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Research Article

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ABSTRACT—*We show how decision makers can be induced to choose a personally inferior alternative, a strong violation of rational decision making. First, the inferior alternative is installed as the leading option by starting with information that supports this alternative. Then, the decision maker uses the natural process of distorting new information to support whichever alternative is leading. This leader-supporting distortion overcomes the inherent advantages of the superior alternative. The end result is a tendency to choose the self-identified inferior alternative. We trace the choice process to reveal the amount of distortion and its influence on preference. Self-reported awareness of distortion to support the inferior alternative is not related to the amount of distortion. The absence of valid awareness suggests that the manipulation that produces this preference violation is unlikely to be detected and that the distortion is unlikely to be corrected by the decision maker. As expected, given the lack of awareness, final confidence is just as high when the inferior alternative is chosen as when the superior one is. The discussion considers how to prevent an adversary from manipulating one's decisions using this technique.*

In the study of intellective tasks, decision making has been the one most characterized by a focus on standards of accuracy and the investigation of errors. Decision researchers have typically taken inaccurate choices to indicate nonnormative choice processes. In the present work, we attempted to contribute to this tradition by exploring an especially stark form of inaccuracy, the choice of a self-identified inferior alternative.

BIASED EVALUATION OF INFORMATION

Our attempt to induce a preference violation in binary choice relied on decision makers' tendency to bias their evaluations of new information to support whichever alternative is tentatively leading. That is, decision makers typically interpret new information, such as information on attributes of the two options, as overly favorable to whichever alternative is currently ahead. This type of biased predecisional processing has been termed predecisional distortion of information (Brownstein, 2003; Russo, Medvec, & Meloy, 1996; Simon, Krawczyk, & Holyoak, 2004).

Recent work has found that the bias resulting from predecisional distortion is short-lived, serving mainly to build confidence in the chosen alternative (Simon et al., 2004). This raises the question of whether predecisional biasing of information evaluation is nonnormative or merely a harmless tactic for (invalidly) augmenting confidence. In a previous study (Carlson, Meloy, & Russo, 2006), we went part way toward answering this question, showing that predecisional distortion, together with a manipulation of the order in which information is presented, can establish a preference violation. (See Pennington & Hastie, 1988, for a similar order effect in legal decision making.) The possibility remains, however, that the individuals who bias their attribute evaluations to support the leading option are those who already favor that option or who are indifferent between the two options. If that is the case, then all that these decision makers do when they distort information is build their confidence at no cost to the accuracy of their choice. Thus, no prior studies have established the nonnormative status of predecisional distortion by showing that it can alter preferences to such an extent that decision makers select an option that is inferior to them personally. In this article, we report a test of whether predecisional distortion can yield such nonnormative choices.

To see how predecisional distortion might induce the choice of an inferior alternative, consider the following manipulation of the order of information. Let the first unit of information favor the inferior alternative, which should install it as the initial leader. Then new information is distorted to support this targeted alternative, yielding an overall bias in the evaluation of the attribute information to favor that alternative. If the inferior (targeted) alternative can remain the leader as additional information is provided, and if predecisional distortion is sufficiently large, the decision maker should prefer the inferior alternative to the objectively superior one. Note that this is not a weighting-based order effect, like primacy and recency, because predecisional distortion affects the attribute values themselves,

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not their importance weights. Indeed, one of the goals of the current work was to trace such changes in value or preference over the course of the decision process.

To see more specifically how the inferior alternative can be targeted, consider a choice between two restaurants. The choice is presented by beginning with the following "dessert" attribute:

> Restaurant S has a small assortment of standard desserts, but daily specials always feature one type of cheesecake, a fruit sorbet, and a chocolate dessert. Restaurant K has a variety of desserts, including cakes, tortes, pies, sorbet, and ice cream. In addition, specialty desserts are prepared daily. Dessert and coffee are included in the price of the meal. A professional dessert chef is on staff and will accommodate requests.

If a specific consumer has previously judged this attribute to favor Restaurant K, then its appearance as the first attribute in a sequence of attributes should establish Restaurant K as the early leader. Although our previous study (Carlson et al., 2006) showed that targeting an alternative in this way led participants to choose the targeted alternative over an equally attractive alternative, our study was between participants. To date, we know of no study that has induced a participant to select a personally inferior option by positioning information that favored that alternative in the initial serial position.

The present study had four goals. First, we attempted to show that participants can be induced to select a self-identified inferior alternative merely by using information order to establish a leader and then allowing predecisional distortion to build support for it. Second, we tracked this choice over time in order to trace support for the inferior option to the distortion of attribute evaluations. Third, we assessed awareness of this distortion. If decision makers are unaware of this bias, it is likely to persist. Finally, we assessed participants' confidence in their choice. If decision makers are unaware of their tendency to distort attribute evaluations, their confidence in their choice should be as high when they choose the inferior option as when they choose the objectively superior one.

METHOD

Design

Two experimental sessions were required. In the first session, we identified a participant's true preference for each of two pairs of restaurants. In the second, we observed whether that same participant chose the restaurant that was less preferred in the first session (i.e., chose the inferior one). Between the first and second sessions, we used the available but necessarily incomplete data on each participant's attribute-level preferences to construct an attribute order that, in our judgment, would target the inferior of the two restaurants in one of the pairs. The order of the attributes for the second, control pair of restaurants was yoked to the order for the first, test pair, producing an approximately random order for this second pair (i.e., an order in which neither option was targeted). The details of precisely how the pairs were assessed and created are described next.

Stimulus Construction

In the first session, participants saw two triples of restaurants, one that was used to devise a test pair for the second session and one that was used as a control pair. For simplicity, we label the three alternatives in each triple A, B, and C. For the first triple, participants chose between A and B. Then the loser of this pair—say, B—was compared with C. After choosing between B and C, participants performed a matching task, changing C (creating Restaurant C′) so that it equaled B in overall attractiveness. Because B and C′ were equally attractive and A was preferred to B, this process yielded a pair for the second session, A and C′, in which one alternative (C′) was known to be inferior to the other (A).

To minimize the possibility that A and C′ would be recognized in Session 2, we disguised them in two ways. First, the letter that identified each alternative was changed between sessions. Second, the alternatives' attributes were restructured. In Session 1, all restaurants were described by nine attributes (atmosphere; daily specials; dishes; dining room; driving distance; hours of operation; parking; timing, which included the two components of speed of service and duration of the meal; and waiting time). Before Session 2, the timing attribute was partitioned into its two components, yielding 10 attributes in total.

In Session 2, A and C′ were not described by the 9 attributes used in Session 1 (10 after the partition of "timing"), but rather were described by the identical information recombined into 6 attributes, constructed and ordered as follows. We placed in the first serial position the attribute (out of the 10 available) that seemed most clearly to favor the inferior alternative. This was the crucial position. We then placed the next most favorable attribute in the sixth and last position, to take advantage of any recency effect. The remaining 8 attributes were aggregated into 4, such that those that appeared most clearly to oppose the inferior restaurant were combined with attributes whose preference was uncertain or neutral.[1] (The partitioned attribute, service and meal duration, could not be recombined.) If any 1 of

[1]For two attributes, the preference ordering was clear. These were daily specials, for which we assumed that within a small range, more was better (e.g., seven specials was better than five), and meal duration (90, 115, 135, or 150 min), for which we specifically obtained participants' rankings following the choice and matching tasks in Session 1. For other attributes, a direction of preference was assumed, but with some uncertainty. For instance, one version of driving distance read, "Restaurant A is located about 45 minutes west of your house in a neighboring community. The roads are not very well lit, but it is a scenic drive. During heavy commute times it can take nearly 50 minutes to get to Restaurant B, and this is on the highway. Without traffic the drive can be as short as 25 minutes." We assumed that the 25- to 50-min range would be preferred to the 45-min drive, but realized that this might not hold for participants who valued the scenic drive more than speed, or who strongly disliked heavy traffic.

the 4 aggregated attributes seemed more supportive of the inferior option than the other aggregated attributes did, it became the second attribute in order to bolster the intended leadership of the targeted restaurant that, we hoped, would be established by the first attribute. The least favorable attributes (as best they could be determined) were buried in the two middle serial positions. Thus, the final construction of the test pair of restaurants in Session 2 relied on partial knowledge of a participant's preferences for the individual attributes, augmented by our own guesswork as to the most likely preferences across participants.

In addition to the test pair, which was contrived to induce choice of the inferior restaurant, we created a control pair using the second pair of triples judged in Session 1. The same process as described for the test pair was followed for the control pair with the single exception that the unique aggregation into 6 attributes and their order in the test choice were applied to the control case as well. That is, the 10 attributes for the control pair were combined into the same 6 attributes as in the participant's test pair and ordered for presentation by duplicating the order for the test pair. Because the attribute descriptions for the two choices were completely different, this yoking of the control choice to the manipulated choice should have provided no basis for inducing choice of the inferior restaurant in the control pair.

Subjects

Subjects were 136 undergraduates who completed both research sessions in exchange for extra course credit. All were aware that the two sessions were part of the same study, but debriefing revealed that they were unaware of the hypotheses. Eight failed to provide complete responses and were dropped from all analyses.

Procedure

The first session included the four choices (two for each triple) and two matching tasks. The second session took place 2 weeks later. This much time was needed to analyze responses and then create the two choice pairs of the second session for each participant individually. In this latter session, all individuals made two binary choices, with half seeing the control choice first and the other half beginning with the test choice. For each choice, participants read the attributes in the predetermined order, answered three progress questions after each attribute, selected the alternative that they preferred, and finally rated their confidence in that choice on a scale from 50 (*a toss-up*) to 100 (*absolutely certain*). The first progress question asked participants to evaluate the attribute just described on a scale from 1 (*strongly favors Restaurant [S]*) to 9 (*strongly favors Restaurant [K]*), with a midpoint of 5 (*favors neither restaurant*). The second progress question asked which restaurant was leading at that point in the choice process, and the third asked participants to indicate their confidence in that leader (responses to this question were not used in any analysis and are not discussed further). The responses to the first two questions were used to compute the distortion of information throughout the choice process, as explained in the Results section.

We expected that the proportion of participants choosing the inferior restaurant would be below chance for the control choice, setting a baseline for comparison. Such a result would also serve as a check that we had correctly identified the inferior restaurant and that this preference, absent the experimental manipulation, was stable across sessions.

After making the test and control choices in Session 2, participants were asked whether they believed they had evaluated the information to favor their early leader: "People sometimes have a tendency to interpret new information to support their current beliefs. In a decision, this might be seeing new information as favoring the alternative believed to be leading. Did you notice yourself doing this in the decisions you just made?" Responses were collected on a 5-point semantic differential scale anchored by 1 (*definitely did not notice doing it*) and 5 (*definitely noticed doing it*). After answering this question, participants were asked about the likelihood that they had interpreted the information so as to support their early leader even if they had not been aware of having done so during the choice process: "Even if you did not definitely notice doing it, how likely is it that you did this in the decisions that you just made?" Responses were collected on a 5-point semantic differential scale anchored by 1 (*definitely did not do it*) and 5 (*I am certain I did it*).

RESULTS

Choice of the Inferior Alternative

Just as they should have, a minority of participants (.41) selected the inferior restaurant in the control choice, in which neither restaurant was intentionally targeted. This proportion was reliably below chance ($z = 2.06$, $p_{rep} = .93$). In contrast, when the inferior restaurant was targeted to become the early leader, a majority of participants (.62) selected it. This proportion not only was reliably greater than .41, but also was significantly above chance ($z = 2.74$, $p_{rep} = .98$). Thus, participants were manipulated into selecting the targeted inferior restaurant over one that they had preferred 2 weeks earlier.

Tracking the Process

The process that produced a majority choice of the inferior restaurant had two components, the first attribute's installation of the inferior option as the leader and the subsequent attributes' distortion to support that leader. After the first attribute was presented, .76 of participants in the manipulated-choice condition indicated that the inferior option was the leader. As the next five attributes were presented, the proportion of partici-

pants favoring the targeted inferior option declined, as expected, from .76 to .71, .59, .54, .59, and finally .68.[2] The largest drop occurred at Attribute 3, and another decline was found at Attribute 4; these were the attributes that most favored the superior alternative. The rebound at Attribute 6 was expected given that this attribute was the second most favorable toward the inferior option.

The distortion of the second through sixth attributes to support the inferior alternative had to overcome two forces. First, the inferior restaurant was not initially installed as the leader for all participants (it was installed as the leader for only .76 of them, to be precise), so distortion (which always favored the leader) supported the inferior restaurant only some of the time. The six ordered proportions reported in the previous paragraph trace this natural decline in retention of the target as the leading alternative, from .76 after the first attribute to .68 after the last attribute. Second, on average, an attribute's true or unbiased evaluation favored the superior, not the inferior, alternative. Thus, the distortion of evaluations in favor of the inferior option had to be large enough to overcome the advantage for the superior alternative that was inherent in the true value of the attributes. The mean evaluation of the control choice's attributes, 0.18 units in favor of the superior option (from the neutral midpoint of 5 on the 9-point scale), served to estimate this true value, as shown in the bottom line in Figure 1. This line reflects the cumulative impact of multiple attributes (i.e., an additional 0.18 units in favor of the superior alternative with each additional attribute) and shows the negative impact of true preference on the evaluation of the inferior alternative as that preference increases with each new piece of information.

Finally, distortion in favor of the inferior alternative was calculated by taking the absolute difference between the reported rating on the first process-tracing question and the average estimate of an attribute's true value (equivalent to 0.18 units away from the 9-point scale's midpoint, in the direction of the superior alternative). This difference was signed positively if it pointed toward the inferior alternative and negatively if it pointed toward the superior alternative. For example, if a participant gave an attribute a rating of 4 on the scale from 1 to 9 and the inferior option was positioned at the low end of the scale, then the distortion toward the inferior alternative would have been $+|4 - 5.18|$, or $+1.18$ units. Similarly, if an attribute's rating had been 6, the distortion would have been $-|6 - 5.18|$, or -0.82, with the negative sign indicating that the distortion was directed toward the superior alternative.

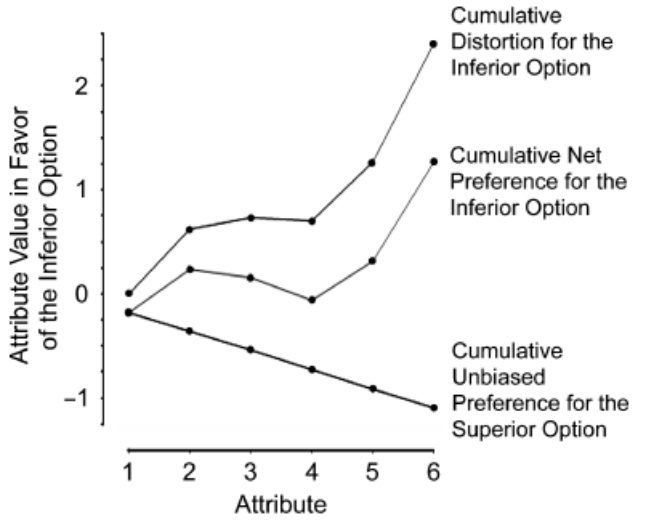

Fig. 1. The net impact of the true preference for the superior option and the leader-supporting distortion of information to create a preference for the inferior alternative. The bottom line represents the mean estimated unbiased value of each attribute, which favors the superior option, cumulated linearly over the six attributes. The top line represents the mean predecisional distortion of each attribute to favor the inferior option, also cumulated over attributes. The middle line plots their difference and reflects the mean cumulative support for the inferior alternative as it develops over the presentation of the six attributes.

The top line in Figure 1 shows the cumulative mean distortion toward the inferior alternative as a function of the number of attributes presented. This distortion already incorporates the first opposing force, namely, that not all participants viewed the targeted inferior restaurant as the leading option. The second opposing force, the true value of the attributes (represented by the bottom line in the figure), was subtracted from this distortion to yield the net effect of our manipulation. This final result is plotted as the middle line in the figure. The resulting pattern traces the development of the net bias for the inferior alternative as participants encountered, in their preset order, the attributes that favored or disfavored it. The final net effect, after all six attributes, was 1.27 units of distortion favoring the inferior alternative. This distortion value yielded choice of that alternative more than half the time (.62). Note that these numbers were closely paralleled by the results for the control condition, which yielded a cumulative value of the attributes that was of a similar magnitude but negative (i.e., favoring the superior alternative), -1.09, and a corresponding .59 proportion of choice of the superior option.

Awareness of Leader-Driven Primacy

We tested for a relation between participants' mean distortion (toward the leading option) and their awareness of this bias. For the first awareness question, "Did you notice yourself [interpreting new information to support your current belief]?" (M = 2.70 on the scale from 1 to 5), the correlation between a

[2]The actual choice proportion, .62, did not equal the proportion of preference for the inferior option after the last attribute was presented (.68) because participants tended to review the entire set of attributes just before announcing their choice. One can view the .68 value as reflecting a recency effect of information favoring the inferior choice and the subsequent review that yielded the choice proportion of .62 as overcoming that effect.

participant's response and mean distortion was .08 ($z = .40$, $p_{rep} = .69$). For the second awareness question, "Even if you did not definitely notice doing it, how likely is it that you did this in the decisions that you just made?" ($M = 2.87$), the correlation was $-.10$ ($z = .50$, $p_{rep} = .72$). Thus, these responses provided no evidence that self-reported awareness correlated with actual bias in the attribute evaluations.

Choice Confidence

We examined decision makers' final confidence in their choice to determine whether they were more confident when they chose the superior, rather than the inferior, option. Greater confidence would be expected in typical decisions when the superior alternative is chosen (because its mean advantage when chosen should be greater than the mean advantage of the inferior alternative when it is chosen). The control choice confirmed this expectation. Confidence was higher among participants who selected the superior option ($M = 84.9$) than among those who selected the inferior option ($M = 80.4$), $t(126) = 2.06$, $p_{rep} = .96$, $d = 0.513$. That is, in the control condition, participants not only selected the inferior option less often than the superior option, but also felt less confident when they selected it. In the test choice, however, the difference in confidence between those who selected the inferior option ($M = 84.3$) and those who selected the superior option ($M = 82.1$) was not even in the expected direction, $t(126) = -0.93$, $p_{rep} = .26$, $d = -0.23$. Thus, in our manipulated choice, participants' lack of awareness when they distorted their evaluation of information and the self-convincing nature of predecisional distortion led to equal confidence whether the inferior or superior alternative had been chosen. That is, the inferior alternative did not seem inferior to participants who chose it.

DISCUSSION

This study demonstrated a tactic for inducing the choice of an inferior alternative. The manipulation raised the proportion of participants who chose the personally inferior option from a baseline of .41 to .62. By tracing the evaluation process across the six units of information presented, we verified that the inferior option was installed as the initial leader and was supported by the distortion of subsequent information. Finally, we found that participants were unaware that they had biased their attribute evaluations to support the leading alternative and exhibited just as much confidence when they chose the targeted inferior alternative as when they selected the superior option.

In order to trace the process and, particularly, to estimate the distortion of information, we had to ask participants to report which alternative was leading. This may have augmented participants' conviction in their current leader and contributed to the magnitude of distortion. If such an effect occurred, it would qualify as a measurement artifact. However, it might also be viewed as an element of the tactic for inducing the choice of the inferior option. That is, asking decision makers for their intermediate preference may strengthen that preference and enhance the success of the manipulation as a whole.

Our results raise the uncomfortable possibility that an adversary might be able to take advantage of decision makers by using some version of our tactic for targeting an inferior alternative. We have no direct evidence of such manipulation in real consequential decisions. However, to take a mundane example, would-be persuaders often appreciate the importance of making a good first impression. It is possible that they sometimes begin by presenting information favorable to their case. They may then wait while at least some decision makers distort subsequent information, essentially "talking themselves into" selecting the alternative targeted by the adversary. To counter such manipulations, we recommend that decision makers control the order in which they acquire information. One natural possibility is to acquire information in order of its importance (Simonson, Huber, & Payne, 1988). What should be avoided is permitting another person to control the order in which information is presented.

Because we manipulated the order of information, our result qualifies as an order effect. A particularly interesting aspect of this effect is that it was traced to a change in the interpretation and evaluation of information. In contrast, most order effects are ascribed to a change in the importance weights assigned to information (e.g., Anderson, 1981).

We conclude by noting that the common approach to decision research is to use a pattern of errors to reveal the causal process. In the present work, we began with knowledge of that process and used it to devise a procedure that produced a violation of an earlier preference. Although we thoroughly appreciate the value of errors in informing inferences regarding the underlying process (e.g., Kahneman & Tversky, 1974) and then prompting direct examinations of that proposed process (Chapman & Johnson, 1999), creating a substantial error is greatly facilitated by knowing the underlying process beforehand.

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