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NOTE

Effects of Perceptual Fluency on Judgments of Truth

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Statements of the form ''Osorno is in Chile'' were presented in colors that made them easy or difficult to read against a white background and participants judged the truth of the statement. Moderately visible statements were judged as true at chance level, whereas highly visible statements were judged as true significantly above chance level. We conclude that perceptual fluency affects judgments of truth. © 1999 Academic Press

Research has shown that repeated exposure increases the perceived truth of statements such as ''Greenland has about 50,000 inhabitants,'' compared to statements that have not been presented before (e.g., Arkes, Hackett, & Boehm, 1989; Begg, Anas, & Farinacci, 1992; Brown & Nix, 1996; Hasher, Goldstein, & Toppino, 1977). Both subjective familiarity and frequency of objective exposure of statements are likely to increase truth ratings (Brown & Nix, 1996). Whereas subjective familiarity may enhance truth judgments by allowing the judge to recollect additional information, it is less clear what mediates between the frequency of objective exposure and judgments of truth.

The possibility that semantic activation in an associative network may lead to higher truth judgments has received no support. Specifically, Begg, Armour, and Kerr (1985, Experiment 4) found that the effect of repeated exposure on truth judgments was not influenced by a level-of-processing manipulation at the encoding stage; whether participants had to rate ease of pronunciation, ease of understanding, ease of imagery, or frequency of encounter, the old–new differences in truth ratings were equal across level-of-processing conditions, although recognition memory was poorer in the pronunciation than in the other three conditions. As an alternative account, Begg et al. (1992) suggested that exposure enhances the ease of subsequent processing (as shown by Jacoby & Dallas, 1981), which in turn may influence judgments of truth. Using Jacoby's (1991) process dissociation procedure, Begg et al. (1992) could show that conscious and automatic influences had independent effects on truth judgments. These dissociations between unconscious influences and intentional recollection suggest that a process such as perceptual fluency may mediate between repeated exposure and truth rating. This possibility is compatible with the available data, given that ease of processing has been found to increase feelings of familiarity (Jacoby & Whitehouse, 1989; Whittlesea, Jacoby, & Girard, 1990) and feelings of

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knowing (Koriat, 1993), which in turn are likely to contribute to judgments of truth. Unfortunately, it is difficult to isolate the role of perceptual fluency in repeated-exposure paradigms because repeated exposure also provides participants with an opportunity to think more about the statement.

If perceptual fluency is the crucial mediating variable, however, any manipulation that facilitates processing of a statement should increase the likelihood that the statement is judged as true, even under conditions where the statement is shown only once. The present study tests this possibility with a perceptual fluency manipulation adapted from Whittlesea et al. (1990). Specifically, we presented statements in colors that made them more or less easy to perceive against a white background, thus manipulating ease of processing independent of exposure frequency. We expected that the same statement, shown only once, would receive higher truth ratings when it is easy rather than difficult to process. This single-exposure procedure isolates the role of perceptual fluency and renders a differential semantic activation interpretation unlikely, thus avoiding a key ambiguity of repeated-exposure procedures.

METHOD

Two hundred thirty-five undergraduates participated for credit in the experiment. The experiment was run individually on Macintosh computers with color screens, using PsyScope, Version 1.0.2b.4 (Cohen, MacWhinney, Flatt & Provost, 1993).

Thirty-two statements of the form ''Town A is in country B'' (e.g., Osorno is in Chile; Lima is in Peru) were presented in the center of the screen. There were more familiar cities (e.g., Lima, Teheran) in half of the statements and less familiar cities (e.g., Bolligen, Osorno) in the other half of the statements (city familiarity). Half of the statements were actually true, and the other half were wrong (actual truth). Visibility of the statements was manipulated by the contrast of colors to the white background. Highly visible colors included blue and red, and moderately visible colors included green, yellow, and light blue.

There were minor differences in procedure within this experiment: 40 participants were shown green and yellow statements in the moderately visible condition. Statements were shown until the participant responded (subset 1). Seventy-nine participants were shown green and yellow statements in the moderately visible condition. Statements were shown for 1 s each (subset 2). Finally, 116 participants were shown green and light blue statements in the moderately visible condition. Statements were shown for 1 s each (subset 3). Highly visible statements were dark blue and red for all participants. The conditions were counterbalanced across participants; i.e., each city and each country appeared in true as well as in wrong statements, and each statement appeared highly visible for half of the participants and moderately visible for the other half of the participants. Each statement was preceded by a fixation point presented for 500 ms. The interval between the fixation point and the onset of the statement was 200 ms. After the presentation of the statement, participants had to decide whether the statement was true (left button) or not (right button).

Participants were told that the statements were shown in different colors because we were interested in the impact of color on reaction times. Systematic interviews of the first 40 participants and more informal questioning of the remaining partici-

pants showed that they were not suspicious about our instructions and did not suspect that we were interested in effects of perceptual fluency (or clarity, visibility, readability, etc.) on truth judgments.

RESULTS AND DISCUSSION

Manipulation Check

To determine whether the color manipulation did indeed affect perceptual fluency, we conducted a manipulation check with eight additional participants. Using a clarification procedure (see Feustel, Shiffrin, & Salasoo, 1983), 20 strings were presented in each of the five colors used in the main experiments. Color was randomly assigned to each letter string, with the constraint that each color was shown equally often. The initially masked letter strings became increasingly visible and participants had to press the mouse button as soon as they could identify the letter strings, which they wrote down. The mean reaction times for accurately identified letter strings were $M = 6.19$ s for the dark blue, $M = 6.02$ s for the red, $M = 9.03$ s for the light blue, $M = 10.44$ s for the green, and $M = 12.61$ s for the yellow strings. *T* tests revealed highly significant differences between the two highly readable colors (dark blue and red, respectively) and each of the less readable colors, indicating successful manipulation of perceptual fluency, *t*'s (7) ranging from 5.51 to 15.97. For subset 3, we replaced yellow for light blue because yellow was the least readable color. Light blue was more readable than yellow, $t(7) = 11.17$, $p < .001$. The mean number of errors for writing down the letter strings was $M = 0.50$ for the dark blue, $M = 1.00$ for the red, $M = 0.25$ for the light blue, $M = 0.63$ for the green, and $M = 1.38$ for the yellow strings. The differences between highly visible colors (dark blue and red: $M = 1.50$) and moderately visible colors were not significant (yellow and green, $M = 2.00$, $t(7) = (-1.18)$; light blue and green, $M = 0.88$, $t(7) = 1.49$).

Judgments of Truth

Some participants endorsed very few statements as being true. We decided to exclude three participants from analysis because the number of true responses they provided was more than 2.5 standard deviations below the average number of true responses. In addition, we excluded the three participants with the highest number of true responses, leaving 229 participants for the analysis, 38 in subset 1, 77 in subset 2, and 114 in subset 3.

Means and standard deviations for endorsements are shown in Table 1. We expected that the statements were more likely to be judged as true when presented in a highly visible color. The results confirmed this prediction. Participants endorsed $M = 8.36$ of the 16 highly visible statements, which is significantly above chance level, $t(228) = 2.43$; $p < .01$, one-tailed. In contrast, they endorsed $M = 8.09$ of the 16 moderately visible statements, which is at chance level, $t(228) = 0.65$. This pattern resulted in the predicted difference between the highly visible and the moderately visible presentation conditions, $t(228) = 1.65$, $p < .05$, one-tailed.[2]

[2] The results of a 2 (visibility) × 2 (city familiarity) × 2 (actual truth) factorial ANOVA are of limited theoretical interest. Overall, true statements were more likely to be judged true than false statements, $F(1,228) = 426.74$, $p < .001$. Moreover, familiar cities received more endorsements, $M = 9.01$ ($SD =$

TABLE 1
Mean Number of Endorsements and Standard Deviations (in Parentheses) for Highly Visible and Moderately Visible Statements, by City Familiarity and Actual Truth of the Statements

	Highly visible	Moderately visible
City familiar		
True	3.27 (.77)	3.17 (.84)
Untrue	1.31 (.94)	1.26 (.93)
City unfamiliar		
True	1.91 (1.08)	1.84 (1.07)
Untrue	1.87 (1.15)	1.82 (1.06)
Total	8.36 (2.26)	8.09 (2.03)

One may worry, however, that participants in the moderately visible presentation condition may simply have judged some statements as ''false'' because they were unable to read them. Additional analyses argue against this possibility: Pilot testing showed that participants were able to read the moderately visible statements within 1 s. It is still possible, however, that some participants could not read some moderately visible statements due to inattention. If such an explanation accounted for our data, one would expect differential effects in the different subsets mentioned above. In this case, the 77 participants in subset 2, who were presented yellow and green statements for only 1 s, should be less likely to endorse moderately visible statements as true than (a) the 38 participants in subset 1, who were shown yellow and green statements until they made a decision and (b) the 114 participants in subset 3, who were shown light blue instead of yellow statements; the light blue statements were more readable than the yellow ones (see Manipulation Check). However, a 3×2 factorial ANOVA treating subsets as a between-subjects factor and color visibility as a within-subjects factor revealed no main effect of subset, $F < 1$, and, more importantly, no interaction of subset and visibility, $F < 1$. The respective mean endorsements of highly visible and moderately visible statements were $M = 8.66$ and $M = 8.39$ for subset 1, $M = 8.18$ and $M = 7.94$ for subset 2, and $M = 8.39$ and $M = 8.09$ for subset 3. Hence, there was no support for the argument that participants may have judged moderately visible statements as false because they were unable to read them.

1.77) than unfamiliar cities, $M = 7.44$ ($SD = 2.90$), $F(1,228) = 51.70$, $p < .001$. In fact, the endorsement of familiar cities was above chance level, $t(228) = 8.67$, $p < .001$, whereas the endorsement of unfamiliar cities was below chance level, $t(228) = -2.94$, $p < .01$, as may be expected on theoretical grounds. However, city familiarity was confounded with the city's country in the present materials, rendering it possible that this effect reflects differential knowledge as well as differential feelings of familiarity. Finally, a significant city familiarity $\times$ actual truth interaction, $F(1,228) = 454.43$, $p < .001$, qualifies these conclusions. For familiar cities, actually true statements were more likely to be endorsed than false statements, $t(228) = 29.08$, whereas actual truth played no role when the city was unfamiliar, $t < 1$. Most important, none of the experimental variables interacted with the visibility manipulation, all F's < 1, which showed the predicted main effect, $F(1,228) = 2.73$, $p < .05$, one-tailed, as discussed under Results and Discussion.

Discussion

In summary, we conclude that perceptual fluency affects judgments of truth independent of exposure frequency. Specifically, the same statements were endorsed as true at chance level when presented in moderately visible colors, but at significantly above chance level when presented in highly visible colors. Importantly, the color manipulation allowed us to test the impact of fluency in a single-exposure paradigm, thus avoiding the ambiguities associated with multiple exposures as a manipulation of ease of processing. Consistent with Begg et al.'s (1992) analysis, the present findings suggest that any variable that increases experienced ease of processing is also likely to increase judgments of truth. This presumably reflects that statements that are easy to process are experienced as familiar (e.g., Whittlesea et al., 1990), thus leading participants to feel that they have heard or seen this before, suggesting that it is probably true.

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