Research Article

DO AMNESICS EXHIBIT COGNITIVE DISSONANCE REDUCTION?
The Role of Explicit Memory and Attention in Attitude Change

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Abstract—*In two studies, we investigated the roles of explicit memory and attentional resources in the process of behavior-induced attitude change. Although most theories of attitude change (cognitive dissonance and self-perception theories) assume an important role for both mechanisms, we propose that behavior-induced attitude change can be a relatively automatic process that does not require explicit memory for, or consciously controlled processing of, the discrepancy between attitude and behavior. Using a free-choice paradigm, we found that both amnesics and normal participants under cognitive load showed as much attitude change as did control participants.*

A fox saw some ripe black grapes hanging from a trellised vine. He resorted to all his tricks to get at them, but wearied himself in vain, for he could not reach them. At last he turned away, hiding his disappointment and saying: "The grapes are sour, and not ripe as I thought."

—Aesop (trans. 1961, p. 100)

When a person responds to disappointments in the same fashion as Aesop's fox, revising his or her attitudes to fit with the current circumstances, other people may doubt the sincerity of the person's new beliefs and may be tempted to think of this change as rationalization or self-deception. If the grapes were suddenly available, the fox might not pass over them for being sour. The research we report here, however, suggests that such conventional wisdom may be wrong, that the grapes may indeed continue to be unappealing even if the memory that they were once unobtainable is completely removed. In this article, we present two experiments suggesting that the incongruency between one's attitudes and behaviors can automatically result in real changes in those attitudes. Such behavior-induced attitude changes may require minimal conscious effort and may endure without memory for the behavior that induced them.

Although rhetoricians since Aristotle have been interested in how and why people change their minds, scientific research on attitude change began in earnest only after the second world war (Asch, 1956; Hovland, Janis, & Kelley, 1953; see Jones, 1998). Although much was learned about the conditions that elicit attitude change, only in the past two decades have psychologists become invested in understanding the information processing mechanisms that underlie it (Chaiken, Lieberman, & Eagly, 1989; Petty & Cacioppo, 1986).

In the current analysis, we focus on the role of conscious reasoning in behavior-induced attitude change (i.e., changing an attitude to fit with recent behavior). We consider conscious reasoning to be composed largely of the attentional operations of working memory and the contents of explicit memory (O'Reilly, Braver, & Cohen, 1997). In two experiments, we examined the role of these two components by severely degrading their contributions to the process of attitude change.

CONSCIOUS CONTENT: THE ROLE OF EXPLICIT MEMORY

Explicit memory refers to one's ability to consciously recollect past events, behaviors, and experiences (Schacter, Chiu, & Ochsner, 1993) and thus is a central component of most social abilities. Indeed, people's memory for the identities and actions of other people and themselves forms the adhesive that gives them a continuing sense of place in their social world. Revising personal attitudes and beliefs in response to a counterattitudinal behavior naturally seems to depend on retrospective capacities. If Aesop's forlorn lover of grapes could not remember that the grapes were out of reach, he would have no reason to persuade himself of their reduced quality.

Current Models of Attitude Change

Explicit memory plays an important role in the dominant models of behavior-induced attitude change. Festinger's (1957) theory of cognitive dissonance posits that when a person's actions and attitudes are discrepant, physiological arousal results, leading to psychological discomfort, which in turn motivates the person to restore harmony between his or her attitudes and behavior by altering the attitudes to fit the behavior. For example, in Brehm's (1956) free-choice paradigm, women were asked to rate how much they liked a set of eight appliances. The experimenter then asked each participant to choose which of two appliances she preferred to take home as compensation for participation. After making a difficult choice between two appliances that they had rated nearly equally, participants were asked to rate the eight items again. In the final ratings, participants rated the chosen item higher, and the rejected item lower, than they had in their original ratings. In essence, participants spread the difference in desirability between the chosen and rejected items.

Dissonance theory explains attitude change in the free-choice paradigm in terms of the arousal caused by making a decision that does not logically follow from the participant's initial ratings. Presumably, this arousal leads to increasing psychological discomfort, which draws attention. Once noticed, the discomfort is attributed back to the discrepancy between the counterattitudinal behavior and the initial attitude. Motivated reasoning ensues and alters the participant's attitudes toward the chosen and rejected items so that the attitudes and behavior become consonant. Explicit memory is implicated in this account at the point when an attribution of the psychological discomfort to the counterattitudinal behavior occurs. In short, the behavior must be remembered in order for it to be an attributional target.

The major alternative to dissonance theory, Bem's (1965) self-perception theory, also relies on explicit memory. According to self-perception theory, people infer their own attitudes the same way they infer the attitudes of others, namely, by observing their own behavior. Asked to report their attitudes toward the appliances, Brehm's participants presumably constructed new attitudes based on the most accessible information, their recent behavior. In order to do this, they needed to have explicit memory for that behavior.

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Anterograde Amnesia

A strong test of whether explicit memory is involved in behavior-induced attitude change would require that individuals perform a counterattitudinal behavior and then completely forget it soon afterward. Patients with anterograde amnesia constitute a neuropsychological population that is likely to do exactly that. This form of amnesia results from either hippocampal or diencephalic damage, and greatly reduces or even eliminates the ability to form new memories that can be consciously retrieved (Squire, 1992). Any information currently held in mind is lost quickly upon distraction. Amnesic patients should not exhibit behavior-induced attitude change if explicit memory is required for it to occur.

EXPERIMENT 1

We tested 12 amnesic patients and 12 age-matched adults using Gerard and White's (1983) modified version of Brehm's (1956) free-choice paradigm. All tasks were completed in a single testing session that was divided into four phases. In the first phase, participants examined two sets of 15 art prints and ranked each set, from most liked to least liked. In Phase 2, participants were shown six groups of two pairs of prints, and indicated for each group which pair they would prefer to hang in their home. For one of the groups, one pair comprised the 4th- and 10th-ranked prints from one of the sets used in Phase 1, and the other pair comprised the 6th- and 12th-ranked prints from the same set. In Phase 3, participants were required to rerank the two sets of prints from Phase 1 to reflect their current liking of them. In Phase 4, participants were shown the prints and asked to identify the 4 prints that constituted the two critical pairs that were used in Phase 2. The participants were then asked to identify each of the 4 prints as having been chosen or rejected in Phase 2.

The primary measures were (a) the average change in ranks of the selected and rejected pairs between Phases 1 and 3 and (b) in Phase 4, how accurately participants could identify the prints they had chosen in Phase 2.

Method

Participants

Participants were 12 amnesic patients (9 men and 3 women; for patients' characteristics, see Table 1) and 12 control participants (8 men and 4 women). They were matched for age (for control participants, $M = 61.7$, range: 43–73; for amnesics, $M = 64.5$, range: 40–80) and years of education (for control participants, $M = 12.9$ years, range: 8–17; for amnesics, $M = 14.2$ years, range: 7–20).

Procedure

When participants entered the testing room, they were informed that they would be completing some tasks that would allow the experimenter to assess their verbal skills and their aesthetic preferences. In Phase 1, they were given a stack of 15 art prints measuring 3 in. by 5 in. and were asked to rank them in order of preference. A sorting board was placed in front of each participant to help him or her in sorting the cards while making the rankings. Participants sorted a set of 15 cards that reproduced paintings by Claude Monet and a second set of 15 cards that reproduced paintings by unknown Aboriginal artists. The order in which they sorted these two sets was counterbalanced across participants, and the second set was always designated as the *critical set*. After finishing their rankings, participants completed a filler verbal task called the "city generation task," which required them to gen-

Table 1. *Patient characteristics*

Patient	Age	WAIS–R IQ	WMS–R score				
			Attention	Verbal	Visual	General	Delayed
Medial temporal lobe damage							
A.B.	59	105	92	72	96	76	50
P.D.	61	109	89	72	73	65	61
R.L.	69	103	93	70	75	68	66
J.M.	49	89	95	84	56	70	52
P.S.	40	95	115	89	95	90	<50
S.S.	71	126	114	104	100	102	<50
Korsakoff's syndrome							
P.B.	72	87	93	77	94	82	60
R.D.	68	83	99	75	75	82	50
R.G.	80	94	104	58	82	61	66
W.R.	70	88	96	78	85	76	53
W.K.	57	94	93	63	78	59	57
R.M.	78	112	95	88	100	90	68
Mean	64.5	98.8	98.2	77.5	84.0	76.8	59.4

Note. WAIS–R = Wechsler Adult Intelligence Scale–Revised (Wechsler, 1981); WMS–R = Wechsler Memory Scale–Revised (Wechsler, 1987). The WAIS–R and the five WMS–R indices yield a mean of 100 and a standard deviation of 15 in the normal population. The WMS–R does not provide numerical scores for participants who score below 50. Therefore, such values were scored as 50 for computing means.

erate the names of 15 U.S. cities from single-letter cues. While they performed the filler task, the experimenter removed two pairs of prints from the critical set. These were designated as the *critical pairs*. One consisted of the 4th- and 10th-ranked prints (referred to as the 4-10 pair), and the other consisted of the 6th- and 12th-ranked prints (referred to as the 6-12 pair). Thus, each critical pair was composed of a relatively liked and a relatively disliked print.

After 3 min of the filler task, the second phase of the study began. Participants were told that they were now going to complete another aesthetic task, and this time they were going to indicate which of two pairs of art prints they would prefer to hang in their home if they could have full-size reproductions of that pair to take with them. Participants made six such choices, five involving novel pairs of prints and one involving the critical pairs. For each choice, two pairs of prints were placed on the table in front of the participant, with one pair on the left and one pair on the right. The participant pointed to the pair that he or she preferred. This pair was designated the *selected* pair, and the other pair was designated the *rejected* pair. As soon as a choice was made, the next pairs of prints were placed before the participant. The pairs of prints used for the participant's fourth choice were the two critical pairs. The sides of the table on which the 4-10 pair and 6-12 pair were placed were counterbalanced across participants.

The third phase began after participants completed another iteration of the city-generation task, with a slightly different instruction to generate only the names of foreign cities. Phase 3 was similar to Phase 1, with a minor change in instructions. Participants were told that preferences can sometimes fluctuate over time, and that they were to rank each set of prints again, in order of their preference, but that they should do so according to how they felt about them "right now." It was emphasized that this was not a memory test, and that they need not try to recollect how they had ranked the items initially. The critical set was always presented second.

The fourth phase began immediately upon completion of Phase 3. Participants were shown the 15 prints from the critical set (either the Monet set or the Aboriginal set) and asked to identify the 4 prints that had appeared in Phase 2. As a test of memory for their choice, participants were also asked to indicate which pair they had selected and which pair they had rejected during Phase 2.

Results and Discussion

Attitude change

The age-matched control participants showed the typical behavior-induced attitude change. That is, there was a greater difference between the mean ranks of the selected and rejected pairs in Phase 3 than in Phase 1, $t(10) = 3.07$, $p < .02$, $r = .68$.[1] Amnesic patients also showed attitude change, $t(9) = 2.52$, $p < .03$, $r = .62$. Table 2 shows

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1. The amnesic patients and elderly control participants in Experiment 1 chose the 4-10 pair 64% of the time. Gerard and White (1983) reported that 75% of their participants chose the higher-ranked pair in a choice that was objectively easier than the one we used. The difference between their result and ours is nonsignificant, $\chi^2(1) = 0.99$, $p > .3$, one-tailed. Gerard and White also reported that eliminating the data of those participants who selected the lower-ranked pair did not change their results. Given the constraints on our sample size, we chose to include data from participants who selected the lower-ranked pair. In Experiment 2, participants chose the 4-10 pair more than 75% of the time.

the average change in rank for the two groups, as well as the spread (increase in rank for the selected prints minus decrease in rank for the rejected prints). A comparison of the attitude change shown by the amnesic patients and age-matched control participants revealed no difference, $t(21) = 0.10$, $p > .3$. Participants also ranked and reranked another set of prints for which no choices were made. Prints with initial ranks equivalent to the ranks of the selected and rejected prints from the critical set provided baseline levels of attitude change in the absence of choice. As shown in Table 2, amnesic patients and control participants showed no significant attitude change in the noncritical set, $t(9) = 0.10$, $p > .3$, and $t(10) = 0.12$, $p > .3$, respectively.

Explicit memory

All participants had great difficulty identifying the 4 critical prints from the set of 15. Both amnesic patients (25% correct) and control participants (33% correct) performed at or near the level of accuracy expected by chance alone (27%). Not surprisingly, these low levels of performance did not differ significantly between the two groups, $t(21) = 0.86$, $p < .2$, $r = .25$. The poor performance is probably attributable to the requirement that participants remember when or how often during the experiment they had encountered the critical pairs. Remembering such contextual information constitutes a type of source memory judgment, which is impaired in both amnesic patients (e.g., Schacter, Harbluk, & McLachlan, 1984) and elderly adults (e.g., Schacter, Osowiecki, Kaszniak, Kihlstrom, & Valdiserri, 1994). Our control group consisted of primarily elderly adults.

More important, however, amnesic patients and control participants did differ with regard to their memory for which critical prints were chosen and which were rejected, a type of memory that specifically references the counterattitudinal behavior. Of the cards correctly identified as critical prints, the age-matched control participants categorized nearly all of the prints correctly as chosen or rejected (91%), and outperformed amnesic patients (44%), $t(21) = 3.00$, $p < .02$, $r = .67$, who performed at chance (50%). In short, control participants remembered their counterattitudinal behavior, whereas amnesics did not, but the two groups showed identical amounts of attitude change.

Table 2. *Attitude change (change in rank) in Experiment 1*

Pair	Amnesic participants	Control participants
Choice prints		
Selected pair	+1.13	+0.86
Rejected pair	−1.20	−1.12
Spread (selected − rejected)	+2.33	+1.98
Nonchoice prints		
Selected pair	−0.15	−0.21
Rejected pair	0.00	−0.29
Spread (selected − rejected)	−0.15	+0.08

Note. Choice prints are the prints in the critical pairs. Nonchoice prints are prints from the noncritical set that were ranked and reranked without an intervening choice; prints with the same ranks as those a participant selected and rejected in the critical set were designated as selected and rejected, respectively, in the noncritical set for comparison purposes.

Perhaps the most important measure bearing on our hypothesis that explicit memory does not necessarily play a role in behavior-induced attitude change is the correlation between attitude change and explicit memory. Although amnesic patients showed generally poor memory for the prints, it is still possible that whatever memory they did possess could be related to the amount of attitude change they exhibited. If anything, however, it appears the opposite is more likely true: For both amnesic patients, $r = -.41$, $p = .25$, and control participants, $r = -.63$, $p < .04$, greater attitude change was observed when fewer prints were accurately identified. In addition, the ability to correctly categorize prints as selected or rejected was not significantly correlated with amount of attitude change for either group, both $ps > .3$.

Conclusion

The amnesic patients in this experiment showed just as much behavior-induced attitude change as did matched control participants despite the fact that they had no explicit memory for which prints they had chosen and no explicit memory for which prints were involved in the choice. Furthermore, for both groups, the degree of explicit memory for the prints involved in the choice was negatively correlated with the amount of attitude change. These results suggest that explicit memory for one's counterattitudinal behavior is not a necessary component of behavior-induced attitude change, and might even disrupt the process.

Of course, the data from this experiment do not rule out the possibility that attitude change occurred right at the moment of choice, while the behavioral information was still accessible in working memory, even for amnesic patients. If this is the case, the current data suggest that if behavior-induced attitude change is a consciously controlled process, it is happening on a much smaller time scale than previously imagined (Festinger, 1964; Steele, Spencer, & Lynch, 1993). In our second experiment, we incorporated a cognitive-load manipulation to provide a more traditional test of the involvement of controlled processing in behavior-induced attitude change.

CONSCIOUS PROCESSES: THE ROLE OF ATTENTION AND WORKING MEMORY

If only to live up to its name, rationalization seems to require a good deal of effortful thinking. It seems scarcely metaphorical to say that a friend "on the short end of the stick" of a romantic breakup appears to be working hard to reconceptualize the extinguished relationship as expendable. Attention seems to be deliberately focused on those elements of the relationship that were undesirable from the start or were ambiguous enough that they can now be reinterpreted in a negative light.

Conscious attention to the counterattitudinal behavior and conscious work in the service of attitude revision are both unspecified, but implied, components of cognitive dissonance theory. Language alluding to the use of consciously controlled processing in attitude change is often used by dissonance researchers: Across four decades of research, there have been references to the need to "engage in cognitive work" (Petty & Wegener, 1998, p. 336), statements that dissonance research is "primarily concerned with processes which are conscious and capable of verbalization" (Hovland & Rosenberg, 1960, p. 202) and that attitude change requires "awareness of . . . his [the participant's] discrepant commitment" (Brehm & Cohen, 1962, p. 168), and mention of the "phenomenological experience of cognitive dissonance"

(Elliot & Devine, 1994, p. 391). Most significant, Festinger (1964) concluded that "dissonance reduction does, indeed, require that time be spent in thinking about the characteristics of the alternative" (p. 59). Given these references and prior research on implicit attitude change more generally (Kunst-Wilson & Zajonc, 1980; Wilson, Lindsey, & Schooler, 2000), it is somewhat surprising that the necessity of conscious attention and effort for behavior-induced attitude change seldom has been investigated (Brock & Grant, 1963; Nisbett & Wilson, 1977).

On the basis of our results from Experiment 1, we hypothesized that the attentional resources associated with working memory are not a necessary component of behavior-induced attitude change. To test this hypothesis, we ran normal participants through the free-choice paradigm under normal or cognitive-load conditions. Cognitive load (e.g., counting the occurrences of a tone) severely reduces the resources available for attentional and cognitive processing (Baddeley, 1986), and processes unimpaired by cognitive load are considered to be relatively automatic (Gilbert, Pelham, & Krull, 1988; Wegner & Bargh, 1998). We predicted that participants under cognitive load would show as much attitude change in the free-choice paradigm as participants under no load.

EXPERIMENT 2

Method

Participants

Sixteen male and 16 female undergraduate students at Harvard University received $10 each for their voluntary participation. All participants were right-handed and between 17 and 21 years of age.

Procedure

The procedure was identical to the procedure used in Experiment 1 with the exception that for half the participants, the two phases during which attitude change might occur (i.e., the choice and reranking phases) were performed under cognitive load. Participants in the cognitive-load condition heard a series of tones, each at one of three pitches, and were required to keep track of the number of tones at the lowest pitch (Gilbert & Silvera, 1996; Lieberman, Gilbert, & Jarcho, 2000). In the no-load condition, participants were told to ignore the tones.

Results and Discussion

Attitude change

No-load participants showed the standard behavior-induced attitude change; there was a greater difference between the mean rank of the selected and rejected pairs in Phase 3 than there was in Phase 1, $t(14) = 2.23$, $p < .05$, $r = .51$. Our prediction that participants under a cognitive load would also show attitude change was supported, $t(14) = 2.64$, $p < .02$, $r = .58$. As shown in Table 3, nearly identical levels of attitude change were evidenced by participants in the two conditions in response to the counterattitudinal behavior. A comparison between the two groups revealed no differences, $t(28) = 0.71$, $p > .2$, $r = .10$. As in Experiment 1, there was no attitude change in the noncritical set; this was true for participants in both the no-load and the cognitive-load conditions, $t(14) = 0.21$, $p > .3$, and $t(14) = 0.12$, $p > .3$, respectively (see Table 3).

Explicit memory

The cognitive-load manipulation did not attenuate attitude change, but did it affect other kinds of processing? To answer this question, we examined participants' ability to identify which of the 15 prints were presented in the choice phase. Because cognitive load impairs encoding (e.g., Fletcher, Shallice, & Dolan, 1998), we expected that load would impair memory for the counterattitudinal behavior. This is exactly what we found: Subjects under cognitive load were able to identify only half as many prints (35%) as their no-load counterparts (67%), $t(30) = 4.89$, $p < .001$, $r = .67$. Though participants under load were near chance in their identification accuracy, they correctly categorized as chosen or rejected those prints that they accurately identified as often as did the no-load participants (67% vs. 73%, respectively), $t(30) = 0.03$, $p > .2$, $r = .01$. In short, even though cognitive load impaired participants' ability to think about their behavior, they showed the same amount of attitude change as participants not under cognitive load.

As in Experiment 1, we assessed the extent to which degree of attitude change correlated with explicit memory measures. For both the cognitive-load and the no-load participants, there were no significant correlations between attitude change and either memory measure, all ps > .3.

Conclusion

Regardless of cognitive-load condition, participants showed substantial attitude change in response to their counterattitudinal behavior. Attitudes changed despite the fact that participants under a cognitive load were significantly impaired in their recall of which prints were involved in the choice phase of the experiment.

These data, combined with the results of Experiment 1, suggest that the process of behavior-induced attitude change is a relatively automatic one (cf. Zanna & Aziza, 1976). It is possible that attitude change requires some minimal amount of attention, conscious awareness, or mental effort, but it is fair to claim that unaltered performance under cognitive load indicates that this attitude-change process is to-

ward the automatic end of the automatic-controlled continuum (Bargh & Tota, 1988; Gilbert, 1989; Wegner, 1994).

GENERAL DISCUSSION

The current experiments provide strong evidence that behavior-induced attitude change requires minimal ability to encode and retrieve new explicit memories and minimal ability to engage in consciously controlled processing. In fact, if one compares the performance of the amnesic patients in Experiment 1 and the no-load participants in Experiment 2, it appears that intact explicit memory may actually attenuate the magnitude of behavior-induced attitude change (cf. Snyder & Ebbesen, 1972). This hypothesis is bolstered by the negative correlations between degree of attitude change and explicit memory in Experiment 1.

The possibility that behavior-induced attitude change can take place automatically and without conscious processing casts new light on the role of motivation in rationalization. People tend to look unfavorably on individuals who change their attitudes to justify their behaviors because these individuals should be able to see that they are "just rationalizing" and thus realize that their new attitudes are glaringly inauthentic. Our results suggest, however, that the behavior-induced attitude-change process may not be consciously experienced. Because the results of automatic attitude processes are often experienced as given by the environment rather than constructed by the mind, what looks like disingenuous rationalization from without may feel genuine from within (Bargh, 1989).

Automatically changed attitudes can be especially hardy inasmuch as their maintenance does not require the individual to remember the reason why the attitude was changed in the first place. In the fable that opened this article, it appears that the fox continued to believe the grapes were undesirable only because they continued to be unobtainable. The new attitude toward grapes seems to serve as the continuing justification for not ruminating over the loss. The results from Experiment 1, however, indicate that this teleological interpretation of attitude change may be unnecessary, because the amnesics did not remember that there was a prior conflict that they would prefer to keep avoiding. Not revisiting the conflict may be a by-product of the new attitude's presence, but it is not the case that the new attitude is sustained because of a need to avoid the conflict.

The current data also place new constraints on the change processes posited by any theory of behavior-induced attitude change. Self-perception theory and cognitive dissonance theory have depended on both explicit memory and conscious processing to differing degrees in their explanations of attitude change. Although the current data do not address either theory's general viability, they do suggest that the processing components of these theories need clearer specification. Future research integrating the methods of neuroscience into social cognition should yield clearer specification of these processes (Lieberman, 2000; Ochsner & Lieberman, 2000).

Table 3. *Attitude change (change in rank) in Experiment 2*

Pair	Condition	
	Load	No load
Choice prints		
Selected pair	+0.44	+0.94
Rejected pair	−0.91	−0.38
Spread (selected − rejected)	+1.35	+1.32
Nonchoice prints		
Selected pair	−0.41	−0.41
Rejected pair	−0.47	−0.25
Spread (selected − rejected)	+0.06	−0.16

Note. Choice prints are the prints in the critical pairs. Nonchoice prints are prints from the noncritical set that were ranked and reranked without an intervening choice; prints with the same ranks as those a participant selected and rejected in the critical set were designated as selected and rejected, respectively, in the noncritical set for comparison purposes.

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