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FLUENCY AND THE DETECTION OF MISLEADING QUESTIONS: LOW PROCESSING FLUENCY ATTENUATES THE MOSES ILLUSION

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When asked, "How many animals of each kind did Moses take on the Ark?" most people respond "Two" despite knowing that Noah rather than Moses was the biblical actor. Two experiments tested the role of processing fluency in the detection of such semantic distortions by presenting questions in an easy or difficult to read print font. As predicted, low processing fluency facilitated detection of the misleading nature of the question and reduced the proportion of erroneous answers. However, low processing fluency also reduced the proportion of correct answers in response to an undistorted question. In both cases, participants were less likely to rely on their spontaneous association when the font was difficult to read, resulting in improved performance on distorted and impaired performance on undistorted questions. We propose that fluency experiences influence processing style.

When asked, "How many animals of each kind did Moses take on the Ark?" most people respond "Two" despite knowing that Noah rather than Moses was the actor in the biblical story (Erickson & Mattson, 1981). This Moses illusion bears on an important aspect of human communication: Under which conditions are distortions in utterances and texts likely to be noticed? Previous research addressed a variety of plausible accounts (for a comprehensive review see Park & Reder, 2003), including the possibility that recipients are cooperative communicators (Grice, 1975; Schwarz, 1996) who notice the distortion, but simply correct for it by responding to what the questioner must have meant. Yet making participants aware that the text may be distorted, or asking them to identify such distortions,

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does not eliminate the effect (e.g., Bredart & Modolo, 1988; Reder & Kusbit, 1991), in contrast to what a conversational cooperation account would predict.

The currently best supported explanation holds that "distortion detection involves a two-pass process—the first to flag a potential mismatch and the second to invoke a careful inspection that might confirm an erroneous term in the question" (Park & Reder, 2003, p. 282; see also Reder, 1987, 1988). Distorted questions pass the first stage when the semantic overlap between the question and the person's knowledge provides a sufficient match (Carpenter & Grossberg, 1995; Metcalfe, Schwartz, & Joaquim, 1993; Park & Reder, 2003), as is the case for the Moses question (e.g., Moses and Noah are both characters in the Old Testament, who received commands from God that were related to water). Low feature-overlap, on the other hand, reliably attenuates or eliminates the Moses illusion (e.g., Erickson & Mattson, 1981; van Oostendorp & de Mul, 1990); for example, it is not obtained when Moses is replaced by "Nixon" in the above question. The observation that distortions remain unnoticed under conditions of sufficient feature overlap is consistent with the assumption that "many of our cognitive operations are driven by familiarity-based heuristics rather than careful matching operations" (Park & Reder, 2003, p. 283).

Taking the notion of familiarity-based heuristics seriously, we go beyond the focus on feature overlap and test whether other variables that influence impressions of familiarity also influence the detection of distortions in text. One of these variables is the fluency with which text can be processed, which can be manipulated through easy or difficult to read print fonts (for a review see Schwarz, 2004). We assume that low familiarity triggers more systematic processing and renders it less likely that people report the first answer that comes to mind. Accordingly, they should be more likely to notice distortions in text and less likely to fall prey to the Moses illusion, resulting in improved performance on distorted questions. On the other hand, low familiarity may also lead people to second guess their answers to undistorted questions, potentially hurting performance in that case. Next, we elaborate on the underlying logic and review selected findings.

FLUENCY, FAMILIARITY, AND PROCESSING STYLE

People correctly assume that familiar material is easier to process than novel material (Schwarz, 2004). Applying this naïve theory, they infer familiarity from high processing fluency, even when the fluency merely results from presentation variables like high figure-ground contrast, long exposure times, or easy-to-read print fonts (for reviews see Kelley & Rhodes, 2002; Reber, Schwarz, & Winkielman, 2004; Schwarz, 2004). In memory research, this fluency-familiarity link gives rise to erroneous recognition judgments (e.g., Whittlesea, Jacoby, & Girard, 1990) and strong feelings of knowing (e.g., Koriat & Levy-Sadot, 2001). Whittlesea and colleagues (1990), for example, reported that participants were more likely to misidentify novel words as previously seen when they were easy rather than difficult to process due to the visual clarity of the presentation format. Perceived familiarity, in turn, feeds into other judgments, including judgments of truth.

Numerous studies showed that familiar statements are more likely to be accepted as true. This is the case when perceived familiarity derives from actual previous exposure (e.g., Begg, Anas, & Farinacci, 1992; Skurnik, Yoon, Park, & Schwarz,

2005) as well as when it derives from fluent processing. For example, Reber and Schwarz (1999) found that statements like "Orsono is a city in Chile" were more likely to be judged true when the color contrast of the print font made them easy- rather than difficult-to-read. Similarly, McGlone and Tofigbakhsh (2000) observed that substantively equivalent statements were more likely to be accepted as true when presented in a rhyming (e.g., "woes unite foes") rather than a non-rhyming form (e.g., "woes unite emenies"). This familiarity-truth link reflects that the familiarity of a statement serves as a social consensus cue—if it seems familiar, we presumably heard it before and the belief may be widely shared (for a review see Schwarz, Sanna, Skurnik, & Yoon, 2007). Accordingly, manipulations that increase the perceived familiarity of a belief also increase estimates of how many people share it (Weaver, Garcia, Schwarz, & Miller, 2007). Perceived social consensus, in turn, can serve as a basis for assessing the truth value of beliefs, as Festinger (1954) suggested—if many believe it, there's probably something to it.

These observations indicate that familiar material is more likely to be accepted as true. Given its apparent truth value, familiar material may also receive less scrutiny and less detail-oriented processing than unfamiliar material. Consistent with this conjecture, familiar persuasive messages receive less systematic processing than unfamiliar ones (Claypool, Mackie, & Garcia-Marques, 2004; Garcia-Marques & Mackie, 2001) and the familiarity of a person description increases stereotyping, which presumably reflects a heuristic rather than systematic processing strategy (Smith, Miller, Maitner, Crump, Garcia-Marques, & Mackie, 2006).

Finally, people report more confidence in the accuracy of their own thoughts when they are easy rather than difficult to bring to mind (for a review see Petty, Brinol, Tormala, & Wegener, 2007). In combination, these diverse findings indicate that fluently processed material seems more familiar, is more likely to be accepted as true and less likely to be scrutinized. Moreover, people may have more confidence in the associations triggered by such material and may be less likely to second guess them.

THE PRESENT RESEARCH

Building on this work, the present studies address the role of processing fluency in the detection of distortions in texts. To manipulate processing fluency, we presented an undistorted control question and the Moses question (Experiment 1) or a variant (Experiment 2) in an easy or difficult to read print font. Consistent with the research reviewed above, we assume that the text seems less familiar when presented in a difficult- rather than easy-to-read font and that low familiarity triggers more systematic processing. Accordingly, participants who are asked, "How many animals of each kind did Moses take on the Ark?" should be less likely to rely on their spontaneous association (Two) and more likely to scrutinize the text when the text is difficult to read, realizing that the biblical actor was not Moses. Hence, low fluency should improve performance on distorted questions. However, processing fluency may also affect participants performance on an undistorted control question, like "which country is famous for cuckoo clocks, banks, and pocket knives?" The less familiar the text seems, the fewer participants may rely on their spontaneous association (Switzerland); if so, low fluency may potentially impair performance on an undistorted question.

FIGURE 1. Easy-to-read (top) and difficult-to-read (bottom) font samples.

EXPERIMENT 1

METHOD

Pretest of Font Ease. Five undergraduates read the sentence "Switzerland is famous for cuckoo clocks, banks and pocket knives" printed in grey Brush Script MT font with font size 12; another five read the same sentence in black Arial font with font size 12. The sample sentences are presented in Figure 1. Participants rated the ease with which they could read the text (1 = very difficult, 7 = very easy). Confirming the intended variation in ease of reading, they reported that the Arial font was easier to read (M = 6.8, SD = .45) than the Brush Script MT font (M = 4.2, SD = 1.3), $t(8) = 4.22$, $p < .01$.

Main Experiment. Thirty-two undergraduates participated for course credit. They were randomly assigned to an *easy-* vs. *difficult-to-read* condition. The instructions (modeled after Erickson & Mattson, 1981) read, "You will a read couple of trivia questions and answer them. You can write the answer in the blank. In case you do not know the answer, please write 'don't know.' You may or may not encounter ill-formed questions which do not have correct answers if taken literally. For instance, you might see the question 'Why was President Gerald Ford forced to resign his office?' In fact, Gerald Ford was not forced to resign. Please, write 'can't say' for this type of question."

Depending on condition, participants were presented with two questions printed in a hard-to-read or easy-to-read font, as described above. The first (control) question did not have a distortion. It read, "Which country is famous for cuckoo clocks, chocolate, banks, and pocket knives?" (Switzerland). The second, distorted question read, "How many animals of each kind did Moses take on the Ark?" (taken from Erickson & Mattson, 1981). This question replaces the correct actor, Noah, with Moses and should be answered "can't say." Answering "2" indicates the Moses illusion.

RESULTS

Distorted Question. As predicted, a difficult-to-read print font attenuated the Moses illusion. As shown in Table 1, 88% (15 out of 17) of the participants answered 2 in response to the Moses question when the font was easy to read, whereas only 53% (8 out of 15) did so when it was difficult to read, $z = 2.5$, $p < .02$ (contrast on proportions, Rosenthal & Rosnow, 1985). Conversely, when the font was easy to read, 6 (1 out of 17) of the participants provided the correct answer "can't say,"

TABLE 1. Frequency of Answers in Experiment 1

	Moses Question (Distorted)			
	% Whale or fish	% Don't know	% Can't say	% Total
Easy to read	88 (15/17)	6 (1/17)	6 (1/17)	100 (17/17)
Hard to read	53 (8/15)	7 (1/15)	40 (6/15)	100 (15/15)
	Switzerland Question (Undistorted)			
	% Switzerland	% Don't know	% Other countries	% Total
Easy to read	88 (15/17)	6 (1/17)	6 (1/17)	100 (17/17)
Hard to read	53 (8/15)	20 (3/15)	26 (4/15)	100 (15/15)

whereas 40% (6 out of 15) did so when the font was difficult to read, $z = 2.66$, $p < .01$.

Undistorted Question. None of the participants answered 'can't say' to the control question, indicating that they did not consider it distorted. Nevertheless, the print font affected their answers, as shown in Table 1. When the font was easy to read, 88% (15 out of 17) of the participants correctly answered Switzerland, whereas only 53% (8 out of 15) did so when it was difficult to read, $z = 2.5$, $p < .02$. Moreover, participants were more likely to name a country other than Switzerland when the font was hard (26%; 4 out of 15) rather than easy (6%; 1 out of 17) to read, $z = 2.27$, $p < .03$, and more likely to report that they 'don't know' (20%, 3 out of 15 vs. 6%, 1 out of 17, for hard- and easy-to-read fonts, respectively), $z = 1.97$, $p<.05$.

In sum, low processing fluency, induced through a difficult-to-read print font, improved performance on a distorted question and impaired performance on an undistorted question, as theoretically predicted. Experiment 2 tests the robustness of this finding with a different distorted question.

EXPERIMENT 2

METHOD

This experiment followed the procedures of Experiment 1, except that the distorted question read, "In the biblical story, what was Joshua swallowed by?" (taken from Erickson & Mattson, 1981). This question replaces the correct actor Jonah with Joshua and should be answered with "can't say"; answers like "whale" or "fish" indicate the illusion. Sixty undergraduates participated for course credit and were randomly assigned to the easy- or difficult-to-read condition.

RESULTS

Distorted Question. As shown in Table 2, the results replicate the earlier findings. 47% (14 out of 30) of the participants answered "fish" or "whale" in response to the Joshua question when the font was easy to read, whereas only 23% (7 out of 30) did so when it was difficult to read, $z = 2.09$, $p < .04$ (contrast on proportions, Rosenthal

TABLE 2. Frequency of Answers in Experiment 2

	Joshua Question (Distorted)			
	% Whale or fish	**% Don't know**	**% Can't say**	**% Total**
Easy to read	47 (14/30)	30 (9/30)	23 (7/30)	100 (30/30)
Hard to read	23 (7/30)	37 (11/30)	40 (12/30)	100 (30/30)
	Switzerland Question (Undistorted)			
	% Switzerland	**% Don't know**	**% Other countries**	**% Total**
Easy to read	63 (19/30)	20 (6/30)	17 (5/30)	100 (30/30)
Hard to read	50 (15/30)	37 (11/30)	13 (4/30)	100 (30/30)

& Rosnow, 1985). Conversely, 40% (12 out of 30) correctly answered "can't say" when the font was difficult to read, whereas only 23% (7 out of 30) did so when it was easy to read, z =1.41, p =.16. Finally, 9 participants (30%) in the easy-to-read condition and 11 participants (37%) in the hard-to-read condition reported that they did not know the answer, reflecting that the Jonah story is less well known than the Noah's Ark story used in Experiment 1.

Undistorted Question. Participants answers to the undistorted question also followed the pattern of Experiment 1, although the differences failed to reach significance (see Table 2). Again, more participants answered "don't know" when the font was difficult rather than easy to read, z =1.48, p =.14, and fewer provided the correct answer "Switzerland," z = 1.02, *ns*.

COMBINED ANALYSIS

To assess the robustness of the results across both experiments, we used Rosenthal's (1978) procedures for combining results of independent studies. This analysis confirms the overall reliability of the observed patterns. When the question was *distorted*, participants were less likely to give an erroneous substantive answer, z = 3.26, $p < .002$, and more likely to recognize the distortion (as indicated by answering 'can't say'), z = 2.89, $p < .004$, when the font was difficult rather than easy to read. When the question was *undistorted*, participants were less likely to give a correct substantive answer, z = 2.5, $p < .02$, and more likely to report that they "don't know, z = 2.45, $p < .02$, when the font was difficult rather than easy to read.

DISCUSSION

The present studies extend our understanding of the role of processing fluency in human judgment. Earlier research indicated that fluently processed material seems more familiar (Kelley & Rhodes, 2002; Schwarz, 2004), is more likely to be accepted as true (McGlone & Tofighbaksh, 2000; Reber & Schwarz, 1999), and less likely to be scrutinized (Claypool, Mackie, & Garcia-Marques, 2004; Garcia-Marques & Mackie, 2001). Moreover, opinions based on fluently processed material are held with greater confidence (Petty et al., 2007), whereas disfluent processing reduces

confidence and fosters decision deferral (Novemsky, Dhar, Schwarz, & Simonson, 2007). Our findings suggest that the same logic applies to the process of question answering. When the question is easy to process, the content seems familiar and people rely on the first answer that comes to mind, probably feeling that the answer is pretty obvious. When the question is difficult to process, the material seems less familiar and people may be less inclined to assume that their first association is the correct one.

How this affects performance depends on the nature of the question. When the question is distorted—as in "How many animals of each kind did Moses take on the Ark?"—closer consideration reveals that Moses was not the biblical actor and hence one's spontaneous answer "2" does not apply. But the same signal of low familiarity may make one wonder whether Switzerland is really the land of cuckoo clocks and pocket knives, fostering an erroneous "don't know" response. Hence, low processing fluency improves performance when one's spontaneous answer is wrong, but impairs performance when one's spontaneous answer is correct.

Note that this diverging influence of processing fluency on answers to distorted and undistorted questions is incompatible with a potential concern arising from our use of print fonts as a fluency manipulation. Reading a question printed in a difficult font presumably requires more attention and this alone may be sufficient to facilitate distortion detection. Yet increased attention would not predict the observed impaired performance on an undistorted question. Next we turn to the broader implications of these findings.

Detecting Distortions in Text

Most accounts of the Moses illusion assign a prominent role to the semantic overlap between the question and participants knowledge (for a review see Park & Reder, 2003). Our findings suggest that semantic overlap is just one of the many variables that facilitate fluent processing, giving rise to a feeling of familiarity. Hence, any of the variables known to affect processing fluency should also affect the size of the Moses illusion, consistent with the observation that "many of our cognitive operations are driven by familiarity-based heuristics rather than careful matching operations" (Park & Reder, 2003, p. 283). Relevant variables include semantic (e.g., Reder, 1988) and phonetic (e.g., Shafto & MacKay, 2000) similarity as well as all presentation variables that facilitate fluent processing (for a review see Reber et al., 2004). In the case of visual presentations, prime candidates include the readability of the print font (as in the present studies), the degree of figure-ground contrast, the presence or absence of visual noise, and exposure frequency and duration. In the case of auditory presentations, prime candidates include the acoustic clarity of the presentation and the presence or absence of distracting noise. Moreover, presentation variables that impair processing fluency should lose their impact when participants attention is drawn to them, thus inviting an attribution of the experienced difficulty to the contextual variable rather than the to-be-processed material (see Schwarz, 2004, for a review).

Ironically, these variables run counter to what common sense would suggest. When asked to advise a communicator on how to present material in a way that minimizes the detection of semantic distortions, most readers would probably opt for presentation formats that "hide" the distortion rather than for presentation

formats that facilitate easy processing. Yet our data suggest that it is exactly easy processing that interferes with distortion detection, presumably by fostering the perception that the material is familiar.

Fluency and Processing Style

From a broader perspective, the subjective experience of processing difficulty may influence individuals' processing strategies in ways that parallel the influence of other experiential "problem" signals. Previous research found, for example, that sad moods (e.g., Bless, Bohner, Schwarz, & Strack, 1990) or bodily avoidance feedback (e.g., Friedman & Förster, 2000) foster more detail-oriented analytic processing, presumably because they alert the person of a potential "problem" that requires attention (for comprehensive reviews see Schwarz, 2002; Schwarz & Clore, 2007). Consistent with this conjecture, Alter, Oppenheimer, Epley, and Norwick (2006) reported that manipulations that increased experienced processing difficulty improved participants' performance on reasoning tasks by evoking a more analytic processing style. This possibility provides a promising avenue for future research.

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