anchoring into account. The effects that have been demonstrated in the classic anchoring paradigm clearly demonstrate that the semantic target knowledge that is rendered accessible during the comparative task plays a pivotal role in the mediation of anchoring effects.

Although these data clearly show that numeric influences are secondary to semantic influences in the paradigm that is typically associated with judgmental anchoring, they may contribute to assimilation effects in contexts that

are relatively atypical of the standard anchoring situation because they are free of semantic content. It is long known that under specific circumstances "basic anchoring effects" (Wilson *et al.*, 1996) are obtained in paradigms that deliberately minimize semantic influences. For example, Wilson *et al.* (1996) demonstrated that copying five pages of numbers under the guise of a handwriting test may influence subsequent numeric estimates (e.g., the number of students who will get cancer in the near future). Similarly, comparing a first target to a given anchor may influence estimates about a second target that is completely unrelated to the first. For example, comparing the number of physicians that are listed in the local phone book to a high anchor may induce them to give higher absolute estimates for the unrelated quantity of African nations in the UN (Wilson *et al.*, 1996). Because the semantic knowledge that is activated during the comparison is not applicable to the critical absolute question in this paradigm, this specific type of an anchoring effect may well be open to purely numeric influences.

Taken together these findings indicate that although numeric influences may be of relatively minor importance in the standard anchoring paradigm, they may contribute to anchoring under specific conditions that minimize semantic effects and are thus atypical of the classic anchoring situation.

THE SEMANTIC–NUMERIC INTERPLAY: AN INTEGRATION

The preceding discussion suggests that the typical anchoring situation is best understood from a semantic perspective, whereas numeric processes are more likely to play a role if semantic influences are incapacitated. This suggests that a complete understanding of anchoring effects in different judgmental contexts may require an appreciation for and an integration of different underlying mechanisms. In fact, this has long been acknowledged in the field (Mussweiler, 1997; Mussweiler & Strack, 1999a, 1999b, 2000a; Wilson *et al.*, 1996). For example, Wilson *et al.* (1996) suggested that the anchoring process consists of different processing stages which involve different psychological mechanisms. In particular, numeric influences may be limited to the initial stage of determining an appropriate comparison standard for the judgmental target, whereas semantic processes are more likely to be at the core of subsequent stages. This integrative perspective is also apparent in our own writings in which we have repeatedly pointed out that ". . . it seems unlikely that—given the diversity of paradigms—all assimilation effects that have been labeled anchoring effects are mediated by the same mechanism" (Mussweiler & Strack, 2000a, p. 1050) and that the different "models of assimilation anchoring are complementary rather than mutually exclusive" (Mussweiler & Strack, 1999b, p. 157).

From this perspective, the critical question is not whether numeric or semantic influences on anchoring exist (Wong & Kwong, 2000)—this question has long been answered in the affirmative in both cases. Rather, the critical question concerns the relative contribution of both mechanisms and the specific boundary conditions under which they operate. To answer these questions, one has

to examine the underlying mechanisms of anchoring in a paradigm which allows the numeric as well as the semantic components to unfold. Investigating anchoring effects in a context that incapacitates semantic influences by exclusively using comparative and absolute tasks that pertain to unrelated objects (Wong & Kwong, 2000) does not put one in a position to evaluate the semantic contributions to anchoring and conclude that anchoring is "primarily dependent on the absolute value of the anchor but not on the semantics of the anchor" (Wong & Kwong, 2000, p. 331). In the present research, we examine these questions. In particular, Studies 1 and 2 investigate the relative contribution of semantic and numeric influences to anchoring in a paradigm that allows both mechanisms to unfold. Study 3 then examines the boundary conditions under which both processes are most likely to be influential.

STUDY 1

To examine the relative contribution of semantic and numeric influences to anchoring, Studies 1 and 2 compared the magnitude of anchoring effects that resulted under conditions which allow semantic influences to operate with those that preclude them. In particular, borrowing on a task used by Wong and Kwong (2000), we presented participants with comparative and absolute anchoring questions that either pertained to the same judgmental target (i.e., the length of the runway of the Nuremberg airport) or to two unrelated targets (i.e., the length of the runway and the price for a luxury bus). If the comparative and the absolute anchoring task pertain to the same judgmental target, then the semantic knowledge that was activated during the comparison is applicable to the absolute estimate and can thus exert an effect. If both tasks pertain to two unrelated targets, however, the activated semantic knowledge is inapplicable to the absolute estimate, so that semantic influences are eliminated and the net numeric anchoring effect becomes apparent. A combined analysis of these two conditions allows one to examine the relative contribution of numeric and semantic anchoring influences. This is the case because purely numeric anchoring effects remain uninfluenced by changes in the judgmental target of the comparative and the absolute anchoring question, so that they should be equally strong in both conditions. Semantic anchoring effects, on the other hand, are only apparent if both tasks apply to the same target. Thus, comparing the size of the purely numeric effect that is obtained if the judgmental target is changed to the size of the combined semantic–numeric effect that is obtained if the target remains unchanged allows one to estimate the relative magnitude of the numeric and the semantic anchoring effect.

In Study 1, the applicability of accessible knowledge to the absolute judgment was manipulated by changing the target of the absolute judgment and holding the target of the comparative judgment constant. In Study 2, the target of the comparative judgment was varied and the target of the absolute judgment remained unchanged.

Method

Studies 1 through 3 were combined into one questionnaire, which was administered to the same group of participants. Thus the general procedure is identical for all three studies, so we only describe Study 1 in detail and note deviations for Studies 2 and 3.

Participants. We recruited 59 students at the University of Würzburg as participants and randomly assigned them to one of four experimental conditions. They were asked to take part in a pretest for the construction of a general-knowledge questionnaire and were offered a chocolate bar as compensation.

Materials. Congruent with the standard anchoring procedure, participants received pairs of general-knowledge questions consisting of a comparative and an absolute question. Thus, for each question pair they were first asked to indicate whether the numerical value of a target was higher or lower than a particular anchor value. They were then asked to give an exact estimate for the numerical value.

The questionnaire consisted of a total of eight question pairs with each pair printed on a separate page. The first pair was the critical one for Study 1. Two of the following were the critical question pairs for Studies 2 and 3. The remaining question pairs were filler items. The sequence of the questions was held constant. To control for order effects, the different versions of the questions that corresponded to the experimental conditions of the respective studies were combined at random.

In the critical pair of Study 1, the comparative question always referred to the length of the runway of the airport in Nuremberg (Germany). In particular, about half of the participants were asked to indicate whether the runway of the Nuremberg airport is longer or shorter than the high anchor of 7300 m, the other half was asked to indicate whether it is longer or shorter than the low anchor of 400 m. For about half of the participants, the subsequent absolute question referred to the same target, whereas for the other half, the judgmental target was changed. In particular, the first group was asked to indicate how long the runway of the Nuremberg airport is (in meters), whereas the second group was asked to estimate the price of a brand new luxury bus (in thousand German marks). In sum, the four experimental conditions represent all four combinations of Anchor (high vs low) and Target (unchanged vs changed).

Procedure. Participants were recruited while studying at the university library. Upon agreement to participate, they were given the questionnaire and told to read instructions carefully. Here, they were informed that they were taking part in a pretest for the construction of a general-knowledge questionnaire. The ostensible purpose of the pretest was to find the best wording for general-knowledge questions. To reduce the prescribed informativeness of the anchors and thus discourage conversational inferences (Grice, 1975) participants were told that the values were randomly selected.[1] In particular, it was

[1]It has been suggested (e.g., Jacowitz & Kahneman, 1995) that applying implicit rules of natural conversations (Grice, 1975) to standardized situations (e.g., Clark & Schober, 1992; Schwarz, 1994;

pointed out that these values had been determined by spinning a wheel of fortune. This process was described in detail, and the fact that as a consequence of their random selection the anchors are not informative with respect to the true value of the target was explicitly pointed out. It was further explained that the random selection of the anchors was necessary to minimize their impact on the answers and to identify the impact of different question formats. Finally, participants were instructed to answer the questions as accurately as possible.

Results

To pool answers across different content domains, absolute estimates were transformed into *z* scores scores for each target. The resulting means thus reflect participants' average deviation from the target mean in units of the pertinent standard deviation.

Inspection of the means given in Fig. 2 reveals that absolute estimates were assimilated toward the provided anchor value. In particular, higher estimates were given if the high ($M = .37$) rather than the low ($M = -.37$) anchor had been provided. More important, however, the size of this anchoring effect critically depended on whether the comparative and the absolute question

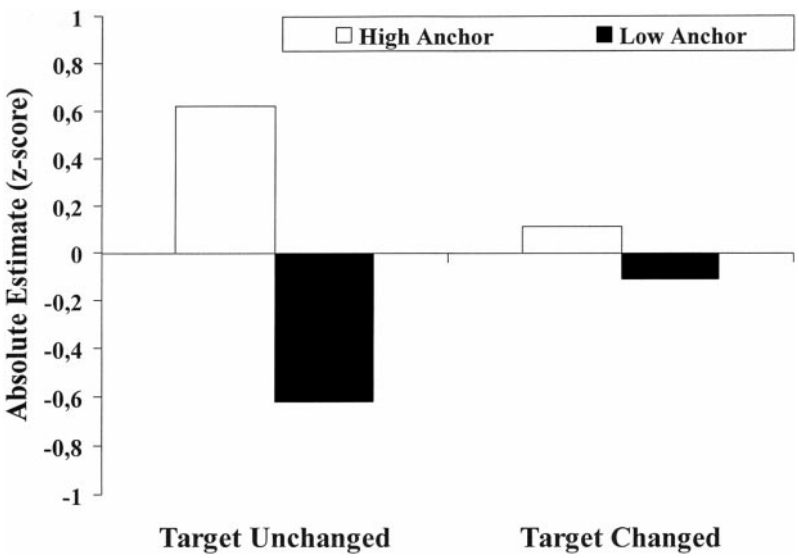

FIG. 2. Absolute estimates (*z* scores) by target and anchor (Study 1).

Strack & Martin, 1987) allows participants to use the anchor value in order to infer the actual range of possible answers. Participants who expect the experimenter to be maximally informative (see Grice's, 1975, *maxim of quantity*) in asking his or her questions may assume that the anchor value is close to the actual value and consequently position their estimate in its vicinity. This explanation, however, presupposes that the anchor value is deliberately selected by the experimenter. Thus, conversational inferences cannot explain the effects of randomly selected anchor values.

pertained to the same judgmental target or to two different targets. In particular, anchoring was more pronounced if the judgmental target remained the same than when it was changed.

In a 2 (Anchor: high vs low) × 2 (Target: unchanged vs changed) ANOVA using the *z*-transformed absolute estimates as dependent variables, this pattern produced a significant interaction effect, $F(1, 55) = 4.71$, $p < .04$. In this analysis the main effect for Anchor also reached significance, $F(1, 55) = 9.77$, $p < .01$. Subsequent analyses further revealed that the difference between the high and low anchor conditions was only reliable when the target remained unchanged, $t(55) = 3.77$, $p < .001$, but not when it was changed, $t(55) = .67$, *ns*.

STUDY 2

Method

Participants. We recruited 55 students at the University of Würzburg as participants and randomly assigned them to one of four experimental conditions.

Materials. To demonstrate the generalizability of the effects we obtained in Study 1, Study 2 used a different set of judgmental targets. In particular, the critical question pair referred to the height of the World Trade Center. For about half of the participants the comparative and the absolute question pertained to the World Trade Center, and for the other half only the absolute question pertained to the World Trade Center, whereas the comparative question pertained to a different target. Specifically, in the comparative judgment task participants were asked either to indicate whether the World Trade Center has more or less floors than the given anchor value or whether the United Nations have more or less members than the exact same anchor. For about half of the participants the comparative question included the high anchor of 160, and for the other half it included the low anchor of 40. Subsequent to the comparative judgment, all participants were asked to estimate the number of floors of the World Trade Center. Thus, the four experimental conditions resulted from an orthogonal combination of Anchor (high vs low) and Target (unchanged vs changed).

Procedure. The procedure was identical to that used in Study 1.

Results

Inspection of the means given in Fig. 3 reveals that—as is true in Study 1—the anchoring effect critically depended on whether the comparative and the absolute judgment pertained to the same target or to two different targets. In particular, the typical anchoring assimilation effect was only obtained if the judgmental target remained unchanged. Here, higher estimates resulted for the high anchor than for the low anchor. If the target was changed, however, this effect did not occur.

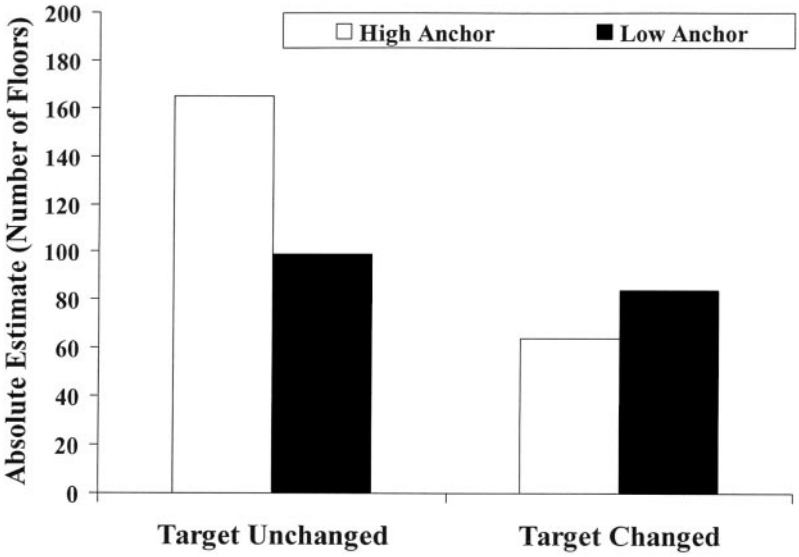

FIG. 3. Absolute estimates for the number of floors of the World Trade Center by target and anchor (Study 2).

This pattern of means produced a significant interaction effect in a 2 (Anchor: high vs low) × 2 (Target: unchanged vs changed) ANOVA using the absolute estimates as the dependent variable, $F(1, 51) = 10.76$, $p < .002$. Subsequent analyses further revealed that the difference between the high and the low anchor was only reliable in the unchanged target condition, $t(51) = 3.55$, $p < .001$, but not in the changed target condition, $t(51) = 1.1$, *ns*.

Discussion

Taken together, the results of Studies 1 and 2 clearly demonstrate that the magnitude of anchoring depends on how applicable the semantic knowledge that was rendered accessible during the comparative task is to the absolute judgment. If both judgments pertained to the same judgmental target, so that semantic influences were allowed to exert an effect, reliable anchoring effects resulted. If, however, semantic influences were eliminated by changing the judgmental target, no reliable effect occurred. Consistent with some of our earlier findings (e.g., Mussweiler *et al.*, 1997; Strack & Mussweiler, 1997) this suggests that within the standard anchoring paradigm, semantic influences are more tangible than purely numeric effects.

STUDY 3

The results of Studies 1 and 2 suggest that semantic influences on anchoring are more potent than purely numeric effects. These data, however, are mute with respect to the question of whether purely numeric influences operate at all in a situation that allows for semantic anchoring (e.g., the standard anchoring paradigm). Do semantic and numeric processes influence absolute estimates in

an additive manner? Or are pure numeric influences only apparent if semantic effects are undermined? Study 3 was designed to investigate this question. Wong and Kwong (2000) have argued that one way to show pure numeric effects is to compare the influences of two anchors that have identical semantic extremity but differ with respect to their numeric extremity because they are expressed in different measuring units (e.g., meters and kilometers). In one study, for example, they demonstrated that comparing the length of the runway of the Hong Kong airport to an anchor of 7300 m yielded higher absolute estimates for the price of a brand-new double decker bus than comparing the runway to a semantically identical but numerically smaller anchor of 7.3 km. This suggests that under conditions which preclude the operation of semantic processes, the absolute value of a numeric anchor may have an effect on subsequent judgments. Would such a pure numeric influence also hold if semantic processes are allowed to operate? Study 3 examined this question by comparing the effects of anchors with different semantic implications and similar absolute values (e.g., 1.6 and 5.1 km) with the effects of anchors that have identical semantic implications and different absolute values (e.g., 1.6 km and 1600 m). These different anchor types were examined in a context that allows semantic influences to operate (i.e., semantic knowledge is applicable to the absolute judgment) and in a context that precludes such influences (i.e., semantic knowledge is inapplicable).

In particular, participants were asked to compare the height of the highest elevation in the Ural mountain range to either a high (5100 m) or a low anchor (1600 m) that was expressed in terms of meters or kilometers. They were then either asked to estimate the highest elevation in the Ural (target unchanged) or the number or languages that are spoken in the world (target changed). From a purely numeric perspective, the largest difference in the extremity of the provided anchors is produced by changing the measurement unit. Compared to the large differences in absolute value caused by changing the unit (e.g., 1.6 vs 1600) the differences within one unit (e.g., 1.6 vs 5.1) are relatively small and should thus have little effect. From a semantic perspective, however, the large numeric differences between anchors expressed in different units should have little effect because the semantic implications are identical. Numerically small differences (e.g., 1.6 km vs 5.1) within one unit, however, should have large effects because they have different semantic implications. Thus, combining these two types of anchor manipulations enables us to investigate the impact of semantic and numeric influences in situations that allow for a semantic influence or preclude such an influence.

Method

Participants. We recruited 110 students at the University of Würzburg as participants and randomly assigned them to one of eight experimental conditions.

Materials. As in Studies 1 and 2 the critical comparative and absolute questions of Study 3 pertained to the same judgmental target for about half

of the participants and to two different targets for the other half. In particular, the comparative question always pertained to the height of the highest elevation in the Ural mountain range. The absolute question then either pertained to the height of the highest elevation or to the number of languages that are spoken in the world. In the comparative question about half of the participants were asked whether the highest elevation in the Ural is higher or lower than a high anchor value, the other half received a low anchor value. The high anchor was set at 5100 m, whereas the low anchor was set at 1600 m. In addition to the magnitude of the anchor, we also manipulated the unit in which it was expressed, so that about half of the participants received an anchor value in units of meters, whereas the other half received an anchor in units of kilometers. Thus, in the comparative task participants were asked to compare the height of the highest elevation in the Ural to one of four anchor values as follows: 5100 m, 5.1 km, 1600 m, or 1.6 km. In the subsequent absolute judgment participants were then either asked to estimate the height of the highest elevation in the Ural (in meters) or the number of languages that are spoken in the world. In sum, the eight experimental conditions resulted from a combination of Anchor (high vs low), Unit (meter vs kilometer), and Target (unchanged vs changed).

Procedure. The procedure was identical to that of the preceding studies.

Results

As in Study 1 absolute estimates were transformed into *z* scores scores to allow for a comparison of estimates for the different target quantities.

The means provided in Table 1 indicate that the influence of the Anchor value as well as the Unit in which it was expressed critically depended on whether the comparative and the absolute question pertained to the same target or to two different targets. In particular, the typical anchoring effect was only obtained, if the target remained unchanged. Here, higher estimates resulted for the high anchor ($M = .52$) than for the low anchor ($M = -.52$), which is not the case under conditions of target change ($M = -.16$, for the high anchor, $M = .18$, for the low anchor). In a 2 (Anchor: high vs low) $\times$ 2 (Unit: m vs km) $\times$ 2 (Target: unchanged vs changed) ANOVA using the *z*-transformed absolute estimates as the dependent variable, this pattern was borne out in a significant interaction of Anchor and Target, $F(1, 102) = 15.2$,

TABLE 1

Absolute Estimates (*z* scores) by Anchor, Unit, and Target (Study 3)

	Target unchanged		Target changed	
Anchor	meters	kilometers	meters	kilometers
High	.64	.41	.11	−.44
Low	−.68	−.37	.50	−.23

Note. *N* is between 13 and 15 per cell.

$p < .001$. In this analysis the main effect of anchor also reached significance, $F(1, 102) = 4.6$, $p < .04$. Subsequent analyses further revealed that the difference between the high and the low anchor condition was only significant if the target was unchanged, $t(102) = 4.33$, $p < .001$, but not when it was changed, $t(102) = 1.23$, $p > .2$.

The effect of the unit in which the anchor was expressed also critically depended on the target change. If the comparative and the absolute question pertained to the same target, absolute estimates did not depend on the anchor unit ($M = .04$ for m and $M = .00$ for km). If the judgmental target was changed, however, higher estimates resulted if the anchor had been expressed in meters ($M = .30$) rather than kilometers ($M = -.35$). This pattern yielded a significant interaction of Unit and Target, $F(1, 102) = 3.95$, $p < .05$. Subsequent analyses further revealed that the difference between the meter and kilometer unit condition was only significant if the target was changed, $t(102) = 2.6$, $p < .01$, but not if it remained unchanged, $t(102) = .18$, *ns*.

Discussion

The results of Study 3 demonstrate that the semantic and the numeric influence of a given anchor critically depends on the applicability of semantic knowledge. If the comparative and the absolute judgment pertain to the same target so that semantic knowledge is applicable, then anchors that have similar numeric values but different semantic implications produce largely different estimates. Under such conditions of semantic applicability, however, we found no indication of a purely numeric anchoring effect: Anchors with extremely different absolute values but similar semantic implications produced similar estimates. The purely numeric effect of anchors expressed in different measuring units appears to be limited to situations in which—by definition—semantic influences cannot operate because the activated semantic knowledge is inapplicable to the critical judgment. This suggests that purely numeric influences are of minor importance in the paradigm that is typically associated with anchoring and are limited to judgmental contexts that are atypical of the classic anchoring situation.

GENERAL DISCUSSION

Previous research has clearly demonstrated that standard anchoring effects are semantic in nature and result from a process of selective accessibility. That is, semantic knowledge about the target object that is activated during the comparison with the anchor influences the absolute judgment. Under specific circumstances, the numeric anchor value itself may also yield an effect. The present research was designed to examine the relative strength of both mechanisms and to explore their boundary conditions.

Taken together our findings suggest that semantic anchoring effects are more potent than purely numeric effects. In two studies we found reliable anchoring effects only under conditions which allowed for a semantic influence.

Under conditions which precluded such influences by rendering activated semantic knowledge inapplicable to the critical target judgment and thus assessed purely numeric influences, however, the resulting anchoring effects were weak and unreliable.

Furthermore, our data do not provide any indication that purely numeric influences operate when semantic knowledge is applicable. Although Study 3 showed a clear numeric anchoring effect under conditions that preclude semantic influences, the same manipulation did not influence judgments for which activated semantic knowledge was applicable. This suggests that purely numeric influences may be limited to situations in which the semantics of anchoring cannot operate. In this respect, purely numeric anchoring may have little to do with what is typically seen as the standard anchoring paradigm in which a comparative and an absolute judgment is made about the same target (Tversky & Kahneman, 1974).

Integrating Semantic and Numeric Influences: Anchoring as a Two-Stage Process

From an integrative perspective, the current findings suggest that to allow for a complete understanding of the anchoring phenomenon, one has to differentiate between the different stages of anchoring and identify those psychological mechanisms that are of primary importance for them (Mussweiler & Strack, 1999a, 1999b, Wilson *et al.*, 1996). At least two stages which appear to be clearly distinguishable with respect to the processes they involve can be differentiated: the *selection* of a judgmental anchor and its subsequent *comparison* with the target (for a related view, see Wilson *et al.*, 1996).

Although selection processes do not play much of a role in the standard anchoring paradigm (Tversky & Kahneman, 1974) because here the standard is explicitly provided to the judges, they may constitute a core aspect of many judgments in everyday life. Theorizing in different areas of psychology has repeatedly pointed out that human judgment is essentially relative or comparative in nature, even if a comparison is not explicitly asked for (e.g., Festinger, 1954; Helson, 1964; Kahneman & Miller, 1986). In fact, even in target domains for which judges have abundant knowledge available, they appear to engage in comparative target evaluation. One case in point are self-evaluative judgments. Although the self may well be the most richly represented cognitive structure (Kihlstrom & Cantor, 1984), people appear to spontaneously engage in comparisons with others when asked to evaluate the self (Festinger, 1954; Gilbert, Giesler, & Morris, 1995). Such a tendency toward comparative evaluation is likely to be even more pronounced when judges have relatively little target knowledge available, as is typically the case in anchoring studies. Judges who desperately search for information that may help them to estimate a quantity they have never thought about are likely to consider the target quantity in comparison to a relevant standard. Participants who are asked to estimate the number of African nations in the UN, for example, may compare this target quantity with a number that comes to their mind because they have previously

compared it to the unrelated quantity of the number of physicians listed in the local phone book (Wilson *et al.*, 1996). Thus, an unrelated anchor value may be selected as a comparison standard for the generation of the target estimate, so this stage of standard selection is open to purely numeric influences.

The outcome of this process of standard selection is likely to influence the subsequent process of target evaluation. Selecting a standard by itself is not sufficient to influence how the judgmental target is judged. Rather, these effects result from the process of comparing the selected standard to the judgmental target. Thus, the purely numeric anchoring effects that have been demonstrated are likely to have occurred because the selected numeric anchor value was then used as a standard for a subsequent comparison with the judgmental target. It is this comparison stage in which the actual influence on target evaluations is rooted. In most situations, the mere selection of a given standard will ultimately lead to an assimilation of the target estimate toward this standard because the default effect of the subsequent comparison is assimilation.

In order for a selected standard to be helpful in the process of evaluating a given target, it has to be related to the characteristics of the judgmental target. This process necessarily requires the activation of semantic target knowledge and is—in light of the accumulated evidence (see Mussweiler & Strack, 1999b)—likely to involve processes of selective accessibility. The current findings further suggest that this comparison stage is relatively immune to purely numeric influences. Once a comparison standard has been selected, it appears to be mostly the semantic content that is activated during its comparison with the target rather than its pure numeric qualities that influence target evaluations.

From this perspective, there appear to exist at least two clearly distinguishable types of anchoring effects: a relatively shallow anchoring influence that operates at the stage of standard selection and a deeper anchoring effect that is rooted in the comparison stage. Notably, it is the latter effect that is typically seen as the classic instantiation of anchoring. Whereas *selection anchoring* is open to purely numeric effects and is thus likely to be relatively short-lived, *comparison anchoring* appears to be immune to such shallow influences. Rather, the actual comparison appears to involve a relatively elaborate process of testing the hypothesis that the target quantity may be similar to the comparison standard by selectively generating target knowledge which supports this assumption. This hypothesis-testing process increases the accessibility of standard-consistent knowledge about the target which influences subsequent target judgments.

One implication of this differentiation is that anchoring processes may indeed be less heuristic than was originally assumed (Tversky & Kahneman, 1974). In fact, the processes than underlie standard anchoring effects appear to be fairly elaborate and systematic in nature. Although a more shallow and heuristic anchoring influence also exists, this influence does not appear to operate in the judgmental situation that is most closely associated with the term anchoring. Given the immense diversity of paradigms that have been used to produce

"anchoring effects," however, it seems little surprising that a careful differentiation of different processes that operate in paradigms which involve clearly different judgmental tasks is called for. With such a perspective on psychological processes rather than judgmental effects we may well find that what has previously been considered as instantiations of one judgmental heuristic called "anchoring" is actually a conglomeration of fairly diverse phenomena whose similarity rests solely on the net outcome they produce.

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