Remembering and Voting: Theory and Evidence from Amnesic Patients

Jason C. Coronel University of Illinois
Melissa C. Duff University of Iowa
David E. Warren University of Iowa
Kara D. Federmeier University of Illinois
Brian D. Gonsalves University of Illinois
Daniel Tranel University of Iowa
Neal J. Cohen University of Illinois

One of the most prominent claims to emerge from the field of public opinion is that citizens can vote for candidates whose issue positions best reflect their own beliefs even when they cannot remember previously learned stances associated with the candidates. The current experiment provides a unique and powerful examination of this claim by determining whether individuals with profound amnesia, whose severe memory impairments prevent them from remembering specific issue information associated with any particular candidate, can vote for candidates whose issue positions come closest to their own political views. We report here that amnesic patients, despite not being able to remember any issue information, consistently voted for candidates with favored political positions. Thus, sound voting decisions do not require recall or recognition of previously learned associations between candidates and their issue positions. This result supports a multiple memory systems model of political decision making.

During campaigns leading up to democratic elections, citizens receive, from a variety of sources and in different forms, information about the issue positions of the candidates running for office. In evaluating the voting performance of citizens, political scientists consistently ask whether voters support the candidate whose policy positions better match their own. Indeed, no other criterion is applied more widely or frequently.[1]

For a long time, political scientists used survey data collected at the end of the campaign to answer this question. These data assume that voters must be able to retrieve and recite issue positions in order to use them.

Jason C. Coronel is a Ph.D. candidate in political science, University of Illinois, 1407 West Gregory Drive, Urbana, IL 61801 (jasoncoronel@gmail.com). Melissa C. Duff is Assistant Professor of Communication Sciences and Disorders, University of Iowa, 250 Hawkins Drive, Iowa City, IA 52242 (melissa-duff@uiowa.edu). David E. Warren is a Post-Doctoral Fellow of Neurology, University of Iowa, 200 Hawkins Drive, Iowa City, IA 52242 (davideugenewarren@gmail.com). Kara D. Federmeier is Associate Professor of Psychology, University of Illinois, 603 East Daniel Street, Champaign, IL 61820 (kfederme@cyrus.psych.illinois.edu). Brian D. Gonsalves is Assistant Professor of Psychology, University of Illinois, 603 East Daniel Street, Champaign, IL 61820 (bgon@cyrus.psych.uiuc.edu). Daniel Tranel is Professor of Neurology, University of Iowa, 200 Hawkins Drive, Iowa City, IA 52242 (daniel-tranel@uiowa.edu). Neal J. Cohen is Professor of Psychology, University of Illinois, 603 East Daniel Street, Champaign, IL 61820 (njc@illinois.edu).

This project is part of the first author's doctoral work, and he would like to thank, first and foremost, Jim Kuklinski for his remarkable support and guidance. We also thank Brian Gaines, David Hendry, Jeff Mondak, Molly Ritchie, Justin Rhodes, Thomas Rudolph, Joel Voss, members of the Amnesia Research Lab and Cognitive Neuroscience of Memory Lab, John Kihlstrom and two anonymous reviewers, and Rick Wilson for helpful feedback and comments. An earlier version of this article was presented at the 2010 New Faces of Political Methodology Conference at Pennsylvania State University and at the Applying Advances in Social and Cognitive Neurosciences to Political Behavior Workshop at Caltech. This work was supported by grants from NINDS (P50 NS19632) and NIHM (RO1 MH062500), with additional funding from the Kiwanis Foundation and the Beckman Institute for Advanced Science and Technology. Data from this study can be obtained at https://netfiles.uiuc.edu/jcorone2/www/. Correspondence regarding this article should be sent to Jason C. Coronel (jasoncoronel@gmail.com).

[1]Some of the main bodies of work that have either explicitly or implicitly used this criterion include the literatures on issue proximity voting (Downs 1957; Enelow and Hinich 1984; for a review, see Grofman 2004), candidate evaluation (Lodge, McGraw, and Stroh 1989; Lodge, Steenbergen, and Brau 1995), and "correct voting" (Lau and Redlawsk 1997, 2006).

American Journal of Political Science, Vol. 00, No. 00, xxx 2012, Pp. 1–12

 DOI: 10.1111/j.1540-5907.2012.00608.x

Researchers generally found that many citizens cannot recall the issue positions of candidates and that issue positions rarely shaped votes or judgments (Berelson, Lazarsfeld, and McPhee 1954; Campbell et al. 1964; Converse 1964; Lazarsfeld, Berelson, and Gaudet 1944). These findings generated the conclusion that citizens do relatively poorly when choosing candidates on the basis of issue proximity.

In recent years, however, researchers have begun to ask whether citizens must remember and use previously learned issue-position information in order to vote for the candidates whose policy stances best reflect their beliefs. According to one particularly influential claim, advanced by Lodge and colleagues via their theory of on-line processing, they do not (Lodge, McGraw, and Stroh 1989; Lodge, Steenbergen, and Brau 1995; also see Hastie and Park 1986). By implication, then, voters' inabilities to remember issue positions of candidates, as revealed in survey data, need not impugn people's capacity to make issue-based voting decisions.

We argue below, however, that no work to date has actually demonstrated that citizens, at the time of vote choice, can or will vote for their favored political candidates without accessing specific issue-position information associated with those candidates. In particular, in the empirical work to date, no study has completely eliminated the possibility that participants remember at least some previously learned information about the candidates.

To overcome this problem, the current study uses a unique and powerful methodology to examine whether citizens can vote for candidates whose policy stances best match their own, hereafter referred to as making a "right" or "sound" vote choice, even when they clearly cannot retrieve the specific issue positions of two competing candidates. The methodology consists of enlisting a rare patient group with selective and severe memory impairments that prevent them from gaining knowledge of facts and events of any kind after their brain lesion event (Cohen and Squire 1980; Gabrieli 1998; Scoville and Milner 1957; Squire 1992). If taught about two political candidates, their neuropathology prevents them from remembering the issue positions associated with each candidate. However, and most critically, other forms of memory, such as emotional memory, remain intact in amnesic individuals and could potentially support sound decision making even in the absence of knowledge of specific issue positions. To find that individuals with profound amnesia can consistently vote for the candidates with political views most like their own would provide compelling evidence that sound voting decisions do not require being able to recall or even recognize the association between candidates and their issue positions.

Our discussion proceeds as follows. The first section introduces a contemporary view of memory, providing the basis for expecting sound decision making to occur without the retrieval of learned issue information. The framework introduced here specifies how other processes aside from on-line processing can support issue-based voting in the absence of policy facts retrieval. The second section discusses Lodge and colleagues' work on candidate evaluation and argues why the data from these studies fail to support strongly the claim that retrieval of previously learned issue-position information is not necessary for sound decisions. We then present the results of an experiment that uses amnesic individuals, and a final section discusses the implications of this study for research on voting, candidate evaluation, and citizen political performance.

Multiple Memory Systems and Voting

Why would anyone even ask whether citizens who learned candidates' issue positions, *and then forgot them*, might still be able to vote consistently for the candidate whose policy stances best represent their own? The answer to this question lies within a large body of work on the nature and organization of memory. A central claim of this research, completed on both humans and nonhuman animals, is that memory is not a unitary or single entity. Rather, distinct and multiple memory capacities exist, with each mediated by a different brain system. This idea is often described as the notion of "multiple memory systems."[2]

Over the past several decades, many memory researchers have begun to make key distinctions between two broad classes of memory: declarative and nondeclarative (Cohen and Squire 1980; Eichenbaum and Cohen 2001; Squire 2004). Declarative memory refers to knowledge for facts and events that can be accessed and expressed consciously. It can support all manner of arbitrary relations and has a high degree of flexibility; thus, such memories can be used in a wide range of novel contexts. In contrast, nondeclarative memory refers to a broad collection of unconscious learning capacities that are expressed through performance; they neither require nor necessarily permit conscious access for expression. Expression of nondeclarative memory is highly inflexible, and most often influences automatic, procedural, and habitual behavior.

[2] For reviews, see Eichenbaum and Cohen (2001) and Squire (2004).

In principle, then, as citizens receive information about candidates and their issue positions, they can store and express different representations of this information in different memory systems. Critically, given that each memory system is relatively distinct from the others, information about a candidate and his or her associated issue positions can degrade completely in declarative memory while different representations of the same information can persist in various nondeclarative memory systems.

Although there are multiple nondeclarative memory systems, two warrant special attention given their likely capacities to facilitate policy-based voting in the absence of declarative information about issue positions. The first is emotional memory. Several memory researchers have proposed a specific memory system that mediates the learning and expression of emotional responses to learned information in the absence of conscious memory for the learning experience itself (Johnson, Kim, and Risse 1985; LeDoux 1995; Zajonc 1980). They claim that, through this system, previously encountered objects can elicit an affective response (e.g., fear, happiness, disgust, etc.) independently of people's capacities to identify the source of such feelings.

Lodge and colleagues' on-line processing is a nondeclarative, emotional learning account of voting behavior.[3] Voters extract affective information about candidates as they learn about them and incorporate this information into an accumulated affective tally, a sort of running average specific to that candidate. For example, voters might react negatively to a given candidate each time the candidate advocates an issue position that diverges from their own political preferences, and thus become increasingly negative toward the candidate. By the time ballots are cast, voters might have forgotten the candidates' specific issue positions; yet earlier affective responses can still influence their candidate selections through the cumulative affective tally.

The on-line processing or emotional memory model has been highly influential in the candidate evaluation literature and currently serves as the only alternative, in political science, to the declarative memory model of political evaluations. However, there are other nondeclarative systems not based on affect that might also be able to support voting decisions. One such system is categorical learning, which helps organisms respond differently to objects that belong to distinct and meaningful classes. Some memory researchers have advanced the notion that a nondeclarative categorization system exists (Knowlton and Squire 1993).[4] In particular, they have proposed and provided evidence for the claim that this system allows people to learn about item membership in distinct categories even in the absence of knowledge defining the newly learned categories.

In a voting context, nondeclarative categorical learning could work as follows: As citizens learn about candidates and their issue positions, they begin to classify candidates into meaningful and preexisting categories, such as "similar to me in political views" or "not similar to me in political views." At the time of voting, they implicitly reactivate the learned categories without retrieving the declarative information that formed the basis of their original classification.

Thus, via these nondeclarative memory systems—emotional memory, categorical learning, and possibly others—citizens presumably can vote for candidates with favored issue stances even when they fail to remember any previously learned declarative information about those stances.

A Formidable Task

As noted above, a few political scientists have attempted to show empirically whether citizens can make such sound voting decisions. However, demonstrating that sound voting does not require the retrieval of previously learned issue-position information is difficult. It entails satisfying two critical conditions: first, participants must vote for candidates whose issue positions most closely align with their beliefs; and second, and more critically, participants must do so even when they hold no declarative information about the specific issue positions associated with the candidates. Meeting this second condition is essential; if a participant remembers and correctly associates even a single issue position with a candidate, there is the possibility that he or she used this declarative information to choose a candidate. Satisfying the second condition represents a formidable task.

Consider two frequently cited studies that have attempted to demonstrate this claim. In their pioneering

[3]The researchers did not explicitly work within or use concepts from the multiple memory systems framework. Their descriptions of "memory" and "on-line" mechanisms of political evaluations are relatively similar to the distinction between declarative memory and a nondeclarative emotional learning process. However, this framework does not consider other nondeclarative processes that may be able to support voting in the absence of declarative information. Finally, consistent with the multiple memory systems framework, we will refer to the "memory model" of political evaluations (Zaller and Feldman 1992) as the "declarative memory model" instead.

[4]But also see Kitchener and Squire (2000) for an examination of the conditions under which this type of categorization can or cannot occur.

work on on-line processing and candidate evaluation, Lodge, McGraw, and Stroh (1989) asked participants to study a fictitious political candidate and his issue positions.[5] Participants were then given a brief distractor task, after which they were asked to provide affective and character trait evaluations of the candidate.[6] These measures were combined into a single measure of candidate evaluation. Later, participants were given a free recall test in which they stated what they remembered about the candidate. A recognition memory test followed. During the recognition test, participants were shown old candidate-issue pairs (pairs with issues that were previously associated with the candidate) and new candidate-issue pairs (pairs involving issues that were not shown during the study phase). Participants were asked to judge whether the candidate-issue pairs were "old" or "new." A measure of the on-line tally was created by summing all of the likes and dislikes of each participant for all of the candidate's policy positions. A regression analysis showed that the constructed on-line tally robustly predicted candidate evaluations while participants' recognition memory for previously studied issue positions did not.

In a follow-up study, the researchers conducted an experiment that relied on a long delay between the learning and evaluation epochs in order to decrease the possibility that participants could recall specific information about the candidates (Lodge, Steenbergen, and Brau 1995). In the study, participants learned about two candidates and their issue positions. They were then asked to provide affective evaluations of the candidates, with the intervals between learning and evaluation spanning from one day to one month. After evaluating the candidates, participants were given a free recall test. Similar to the previous study, a measure of the on-line tally was constructed by summing all of the likes and dislikes of each participant for both of the candidates' issue positions. The researchers' regression analyses showed that the constructed on-line tally robustly predicted candidate evaluations, whereas recalled declarative facts about the candidates had either a marginal or negligible impact on self-reported affective evaluations.

These two studies represent the best and most important work to date on voter evaluations of candidates presumably in the absence of declarative knowledge. Neither, however, convincingly demonstrates that political judgments were made in the complete absence of declarative knowledge about the candidates' issue positions.

First, participants from both studies demonstrated declarative knowledge of previously learned facts about the candidates. As a group, participants in Lodge, McGraw, and Stroh showed robust recognition memory performance for previously learned information (1989, 407, Table 2).[7] This outcome is not surprising given that the study used a very short delay (i.e., span of minutes) between the learning and memory test epochs. Lodge et al. were aware of this weakness in their research design, as reflected in their use of a longer delay (i.e., span of days) in their follow-up study.

However, even the use of a longer delay failed to remove recall of declarative knowledge completely. In Lodge, Steenbergen, and Brau, at least 40% of the participants were able to recall at least one piece of previously learned information (1995, 314).[8] Furthermore, since this study did not use a recognition memory test but instead assessed declarative knowledge solely through recall, the proportion of participants who demonstrated declarative knowledge was most likely a low estimate. Recall tasks are a conservative means of assessing declarative knowledge (Postman, Jenkins, and Postman 1948), and, even when people report no recollection of information on a free recall test, they can display robust performance on a recognition test (Richardson-Klavehn and Bjork 1988). Therefore, it is inappropriate to conclude that a particular piece of declarative information cannot be retrieved just because recall fails. Demonstrations of *both* failed recall and recognition provide stronger evidence of lack of retrieval of declarative knowledge (Richardson-Klavehn and Bjork 1988).

Second, that some of the participants were able to recollect declarative information opens the possibility that the strong relationship between the on-line tally and candidate evaluations was driven largely by the subset of participants who expressed some declarative knowledge about the candidates. There is evidence showing that participants who recollect more previously learned

[5]The preponderance of other empirical work on on-line processing intentionally examines political decision making under conditions wherein participants are able to (1) retrieve and use some declarative information about the candidates and (2) presumably use an affective tally as well (Lau and Redlawsk 2006; McGraw, Hasecke, and Conger 2003; Mitchell 2012; Redlawsk 2001). In contrast, the Lodge et al. studies were designed to examine political decision making under conditions where participants (1) were unable to retrieve declarative information about candidates and (2) had to rely exclusively on a nondeclarative process like an affective tally. Our discussion will be confined to the Lodge et al. studies.

[6]The two studies did not directly consider vote choice, but instead examined citizens' explicit evaluative judgments of candidates. This requires the additional assumption that citizens use these evaluative judgments when voting. Our study directly examines vote choice.

[7]Participants' recognition memory scores were robust despite the fact that "don't know" responses were not included.

[8]The researchers did not check the factual accuracy of the recollected information (i.e., whether the issue was correctly associated with the right candidate).

information about candidates also tend to make more accurate evaluations and vote choices (Redlawsk 2001). In fact, even Lodge, Steenbergen, and Brau's data show that recollected facts had a marginal influence on evaluations for at least one of the candidates (1995, 317, Table 2). Thus, another plausible, and likely, interpretation of their results is that the retrieval of both previously learned declarative and nondeclarative information (e.g., emotional memories or categorical information) contributed to the candidate evaluations.

In sum, these two studies highlight the difficulties and limitations associated with using normal participants to try to support the claim that nondeclarative memories alone are sufficient to facilitate sound political decision making. It is very difficult to ensure that normal participants fail to remember previously learned facts, and even the use of a long delay normally does not preclude at least some participants from remembering at least some declarative information. Thus, the data cannot support the strongest conclusions drawn from these studies, namely that sound voting decisions do not require remembering previously learned issue-position information. Indeed, completely removing the effects of declarative information in a normal population is often difficult and improbable. A compelling alternative is to find and test a population who display profound deficits in their capacities to learn and remember new declarative knowledge, so that any contamination from declarative memory can be confidently excluded.

Amnesic Patients as Research Participants

This study attempts to overcome some of the limitations of previous research by taking advantage of a rare patient group with selective and severe memory impairments, patients with anterograde amnesia. Amnesia following damage to the hippocampus causes severe impairments in learning and remembering facts and events (i.e., declarative memories; Cohen and Squire 1980; Scoville and Milner 1957). Furthermore, amnesic patients are impaired in their abilities to remember links between arbitrary elements of an experience, or relational memories, such as remembering the association between a person and what he or she said (e.g., candidates and their stated issue positions; Cohen and Eichenbaum 1993).

Critical to the design of this study, their deficits are specific to declarative memory, while leaving other nondeclarative forms of memory, such as emotional and categorical learning, preserved (Bechara et al. 1995; Cohen and Eichenbaum 1993; Cohen and Squire 1980; Corkin 1968; Feinstein, Duff, and Tranel 2010; Johnson, Kim, and Risse 1985; Knowlton and Squire 1993; Todorov and Olson 2008; Tranel and Damasio 1993).[9] In one especially pertinent study, researchers showed that an amnesic patient was able to update his affective assessment of individuals who displayed either positive or negative behavior toward him even though the patient could not even remember interacting with the same individuals (Tranel and Damasio 1993).

In all cases, impairment of these patients' declarative memory systems is expected to prevent them from recalling or recognizing any specific information about a given candidate, while leaving intact their capacities to acquire and retain emotional or categorical information. Thus, amnesic patients, because of their lack of capacity to retain and use previously learned declarative issue information, afford a unique and powerful opportunity to test the claim that sound voting decisions do not require the recollection of specific issue positions.

Predictions

If sound voting decisions do not require retrieval of previously learned declarative issue information about candidates, then the amnesic patients should be able to make consistently "right" voting decisions, that is, they should vote for candidates whose issue positions best approximate their own even despite a failure to recall and recognize candidates' issue positions. Normal comparison participants should also be able to make consistently "right" voting decisions, but, unlike the amnesic patients, they should also demonstrate robust performance in recalling and recognizing the issue positions associated with the candidates.[10]

[9]Indeed, historically, the critical data in arguing for the idea of multiple memory systems have come from studies of amnesic patients—in their ability, in particular, to demonstrate robust performance in some domains of learning but not others. Studies during the 1950s of one amnesic patient, known by his initials as patient H. M., inspired a tremendous amount of research on the question of whether multiple memory systems exist. Currently, support for the notion of multiple memory systems comes from many converging lines of evidence: performance dissociations and single-cell recordings in animal models, and behavioral, eye movement, fMRI, and event-related potential studies of both normal and brain-damaged human populations (for reviews, see Eichenbaum and Cohen 2001; Gabrieli 1998; Squire 1992).

[10]These predictions are based on the assumption that the time between learning about the candidates and the recall and recognition tests occurs in a short (e.g., minutes) as opposed to a long period of time (e.g., months or years).

TABLE 1 Demographic Information on the Amnesic Patients

Patient	Age (2010)	Onset	Sex	Race	Partisan ID	Ideology
1846	47	1993	F	Caucasian	Republican	Moderate
2308	54	1999	M	Caucasian	Strong Democrat	Strongly Conservative
2363	54	1998	M	Caucasian	Democrat	Liberal
2563	55	2000	M	Caucasian	Republican	Conservative

Note: "Onset" refers to the beginning date of a patient's amnesia.

Methods

The main experiment employed a straightforward study-test method. We recruited both amnesic patients and normal neurologically intact individuals as research participants.

Participants

We enlisted four patients with anterograde amnesia that resulted from bilateral hippocampal damage; all have severe impairments in declarative memory, and all have memory impairments sufficiently severe to interfere with their daily lives (Table 1). For example, none have been employed since the onset of his or her amnesia, and all exhibit severe memory impairments on standardized tests of memory (see the online supporting information).[11] Seven normal comparison participants (NCs) were also recruited. At least one normal comparison participant was matched to each amnesic patient on age, education, and sex.[12]

Experimental Procedure

Prior to the experiment itself, participants were shown faces of middle-aged white males obtained from law firm websites and asked to rate each face with respect to the following criteria: attractiveness, likeability, competence, and trustworthiness.[13] For each participant, pairs of faces that he or she rated equally on all criteria were used as the fictitious candidates in the experiment. After this individualized norming phase, and before commencing the experiment, the patients were given a five-minute distractor task consisting of simple math problems (Figure 1).

At the outset of the study phase, participants read aloud nine issue positions associated with each of the two political candidates.[14] The issue positions were personalized for each participant on the basis of pretests. These allowed the creation of three unique within-subject experimental conditions. In the *congruent-incongruent condition*, a participant learned about one candidate who completely agreed with the participant's political issue positions and a second candidate who completely disagreed with his or her positions. In the *congruent-neutral condition*, one candidate was associated with issues the participant agreed with, and the other candidate was associated with "neutral" issues.[15] Finally, the *neutral-incongruent condition* presented one candidate associated with neutral issues and another associated with issues with which the participant disagreed.

Our design thus structured candidate information so that one of the two candidates was always closer to the participant's own political beliefs. The "right" candidates should elicit either the more positive affective reactions or the more favorable classifications (e.g., "most similar to my political views" categorization) from the participants.[16] A "right" voting decision, then, corresponds to selecting the congruent candidate in the congruent-incongruent condition, the congruent candidate in the congruent-neutral condition, and the neutral candidate in the neutral-incongruent condition.

After the study phase of any condition, participants were asked to solve arithmetic problems for 12 minutes as a distractor task and then asked to vote for one of the candidates. After voting, participants were asked to provide a rationale for their vote choice and also to explain why they did not vote for the other candidate. They also were given a free recall test wherein they generated as much information about the candidates as possible; a recognition memory test followed, in which participants

[11] Also see Konkel et al. (2008) for more information about the amnesic patients recruited in this study.

[12] Specifically, patient 1846 was matched to one comparison participant, whereas the rest of the patients were matched to two comparison participants.

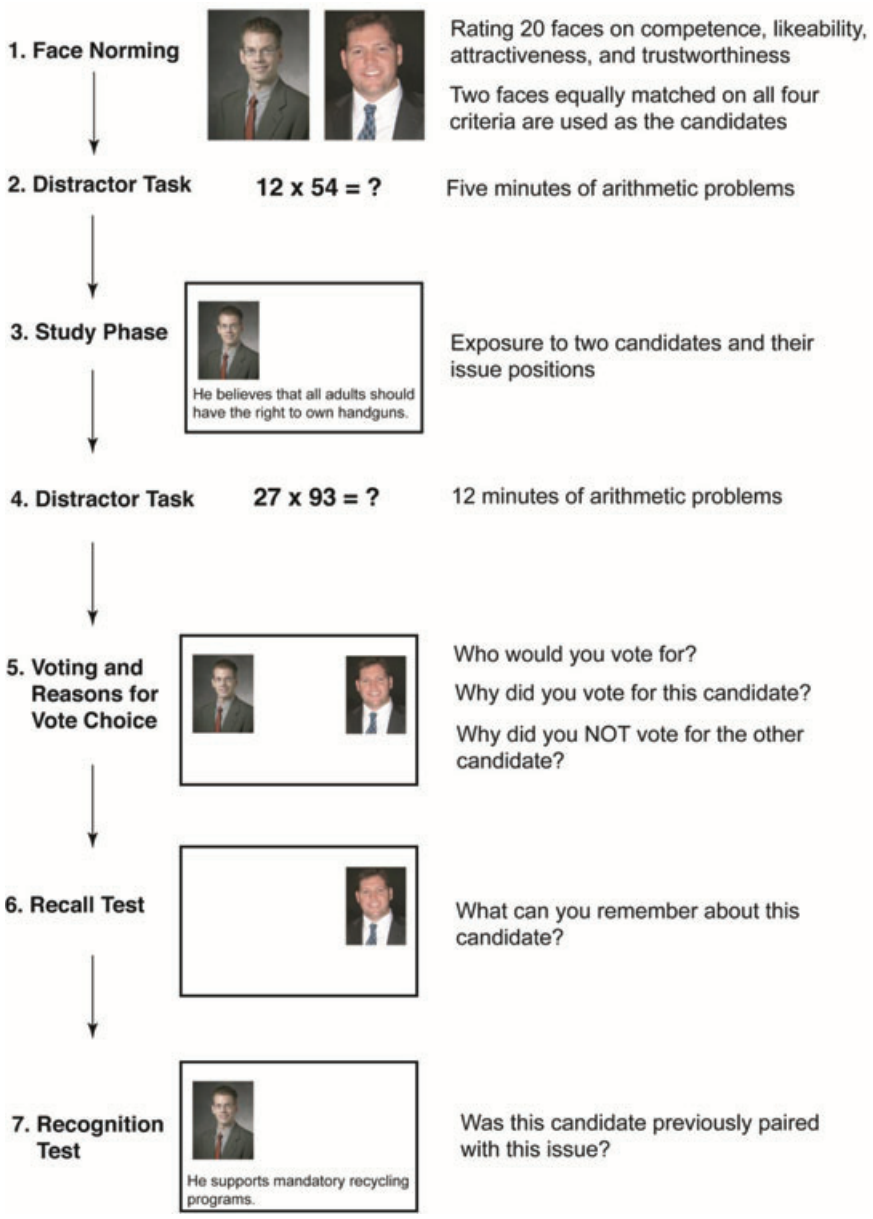
[13] For a full description of the experimental methods, see the online supporting information.

[14] Each of the issue positions was associated with only one of the candidates.

[15] These were issues on which the participant had "no opinion."

[16] In the neutral-incongruent condition, the neutral candidate should elicit the *least* negative reaction from the participant.

FIGURE 1 Schematic Diagram of the Experimental Design



Note: The photos above were not the actual photos used in the experiment.

were presented with "old" or "new" issue positions paired with candidates' photos and asked to indicate whether each was or was not associated with a particular candidate.

Results

As mentioned previously, demonstrating that sound voting decisions do not require the retrieval of specific issue-position information must satisfy two criteria: first, participants must vote for candidates whose issue positions more closely align with their beliefs, and, second, participants must make this choice even when it can be demonstrated convincingly that they hold no declarative information about the specific issue positions associated with the candidates.

In terms of their voting decisions, both the normal comparisons and the amnesic patients systematically made "right" vote choices. The normal comparisons voted for the candidates whose issue positions better aligned with their preferences on 20 out of 21 trials ($p < .001$,

TABLE 2 Voting Outcome and Free Recall Performance

	Voting Outcomes "Right" Votes/Total Voting Trials		Average Correctly Recalled Candidate-Issue Pairs	
Experimental Conditions	***Amnesics***	***NCs***	***Amnesics***	***NCs***
Congruent vs. Incongruent	6/7	7/7	0	4.71
Congruent vs. Neutral	6/7	7/7	0	2.14
Neutral vs. Incongruent	6/6	6/7	0	3.57

binomial test, two-tailed).[17] Critically, the amnesic patients performed similarly well, voting for the "right" candidate on 18 out of 20 trials ($p < .001$, binomial test, two-tailed; Table 2). However, unlike the normal comparisons, the patients were unable to recall the issue positions associated with candidates during the free recall test (Table 2). Not one amnesic patient was able to recall even a single issue position that was correctly associated with any candidate, whereas the normal comparisons correctly recalled an average of 3.47 policy issues per candidate ($p = .003$, two-tailed).[18]

Amnesic patients' striking deficits in memory for specific candidate-issue pairs were substantiated by their performances on the recognition memory test. Recognition memory was assessed using the standard discriminability index D-prime (d').[19] A d' score of zero or below indicates an inability to discriminate correctly between old and new candidate-issue parings. Amnesic patients demonstrated chance-level performance on recognition memory (d': $-.04 \pm .07$ s.e.m.), whereas normal comparisons showed robust performance (d': $2.94 \pm .22$ s.e.m.) ($p = .003$, two-tailed; Figure 2).

In addition to the striking differences in memory performance, the amnesic participants and the normal comparisons expressed qualitatively different reasons for why they did or did not vote for a given candidate (Table 3). Whereas the normal comparisons always gave issue-based rationales for their voting decisions, the amnesic patients primarily provided nonissue-based reasons (e.g., age, physical appearance, etc.), even though their ratings of attractiveness, likeability, competence, and trustworthiness were the same for each candidate pair. Furthermore, available evidence suggests that the patients provided post hoc rationalizations. For example, one amnesic patient used the same observation, "He looks a little bit older," to justify different decisions across trials: she voted *for* the congruent candidate on one trial because "He looks a little bit older so maybe he has more experience," but voted *against* the incongruent candidate on a different trial because "He looks a little bit older so maybe couldn't be in office as long."

In sum, converging evidence from three declarative memory measures—stated reasons for vote choices, recall of issue positions, and recognition of candidate-issue pairs—indicates that the amnesic patients were not able to retrieve previously learned declarative issue information about the candidates. Yet, despite their profound inabilities to remember declarative information about the candidates, they still voted for the "right" candidate, choosing the candidate whose issue positions better reflected their political preferences.

Discussion

This study provides several substantive and methodological contributions to research on candidate evaluation, voting behavior, and citizen political performance. Critically, the present study gives striking evidence that sound voting decisions do not require remembering declarative knowledge about previously learned issue positions of candidates. Even in the extreme case studied here, wherein voters could not recall and recognize any specific issue information at all, they could still render sound voting decisions of political figures, consistently choosing the candidate whose positions better aligned with their beliefs. By implication, data showing that normal voters cannot remember issue facts about candidates are not sufficient to infer that such citizens are unable to make sound voting decisions.

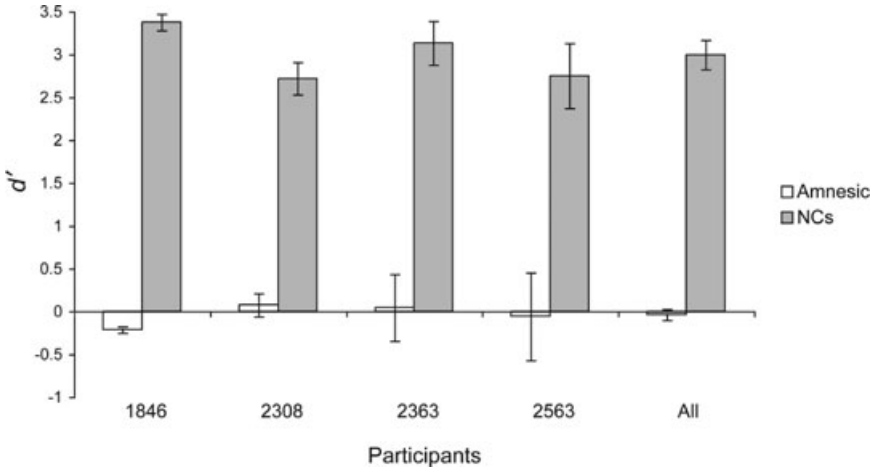
The multiple memory systems framework introduced here points to several nondeclarative processes known to be intact in amnesic patients, such as those involved in emotional memory, categorical learning, or some combination of both, that presumably facilitated their capacities to make sound decisions. Although this study was not designed to tease apart the specific contributions of the potentially multiple nondeclarative

[17] One of the normal comparison participants voted for the incongruent candidate in the neutral versus incongruent condition. His reason for voting against the neutral candidate was that he (the participant) "Didn't know many of the issues that he (the candidate) stood for."

[18] We conducted nonparametric permutation tests on all comparisons between amnesic patients and normal comparisons in order to obtain exact p-values that are conditional on the data. Specifically, we evaluated the probability of the observed data given that the participants were randomly assigned to the two groups (i.e., amnesic patients and normal comparisons).

[19] See the online supporting information for more details on how d' scores were calculated.

FIGURE 2 Recognition Memory Scores



Note: Mean (±SEM) recognition *d'* scores for patient and normal comparison participants (NCs). Patient 1846 was matched to one comparison participant, whereas the rest of the patients were matched to two comparison participants. A *d'* score of zero or below indicates an inability to discriminate correctly between old and new candidate-issue pairings.

TABLE 3 Sample of Reasons Provided by Amnesic Patients (Highlighted) and Normal Comparisons (NC) for Vote Choices

Participant	Why did you vote for candidate *X*?	Why did you NOT vote for candidate *Y*?
1846	I don't know. He just seems more likeable.	He just seems to look more stuck up.
NC 1846	Because most of his views were more aligned with the Democratic Party's position which I pretty much agree with.	Because of his stances on immigration, homosexuality, and the military.
2308	He's dressed a little bit better. He has more style.	He's not dressed as well.
NC 2308	I didn't like the other person's stance on the issues.	Because he wanted to cut down all the trees in the national forests. He wanted to legalize marijuana use and cocaine use. He wanted to give welfare benefits to all illegal aliens in the country.
2363	I think he looks more trustworthy.	I just didn't feel like he was the candidate of choice.
NC 2363	He doesn't have much going in terms of a strong platform but the other guy seems anti-rights and environment.	He's against having homosexuals in the military. He's anti-environment. He wants to allow torture. Because I don't agree with those things I wouldn't vote for him.
2563	He's the first one I saw.	No reason.
NC 2563	I would vote for him because of his political stance. His support for Israel. His support for adult women to be able to obtain abortion on demand. Increasing the minimum wage. Increasing the tax on the wealthy.	His stand on teaching creationism in the classroom, teaching the Bible, allowing chemical companies to dump their waste in the ocean. If I remember, I didn't agree with any of his issues.

memory processes underlying the amnesic patients' decisions, it raises the question of what nondeclarative systems support voting among normal citizens as a promising area for future research. Identifying the specific memory systems that come into play is essential for understanding how voters use political information, since these systems differ in how they represent, update, and use information across a range of contexts (Eichenbaum and Cohen 2001).

In terms of its methodological contribution, this study adds the lesion method to the arsenal of tools available to political scientists. The lesion method provides a unique form of information not available via other types of methods: it permits a critical test of whether a particular cognitive or affective process is *necessary* for the implementation of a specific type of political behavior.[20] Even though this approach required the use of a small sample of participants, our intentional sampling of amnesic individuals provides greater validity, in terms of removing the capacity of voters to access relevant declarative knowledge, than previous, larger-sample studies.

What can this study tell us about the political performances of normal voters? Drawing general implications from this study requires caution. This study specifically examined voting under conditions in which the amnesic voters could not retrieve previously learned declarative information and showed that sound decisions were nevertheless possible. However, the study cannot answer questions about voter political performance under conditions wherein citizens retrieve and use *both* declarative and nondeclarative information. Emerging evidence suggests that this relationship is complex and that the interaction between these two systems can either aid or hinder political performance.[21] The literature on multiple memory systems introduced above can provide researchers with the appropriate conceptual and measurement tools to tackle this question.[22]

In addition, this study exposed amnesic participants to issue positions. In campaigns, voters, at minimum, need to be exposed to political facts such as candidate issue positions in order to form, update, and use nondeclarative memories. In some cases, some voters may choose not to expose themselves to any political information at all. For this subset of voters, the nondeclarative memory systems discussed in this study would not then be able to facilitate sound decision making.

Furthermore, the design of this study was highly controlled both in the type (only issue positions) and the sorting of the information presented to the participants, whereas the real-world informational environment is saturated with "noise." For example, personal information about political figures is disseminated as well. Even though some personal facts about candidates may be considered irrelevant by some voters, such personal information might still generate emotional responses and could, therefore, be incorporated into voters' emotional memories. This leaves open the question of whether nondeclarative systems in noisy informational environments promote or discourage sound voting decisions in the absence of declarative knowledge.

Finally, although this study showed that retrieval of declarative issue information was not necessary for sound decision making, we are still inclined to conclude, with a few qualifications, that across any conception of democracy (e.g., elitist, pluralist, participatory, etc.), citizens who remember and use a substantial number of *accurate* and *relevant* pieces of declarative political information are generally preferable to citizens who do not. One of the key hallmarks of declarative memory, and a property that differentiates it from nondeclarative memory, is that it can be used flexibly and creatively in response to changing situational demands. Absent such capacity, individuals tend to rely on highly inflexible behavioral repertoires.[23] Indeed, behavioral inflexibility is a well-known feature of individuals with amnesia. This implies that in the political domain, citizens who display the capacity to remember and use declarative information should be most able to adapt to a complex, ever-changing, and noisy political environment.

However, this view assumes that information retrieved from declarative memory is correct. Citizens could also retrieve misinformation in the form of a demonstrably false belief or a false memory. Indeed, there are many potential sources of misinformation, including

[20] The general logic of the lesion method is as follows: (1) Postulate whether a specific psychological function is necessary for implementing a particular political behavior, (2) Specify a brain structure or network that is critical for implementing the psychological function of interest, (3) Make a theory-driven prediction concerning how impairment of the psychological function will affect the political behavior of interest, (4) "Lesion" or destroy the brain region or network through the use of neurologically damaged patients, (5) Compare neurologically damaged individuals with normal individuals and examine whether the resulting behavior is consistent with the initial prediction.

[21] For example, some studies in candidate evaluation suggest that some types of information retrieved from declarative memory (e.g., partisan ID) can override the influence of an affective tally (Mitchell 2012). Other studies suggest that nondeclarative memory processes distort what is later retrieved in declarative memory (Coronel, Federmeier, and Gonsalves, 2012).

[22] For instance, most studies on candidate evaluation rely exclusively on self-report techniques as a means of measuring what are theorized to be nondeclarative processes (e.g., measuring an affective tally via verbal self-reports). Memory researchers employ several powerful techniques, such as eye movement monitoring, galvanic skin response, and event-related potentials, in order to reveal memory without appealing to self-reports or requiring conscious awareness on the part of the participant (for examples, see Bechara et al. 1995; Hannula et al. 2010). For an example of a study that uses event-related potentials in examining declarative/nondeclarative memory interactions during candidate evaluation, see Coronel, Federmeier, and Gonsalves (2012).

[23] For a review on the inflexible nature of nondeclarative memory, see Cohen and Eichenbaum (1993).

political elites, individuals within one's social network, or even internal generation by citizens themselves.[24] The extent to which declarative memories presumably aid political performance depends on the accuracy of such memories. If true, then other factors, such as the voter's informational environment and the extent to which citizens scrutinize the accuracy of their memories, should be of equal or greater concern than citizen amnesia of political information.

References

Bechara, Antoine, Daniel Tranel, Hanna Damasio, Ralph Adolphs, Charles Rockland, and Antonio R. Damasio. 1995. "Double Dissociation of Conditioning and Declarative Knowledge Relative to the Amygdala and Hippocampus in Humans." *Science* 269(5227): 1115–18.

Berelson, Bernard R., Paul F. Lazarsfeld, and William N. McPhee. 1954. *Voting: A Study of Opinion Formation in a Presidential Campaign*. Chicago: University of Chicago Press.

Campbell, Angus, Philip E. Converse, Warren E. Miller, and Donald E. Stokes. 1960. *The American Voter*. New York: John Wiley & Sons.

Cohen, Neal J., and Howard Eichenbaum. 1993. *Memory, Amnesia, and the Hippocampal System*. Cambridge, MA: MIT Press.

Cohen, Neal J., and Larry R. Squire. 1980. "Preserved Learning and Retention of Pattern Analyzing Skill in Amnesia: Dissociation of Knowing How and Knowing That." *Science* 210(4466): 207–10.

Converse, Philip E. 1964. "The Nature of Belief Systems in Mass Publics." In *Ideology and Discontent*, ed. David Apter. New York: Free Press, 206–61.

Corkin, Sue. 1984. "Lasting Consequences of Bilateral Medial Temporal Lobectomy: Clinical Course and Experimental Findings in H.M." *Seminars in Neurology* 4(2): 249–59.

Coronel, Jason C., Kara D. Federmeier, and Brian D. Gonsalves. 2012. "Event-Related Potential Evidence Suggesting Voters Remember Political Events That Never Happened." Submitted for publication.

Downs, Anthony. 1957. *An Economic Theory of Democracy*. New York: Harper & Row.

Eichenbaum, Howard, and Neal J. Cohen. 2001. *From Conditioning to Conscious Recollection: Memory Systems of the Brain*. New York: Oxford University Press.

Enelow, James, and Melvin Hinich. 1984. *The Spatial Theory of Voting: An Introduction*. Cambridge: Cambridge University Press.

Feinstein, Justin S., Melissa C. Duff, and Daniel Tranel. 2010. "Sustained Experience of Emotion after Loss of Memory in Patients with Amnesia." *Proceedings of the National Academy of Sciences* 107(17): 7674–79.

[24] See Kuklinski et al. (2000) and Coronel, Federmeier, and Gonsalves (2012).

Gabrieli, John D. E. 1998. "Cognitive Neuroscience of Human Memory." *Annual Review of Psychology* 49(1): 87–115.

Grofman, Bernard. 2004. "Downs and Two-Party Convergence." *Annual Review of Political Science* 7(1): 25–46.

Hannula, Deborah E., Robert R. Althoff, David E. Warren, Lily Riggs, Neal J. Cohen, and Jennifer D. Ryan. 2010. "Worth a Glance: Using Eye Movements to Investigate the Cognitive Neuroscience of Memory." *Frontiers of Human Neuroscience* 4: 166. doi:10.3389/fnhum.2010.00166.

Hastie, Reid, and Bernadette Park. 1986. "The Relationship between Memory and Judgment Depends on Whether the Judgment Task Is Memory-Based or On-line." *Psychological Review* 93(3): 258–68.

Johnson, Marcia K., Jung K. Kim, and Gail Risse. 1985. "Do Alcoholic Korsakoff's Syndrome Patients Acquire Affective Reactions?" *Journal of Experimental Psychology: Learning, Memory, and Cognition* 11(1): 22–36.

Kitchener, Erin G., and Larry R. Squire. 2000. "Impaired Verbal Category Learning in Amnesia." *Behavioral Neuroscience* 114(5): 907–11.

Knowlton Barbara J., and Larry R. Squire. 1993. "The Learning of Categories: Parallel Brain Systems for Item Memory and Category Knowledge." *Science* 262(5140): 1747–49.

Konkel, Alex, David E. Warren, Melissa C. Duff, Daniel Tranel, and Neal J. Cohen. 2008. "Hippocampal Amnesia Impairs All Manner of Relational Memory." *Frontiers of Human Neuroscience* 2: 15. doi:10.3389/neuro.09.015.2008.

Kuklinski, James H., Paul J. Quirk, Jennifer Jerit, David Schweider, and Robert F. Rich. 2000. "Misinformation and the Currency of Democratic Citizenship." *Journal of Politics* 62(3): 790–816.

Lau, Richard R., and David P. Redlawsk. 1997. "Voting Correctly." *American Political Science Review* 91(3): 585–99.

Lau, Richard R., and David P. Redlawsk. 2006. *How Voters Decide: Information Processing during Election Campaigns*. New York: Cambridge University Press.

Lazarsfeld, Paul F., Bernard Berelson, and Hazel Gaudet. 1944. *The People's Choice: How the Voter Makes Up His Mind in a Presidential Campaign*. New York: Columbia University Press.

LeDoux, Joseph E. 1995. "Emotion: Clues from the Brain." *Annual Review of Psychology* 46(1): 209–35.

Lodge, Milton, Kathleen M. McGraw, and Patrick Stroh. 1989. "An Impression-Driven Model of Candidate Evaluation." *American Political Science Review* 83(2): 399–419.

Lodge, Milton, Marco R. Steenbergen, and Shawn Brau. 1995. "The Responsive Voter: Campaign Information and the Dynamics of Candidate Evaluation." *American Political Science Review* 89(2): 309–26.

McGraw, Kathleen M., Edward Hasecke, and Kimberly Conger. 2003. "Ambivalence, Uncertainty, and Processes of Candidate Evaluation." *Political Psychology* 24(3): 421–48.

Mitchell, Dona-Gene. 2012. "It's about Time: The Lifespan of Information Effects in a Multiweek Campaign." *American Journal of Political Science*. 56(2): 298–311.

Postman, Leo, William O. Jenkins, and Dorothy Postman. 1948. "An Experimental Comparison of Active Recall and Recognition." *American Journal of Psychology* 61(4): 511–19.

Redlawsk, David P. 2001. "You Must Remember This: A Test of the On-line Model of Voting." *Journal of Politics* 63(1): 29–58.

Richardson-Klavehn, Alan, and Robert A. Bjork. 1988. "Measures of Memory." *Annual Review of Psychology* 39(1): 475–543.

Scoville, William B., and Brenda Milner. 1957. "Loss of Recent Memory after Bilateral Hippocampal Lesions." *Journal of Neurology, Neurosurgery, and Psychiatry* 20(1): 11–21.

Squire, Larry R. 1992. "Memory and the Hippocampus: A Synthesis of Findings with Rats, Monkeys, and Humans. *Psychological Review* 99(2): 195–231.

Squire, Larry R. 2004. "Memory Systems of the Brain: A Brief History and Current Perspective." *Neurobiology of Learning and Memory* 82(3): 171–77.

Todorov, Alexander, and Ingrid R. Olson. 2008. "Robust Learning of Affective Trait Associations with Faces When the Hippocampus Is Damaged, but Not When the Amygdala and Temporal Pole Are Damaged." *Social Cognitive and Affective Neuroscience* 3(3): 195–203.

Tranel, Daniel, and Antonio R. Damasio. 1993. "The Covert Learning of Affective Valence Does Not Require Structures in Hippocampal System or Amygdala." *Journal of Cognitive Neuroscience* 5(1): 79–88.

Zajonc, Robert B. 1980. "Feeling and Thinking: Preferences Need No Inferences." *American Psychologist* 35(2): 151–75.

Zaller, John, and Stanley Feldman. 1992. "A Simple Theory of the Survey Response: Answering Questions versus Revealing Preferences." *American Journal of Political Science* 36(3): 579–616.

Supporting Information

Additional Supporting Information may be found in the online version of this article:

- Full Description of Methods
- Political Attitudes Questionnaire

Please note: Wiley-Blackwell is not responsible for the content or functionality of any supporting materials supplied by the authors. Any queries (other than missing material) should be directed to the corresponding author for the article.