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# The anchoring-bias in groups

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## ABSTRACT

Decision-making groups decide on many numerical issues, which makes them potentially vulnerable to cognitive anchors. In the current study we investigated (1) whether the anchoring-bias operates in groups, (2) under which circumstances group anchoring is more or less likely to occur and (3) which processes underlie the anchoring-bias in groups. In three group decision-making studies we found that cooperative groups were susceptible to anchors. However, the anchoring-bias in groups was mitigated when groups were made process accountable or competitively motivated. Finally, we investigated whether the anchoring bias in groups operated through a fast and early influence on individual preferences, or through biased information exchange. We found evidence for the former process, but not for the latter.

## 1. The anchoring-bias in groups

Trial parties ask for punitive damages, negotiation teams invest in developing their outside alternatives and benchmarks, corporate investment boards know what rival companies invested, and selection committees remember the test-score of the previous candidate. In all these cases groups are confronted with anchors – numerical values that can influence and bias subsequent judgments (Tversky & Kahneman, 1974). While the biasing effects of anchors on individual decision makers have been demonstrated repeatedly (Furnham & Boo, 2011), little is known about when anchors influence group decision-making. Indeed, although earlier work suggests that groups will be influenced by anchors, three key issues remain unresolved. First, little is known about conditions that amplify or mitigate possible anchoring-bias in groups. Second, we have little insight into which processes underlie anchoring in groups and third, there is limited insight into whether groups are more or less biased by anchoring than individual decision makers. Here we address these voids with three group decision-making experiments that reveal whether and how anchoring-bias operates in groups and influences group judgment and decision-making.

### 1.1. The anchoring-bias

When people make judgments or estimates about an uncertain situation they tend to rely on initial, salient values, impressions, or pieces of information – often called “anchors” (Epley & Gilovich, 2010; Mussweiler & Strack, 2000; Tversky & Kahneman, 1974). In one now seminal study, participants were asked to estimate the percentage of

African countries in the United Nations. Participants receiving a low anchor (10%) estimated 25%, while those receiving a high anchor (65%) estimated 45% (Tversky & Kahneman, 1974). Anchoring has proven to be a pervasive judgmental bias affecting novices and experts alike (Loschelder, Frieze, Schaerer, & Galinsky, 2016). For example, anchors affect purchase quantity decisions (Wansink, Kent, & Hoch, 1998), concession making in negotiations (De Dreu, Koole, & Steinel, 2000; Galinsky & Mussweiler, 2001; Loschelder, Trötschel, Swaab, Frieze, & Galinsky, 2016), performance judgments (Thorsteinson, Breier, Atwell, Hamilton, & Privette, 2008), credit card repayments (Stewart, 2009), and real estate agents' housing price estimates (Northcraft & Neale, 1987). The anchoring effect thus is not only a robust psychological phenomenon (Klein et al., 2014), it also affects individual judgment and decision-making in a broad range of settings and situations.

Anchoring influences individuals for several reasons. The Selective Accessibility Model (Mussweiler & Strack, 1999, 2000; Strack et al., 1997), explains anchoring effects in terms of confirmatory hypotheses testing. For example, when individuals are asked if Gandhi lived longer or shorter than 120 years, they tend to engage in confirmatory hypothesis testing (e.g., searching for information supporting Gandhi's old age), which can be more or less thorough and effortful (Chapman & Johnson, 1999; Mussweiler & Strack, 2001; Wegener, Petty, Blankenship, & Detweiler-Bedell, 2010). During this process of confirmatory hypothesis testing, anchor-consistent knowledge becomes activated (e.g., Gandhi grew very old) even when one knows that Gandhi did not reach the age of 120 (Mussweiler & Englich, 2005), and this information influences the final judgment (see Brewer & Chapman,

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2002). Alternatively, the anchoring-bias is explained by insufficient adjustment (Tversky & Kahneman, 1974). According to this theory anchors are a starting point for one's estimation process. People then adjust too little because they stop adjusting when they reach a plausible value (Epley & Gilovich, 2006; Furnham & Boo, 2011).

Although some debate exists on whether the anchoring-bias is explained by selective accessibility, insufficient adjustment (Tversky & Kahneman, 1974), or both (Chaxel, 2014; Simmons, LeBoeuf, & Nelson, 2010), evidence has accumulated for the idea that selective accessibility operates especially for externally generated anchors, such as anchors provided by third parties such as experimenters or organizational leaders (Epley & Gilovich, 2001, 2005, 2006, 2010; Furnham & Boo, 2011). In the present studies externally provided anchors were investigated, rendering selective accessibility the more important mechanism for individual-level anchoring during group decision-making.

### 1.2. The anchoring bias in group decision-making

Groups are often assumed to be less biased, more rational, and to make better decisions than individuals (Tindale, Kameda, & Hinsz, 2003). Across the board however, there is mixed evidence for this claim (Gigone & Hastie, 1993; Kerr, MacCoun, & Kramer, 1996; Kerr & Tindale, 2004; Laughlin, Bonner, & Altermatt, 1998; Laughlin, VanderStoep, & Hollingshead, 1991; Sunstein, 2004; Whyte, 1993). Although groups tend to perform equal or better than their best member on intellectual tasks that have a demonstrably correct answer and high information load (Laughlin et al., 1998, 1991), often they appear to be as biased as, or even more biased than, individuals operating alone and independently (Kerr et al., 1996; Kerr & Tindale, 2004).

Suboptimal group outcomes are due to (combinations of) biased information-driven and preference-driven processes (De Dreu, Nijstad, & Van Knippenberg, 2008; Hastie, Penrod, & Pennington, 1983; Schulz-Hardt, Brodbeck, Mojzisch, Kerschreiter, & Frey, 2006; Stasser & Birchmeier, 2003; Winquist & Larson, 1998). Information-driven decisions occur when members seek, communicate, and integrate relevant information and arguments. Yet information is typically shared selectively and processed in a biased fashion. For example, group members give more weight to their own information and to common information, than to other members' information, and information that is less common (De Dreu et al., 2008; Schulz-Hardt et al., 2006; Stasser & Titus, 1985, 1987). Consequently, when group members' individual knowledge and information is biased, group discussion amplifies initial bias and the quality of group decision-making suffers substantially.

Preference-driven decisions occur when members take stock of the current preferences in the group and weight and aggregate these preferences. Typically, group members pool preferences early on in the decision process, and tend to settle for either the majority or the median preference (Davis, 1973, 1996; Laughlin & Earley, 1982; Schulz-Hardt et al., 2006). Accordingly, the more individual preferences within a group are biased, the more biased the group decision-making will be. Indeed, in a study by Whyte and Sebenius (1997) participants received an individual anchor before any group interaction took place and when they were put together in groups, the pooling of their biased individual preferences resulted in group decisions that were influenced in the direction of the individual anchors given before group discussion.

The initial evidence for group decisions being influenced by anchors notwithstanding, several issues remain elusive. Specifically, existing work leaves unanswered whether and when anchors presented at the group level affect the group's decision. Indeed, previous work did not show that groups collectively are vulnerable for the use of an anchor, but rather showed that individually anchored persons influence groups decisions by pooling their respective estimates. There are two reasons to assume that the anchoring-bias in groups could be different from the individual-level anchoring-bias.

First, previous work suggests that groups have a tendency to ignore or reject outside information, which could apply to a group-level

anchor as well. For example, work on advice utilization showed that when groups of individuals interact to reach a joint decision, they tend to be more confident in their own estimates, which led them to utilize advice to a lesser extent than individuals deciding alone (Minson & Mueller, 2012, 2013; Schultze, Mojzisch, & Schulz-Hardt, 2013). Because anchoring effects seem to be mitigated by confidence (Jacowitz & Kahneman, 1995) and groups indeed tend to be more confident than individuals (Patalano & LeClair, 2011), one might expect groups to be less influenced by the anchoring bias when the anchor is presented at the group-level.

Second, unlike in the study by Whyte and Sebenius (1997), when individual preferences are not biased by an anchor prior to group discussion, multiple different anchors (i.e. personal preferences) might enter the discussion space. For example, trial judges deal with both the prosecution's demand (an external anchor) and the sentencing preferences held by each individual judge. According to the 'competing anchors hypothesis', when individually generated anchors compete with the external anchor, it renders the latter less influential (Sniezek, 1992; Whyte & Sebenius, 1997). Indeed, Switzer and Sniezek (1991) found that individuals' performance predictions were less biased by an arbitrary, externally determined goal when a contradictory relevant anchor was introduced, such as others' performance (see also Galinsky & Mussweiler, 2001; Schaerer, Loschelder, & Swaab, 2016; Schaerer, Swaab, & Galinsky, 2015). Thus, decision makers appear to give more weight to cues or anchors deemed more relevant, which might mean that externally provided anchors are less influential when self-generated anchors are present, like group members' individual pre-anchor preferences.

### 1.3. Overview

In sum, theory and research on group judgment and decision-making suggests that groups tend to be sensitive for judgmental biases, and this should also hold for the anchoring-bias. However, work on advice, confidence and competing anchors suggest that groups might be less affected by anchors. To establish whether the anchoring-bias operates in groups, in an initial study we compared groups presented with a low versus high anchor. In Studies 2 and 3, we tested conditions that amplify or mitigate possible anchoring-bias in groups, and the processes that underlie anchoring in groups.

## 2. Method study 1

### 2.1. Design and participants

Participants ( $N = 72$  graduate and undergraduate students; 23 men;  $M = 22.62$  years,  $SD = 4.70$  years) were randomly assembled in twenty-four 3-person groups; groups were then randomly assigned to a low or high anchor condition. Sample size was based on a large replication project (Klein et al., 2014) in which five classic anchoring studies were replicated 36 times, which revealed an average median effect-sizes of  $d = 1.87$ . Using this effect-size, an independent  $t$ -test with 80% power requires a total sample size of 12. Because these effects pertain to individuals rather than groups, we doubled sample size to 24 groups. The study was approved by the local Psychology Research Institute Ethics Review Board and participants provided informed-consent. They were compensated with course-credit or €3.50.

### 2.2. Procedure and decision-making task

Upon entering the laboratory, three participants forming one group were seated behind a table, separated by wooden partitions, which prevented them from seeing each other's answers but allowed them to see each other. After individually filling out a short demographics questionnaire, and when all group members were ready, participants received a realistic 7-page criminal case about an alleged rape and were

given 15 min to examine the materials individually and without communication. The case resembled the materials described in [Mussweiler and English \(2005\)](#), and was formulated in such a way that participants would agree on the defendant's guilt. This would ensure that participants would also determine a prison sentence. The case, including statements from all parties and expert opinions, described that Mark W. and Anne L. went out for drinks with colleagues. They flirted, leading Anne to miss her bus and Mark offering to give her a ride home. Instead of bringing her home he took her to a deserted meadow, where he forced himself onto her. In a pretest of the materials ( $N = 38$ ) only one participant declared the defendant not guilty and five reported they did not know.

After reading the case, participants individually and without consulting others noted their personal sentencing preference. Next, the wooden partitions were removed and groups received the prosecutor's demand (see "Manipulation of Anchor"). Group members were allowed to communicate about the guilt of the defendant and were asked to collaboratively reach a joint sentencing judgment. After reaching a sentencing judgment, the wooden partitions were replaced and all participants alone and without communication answered several additional questions about their decision (see Online Supplementary Information). Hereafter, participants were thanked, debriefed and received their credit or payment.

### 2.3. Manipulation of anchor

Importantly, the anchor was presented at the group level, rather than presented to individuals separately (contrary to [Whyte & Sebenius, 1997](#)). Each group drew one lot from a bowl, which was told to contain the numbers 1 to 100 (see [Englich, Mussweiler, & Strack, 2006](#) for a similar procedure using loaded dice). The lot represented the prosecutor's demand (e.g., lot 25 meant a 25 month sentencing demand). Unknown to participants, the bowl only contained the numbers 6 (low anchor) or 61 (high anchor). These anchor values were determined based on a pretest in which 37 individuals read the case and indicated a sentencing judgments ( $M = 27.76$  months,  $SD = 34.10$ ), and roughly corresponded with the 10th and 90th percentile of the sentences generated without any anchor being given.

### 2.4. Dependent variable

#### 2.4.1. Sentencing judgment

Our dependent variable was the group's sentence (in months). We also noted individual preferences both prior to and following group decision-making.

#### 2.4.2. Auxiliary measures

In addition we measured the extent group members experienced decision certainty and difficulty and the agreement with the group choice. These measures – and any other additional measures we examined in Study 2 and 3 – are reported in the Supplementary Materials.

### 2.5. Analyses

In all three studies, analyses on group sentencing judgments have been performed on square-root transformed variables. Means, standard deviations and standard errors of these transformed sentencing judgments are shown in Table S1 (Supplementary Information). Untransformed means and standard deviations are reported in the main paper.

Variables pertaining to group processes (information, preference exchange and sentencing decisions) are analyzed at the group level. However, individual-level variables (e.g., decision certainty, agreement etc.) are analyzed using Mixed-Model Analyses that include a random-intercept to account for group membership. In these analyses the degrees of freedom are adjusted depending on how much variance is

explained by group membership. When group membership explains much variance, the test, and its concomitant degrees of freedom, will be equal to a group-level test, and when the random intercept is redundant the test will be equal to an individual level test.

## 3. Results

### 3.1. Data preparation

There were no differences in sex,  $\chi^2(1) = 2.56$ ,  $p = .110$  and age,  $t(69) = -1.13$ ,  $p = .263$  between conditions. As expected, group members' individual (pre-anchor) sentencing judgments did not differ between low anchor groups ( $M = 23.53$ ,  $SD = 17.79$ ) and high anchor groups ( $M = 26.77$ ,  $SD = 24.87$ ),  $t(69) = -0.43$ ,  $p = .672$ . Since the sentencing preferences were skewed (in all three studies) we analyzed results on the basis of square root transformed sentences. When this yielded different results than the untransformed variable this is noted in the text. For ease of interpretation untransformed means are presented (see Supplementary Information for transformed means).

### 3.2. Sentencing judgment

An independent samples  $t$ -test showed that groups gave higher punishments in the high anchor condition ( $M = 30.67$ ,  $SD = 14.87$ ) than in the low anchor condition ( $M = 18.38$ ,  $SD = 10.54$ ),  $t(21.84) = 2.38$ ,  $p = .027$ ,  $r = 0.43$ ,  $d = 0.97$ .<sup>1</sup> Although this effect-size was smaller than found by [Klein et al. \(2014\)](#) in individual decision-making, the effect of anchors on group decision-making appears substantial.

## 4. Discussion and introduction to study 2

Study 1 provided initial evidence that anchors influence decision-making in groups. Interestingly, the externally provided anchor has to compete with the preferences of three group members, and, as also argued by others ([Switzer & Sniezek, 1991](#)), these preferences can be seen as multiple anchors. Thus, our study shows that external anchors can have an impact on group judgments over and beyond the impact of individual preferences.

Study 1 provided little information about the possible mechanisms that explain why groups fall prey to anchoring. As mentioned previously, biased or flawed decision-making can be explained by (combinations of) preference-driven and information-driven processes. According to the Selective Accessibility Model ([Strack et al., 1997](#)) anchors can influence people's judgments fast, and outside of their awareness. This suggests that group members' preferences might rapidly shift towards the anchor. When these biased preferences are further pooled during discussion, the group's decision is likely to be biased in the same direction, because groups tend to combine numerical preferences by averaging them, or by adopting the median preference ([Davis, 1996](#); [Laughlin & Ellis, 1986](#)). Alternatively, when individual preferences remain unbiased, the group's judgment is likely to be unbiased too.

In addition to these preference-driven processes, anchors can affect judgments through information-driven processes, by making anchor-consistent information more accessible ([Mussweiler & Strack, 1999](#); [Strack et al., 1997](#)). Applied to Study 1's criminal case, incriminating arguments might thus have become more accessible when groups were presented with a high anchor, versus exonerating arguments when groups were presented with a low anchor, thereby biasing information exchange. Thus, group judgments might be influenced by anchors

<sup>1</sup> The effect of Anchor remained significant when we controlled for individual pre-anchor preferences. Thus, the anchor explained variance above and beyond individual preferences. Controlling for pre-anchor preferences in Study 2 and 3 also did not alter our conclusions.



because groups focus on information that is consistent with the anchor.

Both preference-driven and information-driven processes underlying anchoring should be conditional on the extent to which group members are motivated to engage in thorough, deep information processing. In Study 2 we examined this possibility by manipulating process accountability—participants were evaluated (or not, in the control condition) by others with unknown preferences and ideas about what constitutes a good decision and process (De Dreu et al., 2008; Lerner & Tetlock, 1999; Tetlock, 1992). Extant work has shown that process accountability makes group members more self-critical and, therefore, elicits more thorough investigation of information. Accordingly, group members that are made process accountable engage in more unbiased information search (Ten Velden, Beersma, & De Dreu, 2010) and are more likely to use and process all available information (Scholten, van Knippenberg, Nijstad, & De Dreu, 2007). In addition, under high process accountability groups are more likely to defer their decision (Nijstad & Oltmanns, 2012). Process accountable group members are less willing to accept an alternative that they do not fully support and are therefore less likely to quickly change their opinion (Davis, Stasser, Spitzer, & Holt, 1976). As a result, we predicted that groups under process accountability will be less influenced by anchors (Hypothesis 1), and that preference-driven processes are less biased in the direction of the anchor (Hypothesis 2a), which in turn predicts the extent of the anchoring-bias (Hypothesis 2b). With regards to information-driven processes we expect that process accountable groups focus more on unbiased, anchor inconsistent information (and thus less on biased, consistent information) than control groups (Hypothesis 3a), which in turn predicts the extent of the anchoring-bias (Hypothesis 3b).

## 5. Method

### 5.1. Design and participants

The experiment used a 2 (Anchor: High vs. Low)  $\times$  2 (Process Accountability: Absent vs. Present) design in which participants, in 90 groups of three, were randomly assigned to conditions. The study was approved by the local Psychology Research Institute Ethics Review Board and participants gave informed consent. Participants ( $N = 270$ ,  $M = 21.67$  years,  $SD = 2.80$  years; 192 women) received course-credit or €10 for their participation. Compared to Study 1 we raised the sample size per cell, which made our sample considerably larger than related studies on process accountability in groups (Nijstad & Oltmanns, 2012;  $N = 10$  per cell; Scholten et al., 2007;  $N = 14$  per cell).

### 5.2. Procedure and decision-making task

We used the same case as in Study 1, and the procedure was similar. Participants were seated in separate cubicles in which they read the case, and individually determined the defendant's guilt and sentence. Next, we manipulated groups' process accountability and the three group members were seated together in one room. The experimenter presented the anchor, as was done in Study 1, and the group deliberated. When finished, groups entered their decision in the computer and returned to their individual cubicles to answer several questions about the deliberation process and to receive a debriefing and their compensation.

### 5.3. Manipulation of anchor

The anchors were determined by using the 10th and 90th percentile from the initial, individual pre-anchor sentences from the first study, and were therefore set at 5 months (low anchor) and 61 months (high anchor).

### 5.4. Manipulation of process accountability

Process accountability was manipulated following an established procedure (De Dreu, Koole, & Steinel, 2000; Nijstad & Oltmanns, 2012; Scholten et al., 2007; Siegel-Jacobs & Yates, 1996). Participants in the process accountability condition received a memo stating that the researchers would like to schedule a follow-up interview about the decision-making task, to gain valuable insights in the way groups reach decisions. During the interview a decision-making expert would ask them about the decision-making process in the group. The memo emphasized that participants should be prepared to explain *how* their group reached their decision, rather than *what* that decision was (outcome-accountability; Lerner & Tetlock, 1999). Participants indicated when they would be available for the interview. Participants in the no-accountability condition did not receive this memo. Groups were instructed to try to reach a joint decision that reflected all group members' preferences.

### 5.5. Dependent variables

The group sentencing judgment (in months) was our main dependent variable. To examine whether process accountability enhanced motivation to engage in deep and thorough information processing, participants answered seven questions about their willingness to elaborate on their own ideas and viewpoints during the discussion (1 = *completely disagree* to 7 = *completely agree*). Example items are: "I always listened carefully to what my group members said", "I tried to make my decision in a thorough and balanced way", and "To not impede the progress of the discussion I sometimes supported things, even though I did not really agree" (reverse coded; Cronbach's  $\alpha = 0.80$ ). As an instruction check, participants rated their agreement with the following statement: "After this study I will need to give an account of the way we made our decision" (1 = *completely disagree* to 7 = *completely agree*).

#### 5.5.1. Preference-driven communication

All group deliberations were audio-recorded. To analyze preference-driven communication, we examined group members' 'first offer', which was defined as the first sentencing preference group members mentioned that expressed their personal preference (unlike, for instance, repeating someone else's preference). We examined first offers in order to test our expectation that process accountable groups exchange first offers that are less biased in the direction of the anchor (Hypothesis 2a), which predicts the extent of the anchoring-bias (Hypothesis 2b).

The three members' first offers were averaged. We were particularly interested in the first offers because early preference exchange has a large influence on subsequent group interaction (see Schulz-Hardt et al., 2006). In addition, first offers should capture early anchor influence in absence of much information exchange (see Schaefer et al., 2015). From the audio recordings we retrieved the first offer from each group member, and the time at which all group members had made their offer.

#### 5.5.2. Information-driven communication

From the audio recordings, we collected arguments that were exchanged while determining the defendant's sentence. The list of potential arguments was based on a pilot study ( $N = 38$ ) where participants wrote down as many incriminating and exonerating arguments, based on the case materials. This led to a list of thirteen unique incriminating arguments and nine exonerating arguments, which were coded as anchor (in) consistent, depending on anchoring condition. Anchor consistent was defined as incriminating arguments when the anchor was high, and exonerating arguments when the anchor was low, and vice versa for anchor-inconsistent arguments. Our indicator of information-driven communication was the proportion of anchor-

consistent/inconsistent arguments. Together, these two variables represent 100% of information exchange. This approach fits with earlier work on anchoring in the legal domain, showing that incriminating arguments became more accessible with a high anchor, and exonerating information became more accessible with a low anchor, as evidenced by a categorization task (Englich et al., 2006).

## 6. Results

### 6.1. Data preparation

One group erroneously did not receive an anchor and therefore had to be excluded from the analyses. Analyses were thus performed on the remaining 89 groups. In two groups, audio recordings failed and could therefore not be included in analyses of the variables derived from audio-recordings. There were no differences between conditions on sex composition,  $\chi^2(3) = 0.27$ ,  $p = .965$  and age,  $F(3,263) = 0.17$ ,  $p = .914$ , nor on individual pre-anchor sentences,  $F(3, 261) = 1.55$ ,  $p = .201$ ,  $\eta_p^2 = 0.018$ .

### 6.2. Manipulation check

Results of a 2 (Anchor: High vs. Low)  $\times$  2 (Process Accountability: Absent vs. Present) Mixed-Model analyses (including a random intercept to account for group membership) on the instruction check revealed the expected main effect of Process Accountability,  $F(1, 263) = 86.74$ ,  $p < .001$ ,  $\eta_p^2 = 0.248$ , with group members under process accountability scoring higher ( $M = 5.48$ ,  $SD = 1.56$ ) than control group members ( $M = 3.53$ ,  $SD = 1.83$ ). Process accountability also enhanced group members' motivation to thoroughly process information as indicated by the 7-item questionnaire,  $F(1,85) = 4.89$ ,  $p = .030$ ,  $\eta_p^2 = 0.054$ . Group members under process accountability were more willing to elaborate on their ideas ( $M = 5.66$ ,  $SD = 0.46$ ) than members of control groups ( $M = 5.39$ ,  $SD = 0.68$ ).

### 6.3. Group sentence (Hypothesis 1)

A 2 (Anchor: High versus Low)  $\times$  2 (Process Accountability: Absent vs. Present) ANOVA showed no main effect of Process Accountability,  $F(1,85) = 0.76$ ,  $p = .387$ , but a significant main effect of Anchor,  $F(1,85) = 5.25$ ,  $p = .024$ ,  $\eta_p^2 = 0.058$ , indicating that overall, a high anchor resulted in higher sentences ( $M = 38.51$ ,  $SD = 21.23$ ) than a low anchor ( $M = 29.59$ ,  $SD = 23.75$ ). This effect was qualified by the expected interaction between Anchor and Process Accountability,  $F(1,85) = 6.31$ ,  $p = .014$ ,  $\eta_p^2 = 0.069$  (Fig. 1A). The interaction is driven by the much higher sentences in the low anchor/process accountable condition. Indeed, simple effects showed that in the control condition, the low anchor groups gave significantly lower sentences ( $M = 21.64$ ,  $SD = 14.50$ ) than the high anchor groups ( $M = 41.74$ ,  $SD = 20.76$ ),  $F(1,85) = 11.66$ ,  $p = .001$ ,  $\eta_p^2 = 0.121$ . However, under process accountability, there was no difference between high ( $M = 35.14$ ,  $SD = 21.67$ ) and low anchor groups ( $M = 37.55$ ,  $SD = 28.49$ ),  $F(1,85) = 0.02$ ,  $p = .877$ . Thus, Hypothesis 1 was supported.

### 6.4. Process analyses

#### 6.4.1. Preference-driven communication (Hypotheses 2a,b)

Overall, first-offer preferences were pooled within 17.97% ( $SD = 17.94\%$ ) of the group's discussion time. To test Hypothesis 2a, we examined whether the interaction between Anchor and Process Accountability influenced first offers. A 2  $\times$  2 ANOVA on the average first offer revealed a main effect of Anchor,  $F(1,83) = 3.28$ ,  $p = .074$ ,  $\eta_p^2 = 0.038$  (marginal), showing that groups in the low anchor condition expressed lower first offers ( $M = 28.26$ ,  $SD = 16.00$ ) than groups

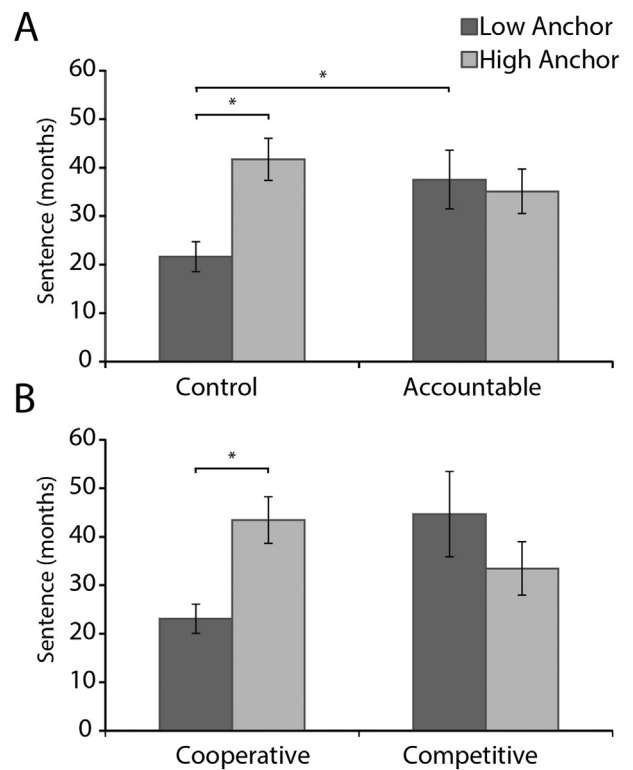


Fig. 1. Sentencing judgments. (A) control and process accountable groups in Study 2; (B) cooperative and competitive groups in Study 3. Displayed  $M \pm SE$ . \* significant difference at  $p < .05$ .

in the high anchor condition ( $M = 36.81$ ,  $SD = 25.40$ ). This effect was qualified by the expected interaction with Process Accountability,  $F(1,83) = 4.32$ ,  $p = .041$ ,  $\eta_p^2 = 0.050$ . Simple effects showed the same pattern as for group sentences: Control groups expressed lower first offers with a low anchor ( $M = 25.45$ ,  $SD = 13.62$ ) than with a high anchor ( $M = 42.56$ ,  $SD = 28.17$ ),  $F(1,83) = 7.65$ ,  $p = .007$ ,  $\eta_p^2 = 0.084$ . Process accountable groups, on the other hand, expressed similar first offers with high ( $M = 31.06$ ,  $SD = 21.39$ ) and low anchors ( $M = 31.21$ ,  $SD = 18.04$ ),  $F(1,83) = 0.04$ ,  $p = .850$ . These results confirmed Hypothesis 2a.

Moderated mediation analyses showed that the indirect effect ( $-1.29$ ,  $SE = 0.60$ ) of the Anchor and Accountability interaction through first offers is larger than zero, as estimated by a 95% bias corrected bootstrapped confidence interval based on 10,000 samples,  $CI_{95} = -2.48 - 0.10$  (Hayes, 2013, Model 8; see Fig. 2). These results are consistent with the idea that preference exchange is a driving factor behind the anchoring effect in groups and are in support with Hypothesis 2b.

#### 6.4.2. Information-driven communication (Hypotheses 3a,b)

Supporting Hypothesis 3a, Process Accountability groups were more focused on anchor-inconsistent arguments ( $M = 0.52$ ,  $SD = 0.24$ ), than control groups ( $M = 0.44$ ,  $SD = 0.20$ ),  $F(1,81) = 5.37$ ,  $p = .023$ ,  $\eta_p^2 = 0.062$ . In addition, but unexpected, the extent to which groups focused on anchor inconsistent arguments was influenced by the anchor,  $F(1,81) = 32.60$ ,  $p < .001$ ,  $\eta_p^2 = 0.287$  (two groups did not exchange any arguments (only preferences), resulting in  $N = 85$ ). When presented with a high anchor, groups showed less focus on anchor inconsistent arguments ( $M = 0.36$ ,  $SD = 0.17$ ), than when presented with a low anchor ( $M = 0.60$ ,  $SD = 0.22$ ). Finally, the interaction between anchor and process accountability was not significant,  $F(1,81) = 0.56$ ,  $p = .456$ .

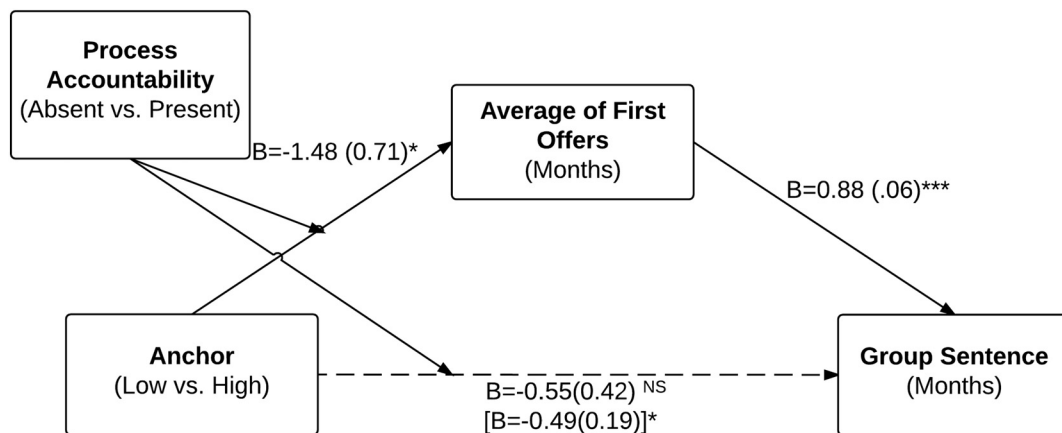


Fig. 2. Mediation Analysis of the interaction between Anchor and Process Accountability on the group sentence. Total Indirect effect is:  $-1.29 (0.60)$ ,  $CI_{95} = -2.48 - 0.10$ . Standard Errors between parentheses and the direct effect of Anchor X Accountability between brackets. Estimates are based on a bootstrapping procedure with 10,000 bootstrap samples. \* $p < .05$ , \*\*\* $p < .001$ . Used Process (Hayes, 2013) Model 8.

In contrast to Hypothesis 3b, moderated mediation analyses showed that the indirect effect ( $-0.31$ ,  $SE = 0.26$ ) of the Anchor X Accountability interaction through anchor inconsistent information was not larger than zero, as estimated by a 95% bias corrected bootstrapped confidence interval based on 10,000 samples,  $CI_{95} = -1.10 - 0.25$ . Thus, process accountable groups' information exchange did not explain their lower susceptibility to the anchoring-bias.

## 7. Discussion and introduction to study 3

Study 1 showed that groups are vulnerable for the anchoring-bias. Study 2 replicated this effect but additionally showed that this vulnerability is limited to groups that are not process accountable. Interestingly, information-driven processes did not explain this differential susceptibility for anchors. Yet, preference-driven processes did: Under process accountability the first exchanged preferences remained unbiased by the anchor, while in control groups these preferences shifted towards the anchor.

Process accountability was manipulated to create variation in the depth and thoroughness of information processing at both the individual and group-level. Indeed, group members under process accountability reported stronger motivation to process information and in their first offers were not influenced by the anchor given to them (in contrast to those in the control condition, whose first offers were influenced by the anchor). Finally, group members under process accountability were more focused on anchor-inconsistent arguments, reflecting more even-handed group deliberation. Whereas these results fit the idea that process accountability raises motivation to thoroughly process information (De Dreu, Beersma, Stroebe, & Euwema, 2006; De Dreu et al., 2008; Scholten et al., 2007), in the specific context of the current group task, process accountability may not only raised the amount and even-handedness of information processing and exchange, but also changed the extent to which an arbitrary starting point is used, something that is indeed difficult to justify to outsiders. It would be interesting to examine, in new research, whether process accountability indeed makes people more or less susceptible to outside information that is arbitrary or, instead, of clear relevance and meaning.

The first two studies are limited in the sense that they followed a setup typical for most group-decision-making studies, in that group members were instructed to reach a joint decision, without any instructions or incentives to behave in a self-focused way. However, many group decision-making settings are characterized by competitive motives that may counter the cooperative motive to reach a consensual group decision (Beersma & De Dreu, 2005; De Dreu et al., 2008; Toma &

Butera, 2009; Toma, Vasiljevic, Oberlé, & Butera, 2013; Wittenbaum, Hollingshead, & Botero, 2004). For example, in many organizations employees work together in teams, while the reward structure is based on individual relative performance (Hackman, 1998; Stanne, Johnson, & Johnson, 1999). Thus, the best performing employees are rewarded (competition), even though the task demands them to work together with those same colleagues (cooperation). There are three important aspects of competition that could have consequence for the occurrence of the anchoring-bias.

First of all, competitive individuals are predominantly focused on their own preferences and outcomes (De Dreu et al., 2008; Toma & Butera, 2009; Toma, Vasiljevic, et al., 2013) and are less likely than cooperative people to compromise (De Dreu et al., 2006; De Dreu, Weingart, & Kwon, 2000). Second, competitive settings make decision-makers experience ownership over personal ideas, arguments and preferences (De Dreu & Van Knippenberg, 2005). As a result of ownership personal information and knowledge are considered more important than other's information (Chernyshenko, Miner, Baumann, & Sniezek, 2003). Subsequently, competitive decision makers, more than cooperative decision makers, base their decision on their personal information, even when their decision would have been better if they valued all available information equally (Toma, Bry, & Butera, 2013). Third, competitive decision makers' focus on themselves is strongly related to non-conformity and resistance against majority influence (Imhoff & Erb, 2008). This attitude is different in cooperative groups, where individuals are more likely to value the majority or the group member with an average or median preference, and may even pressure deviants into conformity (Janis & Mann, 1977).

Because of their focus on convincing others, strong ownership of personal preferences, and non-conformity, individuals in competitive groups may consider a smaller range of potentially acceptable group decisions, which in turn could mitigate the anchoring-bias. Accordingly, we predict that the anchoring-bias is weaker in competitive groups than in cooperative groups (Hypothesis 4). With regards to preference-driven processes we expect that competitive group members' preferences will be less biased in the direction of the anchor than cooperative group members' preferences (Hypothesis 5a), which will account for the expected differential susceptibility to anchors (Hypothesis 5b). Next, we expect that in cooperative groups, more than in competitive groups, the median preference, rather than extreme preferences, is more predictive of the group decision (Hypothesis 5c). With regards to information-driven processes we expect cooperative groups to be focused more on biased, anchor consistent information (and thus less on inconsistent information) than competitive groups (Hypothesis 6a), which will account for the anchoring-bias (Hypothesis 6b).

## 8. Method

### 8.1. Design and participants

Hypotheses were tested in a 2 (Anchor: Low vs. High)  $\times$  2 (Motivation: Competitive vs. Cooperative) design in which participants were randomly assigned to three-person groups and conditions. The study received ethics approval from the local Psychology Research Institute Ethics Review Board and participants provided informed-consent. Because effects of competition in groups tend to be large (e.g.,  $d \geq 1.15$  in Toma & Butera, 2009 information exchange analyses), and the effect-size of anchoring in (cooperative) groups was large ( $d \pm 1$  over the previous studies, requiring a total of 24 groups for an independent sample  $t$ -test at 80% power) we aimed to recruit 180 participants for 60 groups.

Undergraduate and graduate students ( $N = 177$ ,  $M = 21.08$ ,  $SD = 2.40$  years; 124 women) participated for course-credit or 10 euro. (Five groups inadvertently contained participants that participated in the pre-test. Because of an exit-question these participants were identified and their groups were removed before any data analysis took place. They are thus not part of the reported sample.)

### 8.2. Procedure and decision-making task

The procedure was similar to the procedure used in the previous two studies. Participants read a realistic 7-page murder case on paper. As was done previously, the case was written to ensure participants reached a guilty verdict whereupon they could determine a sentence. The case described the life of Anne. She felt trapped in a marriage with Mark, her second husband who physically and mentally abused her. Anne was afraid to leave because Mark threatened to hurt their daughter. She confessed planning Marks murder months in advance, and confessed to killing him in his sleep. In a pretest ( $N = 41$ ) 38 participants declared the defendant guilty and three indicated they did not know.

### 8.3. Manipulation of anchor

The 38 participants from the pretest who declared the defendant guilty indicated their preferred sentence ( $M = 36.05$ ,  $SD = 33.69$ ). Based on their answers, we created a high anchor, which roughly corresponded with the 90th percentile, at 71 months, and a low anchor, which corresponded with the 10th percentile, at eight months.

### 8.4. Manipulation of cooperative and competitive motivation

We manipulated the groups' cooperative or competitive motivation using instructions, following procedures established in previous work (e.g., Nijstad & Oltmanns, 2012). Group members in the competitive condition received instructions to "try to ensure the group decision represents your opinion". Group members in the cooperative condition received instructions to reach a joint, collaborative decision: "try to reach a decision that represents all group members' opinions". By doing so we created differences in the alignment of member's goals. Cooperative groups could succeed if all members gave in a bit, while in competitive groups a shift towards one member's preferences meant a 'loss' for other members. All members of a group received the same instructions. After these instructions participants answered two instruction check questions that they had to answer correctly before they could continue.

### 8.5. Dependent variables

#### 8.5.1. Sentence

The main dependent variable was the group sentencing judgment (in months). As in the previous studies, prior to receiving the anchor

and manipulation, participants noted their individual sentencing preference.

#### 8.5.2. Process measures

All group deliberations were audio-recorded, transcribed and coded. We again recorded members' first offers and the speaking turns in which the first offers were made. Additionally, 16 different incriminating arguments and 20 exonerating arguments were coded. The arguments were based on the pretest mentioned above ( $N = 41$ ) in which participants were asked to indicate, from the case materials, as many arguments in favor of a high sentence (incriminating arguments) and in favor of a low sentence (exonerating arguments). The coding process resulted in frequency data for all 36 arguments. As in Study 2, information-driven communication was analyzed as the proportion of anchor-consistent/inconsistent arguments mentioned. Together, these two variables again represent 100% of information exchange.

## 9. Results

### 9.1. Data preparation

Two groups were removed because they declared the defendant not guilty and thus did not determine a sentence. The data of the remaining 57 groups were analyzed. There were no differences between the conditions in sex composition,  $\chi^2(3) = 5.37$ ,  $p = .147$  and age,  $F(3,167) = 1.17$ ,  $p = .325$ , nor were there differences between conditions on the mean individual pre-anchor sentences,  $F(3,167) = 0.89$ ,  $p = .449$ .

Group sentence (Hypothesis 4).

Hypothesis 4 predicted that anchors influence the group sentencing judgment in cooperative groups but not, or to a lesser extent, in competitive groups. A 2 (Anchor: High versus Low)  $\times$  2 (Motivation: Competitive versus Cooperative) ANOVA on group sentence showed that there were no main effects of Motivation (Cooperative:  $M = 33.67$ ,  $SD = 17.97$ ; Competitive:  $M = 38.73$ ,  $SD = 27.74$ ),  $F(1,53) = 0.11$ ,  $p = .743$ , and Anchor,  $F(1,53) = 0.65$ ,  $p = .425$  (Low anchor:  $M = 34.30$ ,  $SD = 26.75$ ; High anchor:  $M = 38.17$ ,  $SD = 20.58$ ). However, results revealed the expected interaction between Anchor and Motivation,  $F(1,53) = 6.40$ ,  $p = .014$ ,  $\eta_p^2 = 0.108$ , indicating that the effect of Anchor was different for cooperative and competitive groups. Fig. 1B shows that, as in the previous two studies, cooperative groups were susceptible to anchoring, giving higher punishments in the high anchor condition ( $M = 43.50$ ,  $SD = 17.94$ ) than in the low anchor condition ( $M = 23.08$ ,  $SD = 10.82$ ),  $F(1,53) = 5.29$ ,  $p = .025$ ,  $\eta_p^2 = 0.091$ . However, there was no significant difference for competitive groups ( $M_{high} = 33.50$ ,  $SD = 22.13$  vs.  $M_{low} = 44.71$ ,  $SD = 32.86$ ),  $F(1,53) = 1.57$ ,  $p = .216$ .

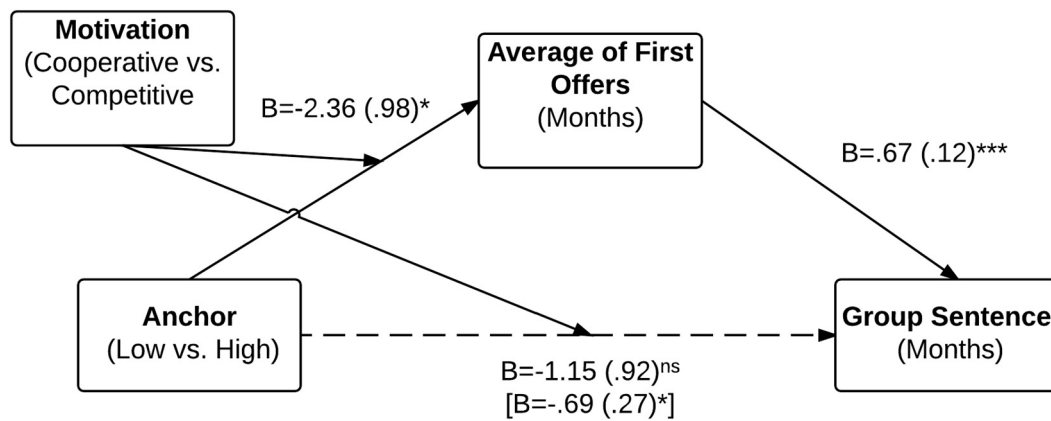
### 9.2. Preference-driven processes

Groups made their first offers after 18.26% ( $SD = 15\%$ ) of the speaking turns. On average only 1.72 ( $SD = 0.45$ ) arguments were mentioned before the first offer was made, thus underlining that the first offer measure indeed captures early preference pooling in the absence of information-driven processes. Cooperative groups ( $M = 16.44$ ,  $SD = 16.78$ ) pooled their preferences after fewer speaking turns than competitive groups ( $M = 27.07$ ,  $SD = 27.44$ ),  $F(1,53) = 3.09$ ,  $p = .085$ , but this difference was marginally significant.

#### 9.2.1. Biased first offers (Hypotheses 5a, b)

We analyzed whether first offers depended on anchor and motivation. A 2 (Anchor)  $\times$  2 (Motivation) ANOVA revealed that there were no differences on first offers between cooperative ( $M = 41.22$ ,  $SD = 20.22$ ) and competitive groups ( $M = 45.00$ ,  $SD = 30.51$ ),  $F(1,53) = 0.17$ ,  $p = .685$ , nor between the high ( $M = 38.28$ ,  $SD = 20.68$ ) and the low Anchor conditions ( $M = 48.69$ ,  $SD = 30.31$ ),





**Fig. 3.** Mediation Analysis of the interaction between Anchor and Motivation on the group sentence. Total Indirect effect is:  $-1.59 (0.78)$ ,  $CI_{95\%}: -3.39 -0.34$ . Standard Errors are between parentheses and the direct effect of Anchor X Motivation between brackets. Estimates are based on a bootstrapping procedure with 10,000 bootstrap samples.  $^*p < .05$ ,  $^{***}p < .001$ . Used Process (Hayes, 2013) Model 8. Alternatively, one could predict an interaction between first offers and motivation on group sentence based on the results of Hypothesis 5C. Including this interaction (Model 59) does not change conclusions.

$F(1,53) = 1.69$ ,  $p = .200$ . Hypotheses 5a and 5b predicted that competitive group members' preferences would be less biased in the direction of the anchor than cooperative group members' preferences, and that this would account for the expected differential susceptibility to anchors. In support of Hypothesis 5a, we found a significant interaction between anchor and motivation,  $F(1,53) = 5.82$ ,  $p = .019$ ,  $\eta_p^2 = 0.099$ , indicating that competitive groups' first offers were not biased in the direction of the anchor. In fact, they made higher first offers in the low anchor condition ( $M = 58.26$ ,  $SD = 34.42$ ) than in the high anchor condition ( $M = 33.40$ ,  $SD = 21.57$ ),  $F(1,53) = 7.26$ ,  $p = .009$ ,  $\eta_p^2 = 0.120$ . This was in contrast to cooperative groups, whose mean first offers were in the direction of the anchor ( $M_{low} = 38.38$ ,  $SD = 22.01$  versus  $M_{high} = 43.86$ ,  $SD = 18.83$ ), although this difference was not significant,  $F(1,53) = 0.59$ ,  $p = .445$ . Thus, interestingly, unlike in Study 2, we did not find clear evidence for cooperative groups' first offers to be biased *towards* the anchor, but evidence for competitive groups being biased *away from* the anchor.

Because there was a strong relation between first offers and group sentence ( $r(57) = 0.619$ ,  $p < .001$ ) we continued with a moderated mediation analysis (see Hayes, 2013, model 8) to check whether first offers could account for motivation effects on the anchoring-bias. The indirect effect through first offer ( $-1.59$ ,  $SE = 0.78$ ) was significant using the 95% bias corrected confidence interval ( $CI_{95\%}: -3.39 -0.34$ ), which did not include zero (see Fig. 3). These results suggest that at least part of the effect of motivation and anchor on the group sentence was already incorporated in the first offers, which is in line with Hypothesis 5b, even though the exact pattern of this data was not predicted.

### 9.2.2. Focus on median first offers (Hypothesis 5c)

We found that preferences in cooperative groups were as diverse as in competitive groups, by comparing first offer variances between conditions,  $F(1,52) = 0.399$ ,  $p = .530$ . Overall, variances within groups were large. The average difference between the minimum and the maximum first offer was 63.70 months ( $SD = 58.81$ ), and did not depend on anchor, motivation or the interaction,  $F_s < 1.23$ ,  $p_s > 0.267$ . To analyze if all groups took full advantage of this diversity of first offer-preferences we created a regression model with the three group members' first offers, dummy coded motivation and the interactions between motivation and first offer as predictors and group sentence as dependent variable. Hypothesis 5c predicted that in cooperative groups the median group member would be most influential, because this member represented the least extreme first offer (see Davis, 1996), while in competitive groups all group members' first offers, including the more extreme ones, would influence the group decision.

Our regression model resulted in a good overall fit,  $R^2 = 0.73$ ,  $F(7,49) = 18.59$ ,  $p < .001$ . We found that indeed, in cooperative groups only the group's middle first offer predicted the group sentence ( $B = 0.784$ ,  $SE = 0.217$ ,  $p = .001$ ), while the lowest ( $B = 0.275$ ,  $SE = 0.187$ ,  $p = .465$ ) and the highest first offer did not ( $B = 0.057$ ,  $SE = 0.078$ ,  $p = .148$ ). In competitive groups the group's lowest ( $B = 0.804$ ,  $SE = 0.132$ ,  $p < .001$ ) and the highest ( $B = 0.168$ ,  $SE = 0.081$ ,  $p = .044$ ) first offer did influence the group sentence, while the middle preference did not ( $B = 0.140$ ,  $SE = 0.129$ ,  $p = .282$ ). Thus, in cooperative groups, but not in competitive groups, the median first offer dominates, supporting Hypothesis 5c.

### 9.3. Information-driven communication (Hypotheses 6a,b)

According to Hypothesis 6a cooperative groups would focus more on biased, anchor-consistent arguments than competitive groups' discussions. Results revealed, however, that motivation did not affect the groups' focus,  $F(1,53) = 2.34$ ,  $p = .132$  ( $M_{coop} = 0.53$ ,  $SD = 0.17$ ;  $M_{comp} = 0.46$ ,  $SD = 0.15$ ) nor did Anchor,  $F(1,53) = 0.22$ ,  $p = .638$ . Thus, Hypothesis 6a received no support. Consequently, Hypothesis 6b – which states that information exchange would account for the extent of the anchoring-bias – was also unsupported.

## 10. Discussion of study 3

Study 3 replicated our finding that cooperative groups are vulnerable to anchoring, and in addition showed that susceptibility is stronger in cooperative than competitive groups. We observed that differential susceptibility to anchoring is mainly due to preference-driven communication. We found that competitive groups' first exchanged preferences shift away from the anchor. Arguably this can be explained by competitive groups' strong sense of ownership (Toma, Bry, & Butera, 2013), and their reluctance to concede to other preferences. When confronted with an unwanted anchor, competitive group members might counter this anchor by shifting their personal preferences in the opposite direction. Indeed, competitive groups in the low anchor condition produced more extreme first offers because with the low anchor being given, individuals only had one direction (upwards) to influence the group.

We manipulated cooperative versus competitive motivations through instructions, and all group members received the same instructions. Group members may not be given such clear-cut instructions to reach consensual or self-serving decisions, and lacking such clear instructions some individuals may seek consensus, and others aim for decisions that reflect their personal interests best. Future research could

examine the effects of group-level heterogeneity in social preferences and concomitant cooperative versus competitive orientations within decision-making groups.

## 11. Conclusions and general discussion

Given that groups make many important numerical decisions and judgments, it is important to determine if, and when, they are vulnerable to the anchoring-bias. Study 1 showed that groups are influenced by anchors. In the two following studies we investigated whether this vulnerability to anchors could be mitigated by process accountability, and intragroup competition. In Study 2 we manipulated groups' motivation to engage in thorough information processing, by making half the groups process accountable. We found that groups are less influenced by anchors when they are process accountable than when they are not. Results further suggested that this was due to biased preference exchange –control groups aligned their preferences with the anchor, while process accountable groups did not. In Study 3, half of the groups were cooperatively motivated, while the other half were competitively motivated. In line with our expectations, we found that competitive groups are less influenced by anchors than cooperative groups. This was explained by competitive groups' preferences moving away from the anchor. In addition, we found that in cooperative groups the median preference in the group (rather than more peripheral preferences) influenced the group's decision.

Taken together our studies show that group decision-making is susceptible to the anchoring-bias, which fits with earlier research indicating that groups are vulnerable to some of the same biases that plague individual decision makers (Gigone & Hastie, 1993; Kerr et al., 1996; Sunstein, 2004). In addition, we have shown that the extent of groups' vulnerability depends on groups' cooperative or competitive motivation, and their motivation to thoroughly process information. That anchors influence judgments even in noisy environments, such as group discussions, underlines the ubiquitous and robust nature of the anchoring-bias (Klein et al., 2014). In the next section we discuss the underlying processes, address implications for research, discuss limitations of the current set of studies and offer suggestions for further research.

### 11.1. Preference-driven vs. information-driven processes

To explain the group anchoring effect we predicted that anchors influence group judgments through both preference-driven and information-driven processes. Preference-driven processes capture whether anchors influenced individual judgments before considerable group discussion has taken place. Information-processes capture whether the group discussion is biased by the anchor. Our results show support for a preference-driven account of group anchoring: The extent of bias in individual preferences explain why some groups fall prey to the anchoring-bias while others do not. In both Study 2 and 3, first offers were overall correlated with the final group judgment. Yet, our results were not unequivocal about the exact role biased preference exchange plays: Whereas in Study 2, anchors biased cooperative control groups' first offers, and this accounted for biased group judgment, in Study 3, surprisingly, cooperative groups' first offers were unaffected by the anchor, yet group judgment was affected by the anchors. In addition, and interestingly, when group members were competitively motivated, their preferences were biased away from the anchor, which resulted in unbiased group decisions (Study 3). While leaving much room for further research these results do highlight that when preferences are biased and point into one direction (regardless of which direction), this bias is generally passed on to the group decision. This is in line with decision-making research showing that individual preferences are highly predictive of the final group judgment (Faulmüller, Kerschreiter, Mojzisch, & Schulz-Hardt, 2010; Hinsz, Tindale, & Vollrath, 1997).

Interestingly, we found no evidence that anchors biased the contents of the information that groups exchanged. This seems at odds with research investigating the Selective Accessibility Model, which has shown in a thought listing procedure (Mussweiler & Strack, 1999) and a lexical decision task (Mussweiler & Strack, 2000) that anchors make anchor-consistent information more accessible. There are at least three explanations for the absent role of information-driven processes in our findings. First, it may be that our measure of counting how often exonerating vs. incriminating arguments were mentioned in a group discussion does not necessarily reflect accessibility very accurately. Second, group-level argument exchange is an interactive process. As a result, an anchor consistent argument is more likely followed by an anchor inconsistent argument in a group setting than in an individual setting, because a disagreeing group member might react, while an individual might continue a train of thought. Consequently, argument exchange in groups might be less biased than argument generation in individuals. Third, judgment tasks like we used in our studies have no demonstrably correct answer (Laughlin, 1980; Laughlin & Ellis, 1986) and therefore depend less on logic and truth-seeking and more on affective reasoning and negotiation or haggling. Affective judgments require less systemic retrieval, encoding and processing of information (Zajonc, 1980), making it more likely that information driven processes might not play a key role in determining a judgment issue.

Our results further show that preferences were unbiased in process accountable groups and biased away from the anchor in competitive groups. These findings can be explained by psychological ownership over ideas (Toma, Bry, & Butera, 2013), and subsequent less willingness to assimilate towards an external anchor. People under process accountability require more convincing information, and are thus more hesitant to shift their preference early on. Such an attitude might be related to psychological ownership (Avey, Avolio, Crossley, & Luthans, 2009). Competition induced sense of ownership is the consequence of a key aspect of competition: Being more focused on individual than group outcomes. Competitive group members' high sense of ownership, in combination with a potential strategic use of a first offer (see Steinel & De Dreu, 2004; Steinel, Utz, & Koning, 2010) might therefore have resulted in competitive groups being biased away from the anchor.

In our studies the anchoring-bias was best explained by preference driven processes that occurred early on in the group discussion: Individual members' preferences influenced the group's decision, with no clear role for group discussion and information exchange. This highlights the individual nature of the anchoring-bias, and suggests that rather than to speak of 'the anchoring-bias in groups' we should speak of 'the anchoring-bias in individuals operating in groups'. Future research should investigate how competition and process accountability influence the anchoring-bias in individuals (see Epley & Gilovich, 2010).

### 11.2. Comparison with individual decision makers

As noted at the outset, early work by others suggested that group decisions are equally biased as individual decisions when the group consists of members who were biased by an anchor *before* the group discussion (Whyte & Sebenius, 1997). In our studies, the anchor manipulation was at the group level and following the individual information intake. To assess the extent to which the group-level anchoring bias in our set-up differs from anchoring in individual decision-makers, we additionally tested 47 individuals (9 men,  $M_{age} = 21.32$ ,  $SD = 4.98$ ), who were given the same case materials as used in Study 1 and 2. Participants either drew a high (61) or a low (6) lottery ticket which represented the demand of the prosecution. After receiving the anchor, they made a sentencing decision. One individual was excluded for declaring the defendant not guilty.

We compared the remaining 46 individual decisions with the sentencing decisions of all 96 cooperative groups from our studies (i.e. all groups in Study 1 [ $N = 24$ ], (cooperative) control groups in Study 2

[ $N = 45$ ], and cooperative groups in Study 3 [ $N = 27$ ]). In order to make decisions comparable we standardized all decisions. A 2 (Decision-Making Entity: Individual vs. Group)  $\times$  2 (Anchor: Low vs. High) ANOVA indicated that overall, sentencing decisions depended on the Anchor,  $F(1,138) = 40.37$ ,  $p < .001$ ,  $\eta_p^2 = 0.226$ . When individuals or groups were given low anchors, their sentences were lower ( $M = -0.48$ ,  $SD = 0.64$ ) than when given a high anchor ( $M = 0.47$ ,  $SD = 1.07$ ). There was, however, no effect of decision-making entity,  $F(1,138) = 0.206$ ,  $p = .651$ , or the interaction with anchor,  $F(1,138) = 0.285$ ,  $p = .594$ . This lack of an interaction is further illustrated by the small difference in effect size between individual ( $d = 1.04$ ) and group decision-makers ( $d = 1.15$ ).

That individuals are as influenced by anchoring as cooperative groups raises the question whether the key finding that groups judgments are influenced by anchoring can be explained by a simple aggregate of individual (biased) judgments, or whether group processes are uniquely contributing to anchoring in group judgment and decision-making. To some extent indeed, our findings suggest that group interaction – including the pooling of preferences and the exchange of arguments – neither reduces nor amplifies individually held bias. At the very least, our findings suggest that also groups are susceptible to anchoring and that socio-contextual influences, such as the cooperative versus competitive incentive structure within groups, moderates such anchoring. Yet our findings also suggest that anchoring bias in groups is the result of an implicit, and arguably fast, negotiation among group members. Such negotiation takes place in a heuristic fashion, with members settling on an easy middle-of-the-road solution. This seems to happen in cooperative groups; in competitive groups, preference-pooling was less obvious and individual positions were arguably defended more fiercely. This points to the possibility that anchoring bias in group-decision making may be the aggregate of individual biases, but also reflects the bargaining power of specific individuals within the group. Future research could invest in further uncovering such social construction of anchoring bias by examining, for example, whether and how status and leadership positions influence group-level anchoring.

Related to this question is that our findings pertain, as mentioned, to group tasks in which objective, verifiable solutions were missing. It is precisely in such settings that individuals are susceptible to social influence and need consensual decision-making rather than a “truth-wins” procedure; (Laughlin & Ellis, 1986). Typically, groups perform better than individuals in such intellectual tasks, as “two-heads-are-better-than-one” and anchoring bias may be, accordingly, substantially reduced (Laughlin et al., 1998). Future studies could include problems that are more intellectual in order to establish group-level anchoring in these tasks.

## 12. Conclusion

Groups are often tasked with making important decisions, after all, “two heads know more than one”, and multiple heads might be able to avoid groups falling prey to influential decision making biases, such as anchoring. Given that anchors are everywhere – from a restaurant name (Critcher & Gilovich, 2008) to subliminal primes (Mussweiler & Englich, 2005; Reitsma-van Rooijen & Dancker, 2006) – the potential impact on group decision-making is large. Indeed, across three studies we found groups can be vulnerable to the anchoring-bias. Especially in the absence of accountability and competitive incentives, groups give higher sentences when presented with a high anchor than with a low anchor. Such anchoring effects emerge because of preference-pooling rather than biased information processing during group discussions. Making decisions cooperatively in a group is no antidote for the anchoring-bias.

## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jesp.2018.02.001>.

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