MEMORY AND VOTING:
NEUROPSYCHOLOGICAL AND ELECTROPHYSIOLOGICAL INVESTIGATIONS OF VOTERS REMEMBERING POLITICAL EVENTS

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DISSEPTION
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Abstract

The studies in this dissertation address two fundamental questions in public opinion research: what kinds of campaign information do voters retrieve from memory and how do they use this information to make political choices?

The first study examines a prominent claim in public opinion that states 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. I use a unique and powerful methodology to examine 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. The results suggest 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.

In the second study, I examine a well-documented phenomenon wherein voters misattribute issue positions to candidates, which are consistent with the candidate’s partisan affiliation, even though such candidates have never explicitly stated such positions. The dominant explanation in political science is that voters misattribute candidates’ issue positions because they use their political knowledge to make educated but incorrect guesses. I challenge this view and suggest that voter errors can stem from a very different source: false memories. The study examines event-related potential (ERP) responses to both misattributed and accurately remembered candidate issue information. The results suggest that ERP responses to misattributed
information elicited memory signals similar to that of correctly remembered old information, a pattern which favors a false memory rather than educated guessing interpretation of these misattributions. Thus, voter misinformation about candidates may be harder to correct than previously thought.

The studies I present here provide part of an initial foundation for understanding the role of memory and its interaction with the informational environment during political decision making. They also show the promise of using conceptual and methodological tools from cognitive neuroscience to answer fundamental questions about the nature of citizen decision making in democratic governance.
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Chapter 1

Conceptualizing and Measuring Memory in Public Opinion Research: Implications for Assessments of Citizen Performance

The capacity of voters to retrieve political information about candidates, parties, and policies from memory has been a central criterion for assessing the competence and performance of democratic citizens. Indeed, in the last 50 years, the concept of “memory” has played a key role in theories of political behavior and decision making.

Historically, political scientists have conceptualized and measured voters’ memories for political information in different ways. As I discuss below, the different attempts by public opinion researchers to conceptualize and measure memory generated multiple and sometimes conflicting conclusions regarding the competence and political performance of citizens. Thus, insights about the organization of memory and the use of appropriate tools to measure memory are critical to understanding the nature of citizen decision making in democratic governance.

The goal of this dissertation is to introduce new ways of thinking about and measuring memory in the context of voter decision making. I use conceptual and methodological tools from cognitive neuroscience to study the role of memory in political behavior. In this dissertation, I make three main arguments: (1) political science research should incorporate certain concepts and basic findings from memory research, (2) accurate measurement of the role that some memory systems play in political decision making requires the use of methods from cognitive neuroscience, and (3) nondeclarative memory, most prominently represented by on-line
processing, has been presented as a rebuttal to critical depictions of the democratic citizen. However, we should expect nondeclarative memory systems to aid decision making only under a narrow set of conditions. In contrast, the capacity of citizens to retrieve political information from declarative memory is critical to sound and flexible political decisions. Thus, contrary claims made by recent work, citizens who rely on nondeclarative memory will generally not perform as well as citizens who remember and use accurate and relevant declarative political information.

I will elaborate and provide evidence for these arguments throughout this dissertation. The goal of this chapter is to give a general background for the studies that I will present in later chapters. This chapter is organized as follows. First, I will discuss how political scientists have conceptualized and measured memory and how these attempts led to different assessments of citizen performance. Second, I will present a prominent view of memory from the field cognitive neuroscience and argue why this framework should be incorporated into political science research. Finally, I provide a brief description of the subsequent chapters.

**Memory in Political Science Research**

Much of the early research in public opinion and political behavior from the 1950s to the 1980s focused on the question of what citizens know about politics. Political scientists asked questions such as how much and what kinds of political information do citizens retrieve from memory. During this time, most political scientists viewed “memory” as information to which voters had conscious access. Many of the early research in public opinion did not explicitly state a
conceptualization of memory.¹ However, one could infer that this view was reflected in the widespread use of survey instruments which was the standard, and sometimes only method used by public opinion researchers.

Researchers used surveys to determine the extent to which voters could recall or recognize explicitly what they knew about candidates, parties, policies, etc. This huge body of work found that many citizens could retrieve little to no political information. In particular, citizens could state or recognize very little about issues, political ideology, the workings of government, officials holding office, etc. (Lazarsfeld, Berelson, and Hazel 1944; Berelson, Lazarsfeld, and McPhee 1954; Campbell et al. 1964; Converse 1964).

Some viewed these results as troubling by given that many prominent theories and models of political behavior assumed that political information could only exert an influence on political judgments and actions only if citizens were able to remember it.² For example, the early Columbia and Michigan studies believed that policy-based voting and ideological thinking required citizens to retrieve and use information about parties, elected officials, policies, and political ideology (Berelson, Lazarsfeld, and McPhee 1954; Campbell et al. 1964; Converse 1964). Theoretical models of issue-proximity voting emphasized recall of voters’ preferences and candidates’ issue stances (Enelow and Hinich 1984). Political attitudes were theorized to be a function of considerations that voters could explicitly retrieve about issues (Zaller and Feldman 1992).

¹ A notable exception to this view is Kelley and Mirer’s model of voting (1974). The authors theorized that “Any decision may be thought of as involving both a set of considerations (conscious or unconscious) and a rule (conscious or unconscious) in accordance with which these considerations are weighted (pg. 573).” However, their empirical work still relied exclusively on self-report measures in order to determine what respondents liked or disliked about candidates (i.e., their indicators of the respondents’ “considerations”).

² A notable exception to this is Berelson, Lazarsfeld, and McPhee’s (1954) controversial conclusion that an uninformed citizenry was necessary for political stability in a democratic society.
1992; Zaller 1992). Thus, the survey findings generated the conclusions that many voters do not think in ideological terms, nor do they make policy-based judgments or decisions, and they do not understand the basic functions of government.

However, by the late 1980s, a key theoretical innovation occurred in the conceptualization and measurement of memory. A group of political scientists started importing concepts and methods from social psychology. One of the most well-known and successful of these groups is Lodge and his colleagues. Adopting the “new” information processing approach in social psychology, Lodge and colleagues asked questions such as how do voters encode, store, and retrieve information during a political campaign and how do they use this information in making political decisions.

In answering these questions, Lodge and colleagues advanced the idea that political information can persist even if voters were unable to recite it explicitly. In particular, they distinguished between “memory-based” and “on-line” processing of political information (Lodge, McGraw, and Stroh 1989; Lodge, Steenbergen, and Brau 1995; also see Hastie and Park 1986). A “memory-based” representation is political information that voters could recall and recite verbally or consciously—the type of memory that was central to early public opinion research.

In contrast, on-line processing specified a different means of representing and storing information. Lodge and colleagues introduced the concept of an “on-line tally”—an overall

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3 The field of social psychology at this time was itself undergoing a transformation as it too was being transformed by ideas from cognitive psychology (see Coronel and Kuklinski, forthcoming).

4 Indeed, Lodge and colleagues’ approach to political psychology were so unique and influential that people refer to their work as the “Stony Brook School.” Lodge and colleagues, at this time, were faculty members at SUNY Stony Brook.
summary evaluation based on affect that is derived, but is independent from, “memory-based” political information. Through a series of laboratory experiments, they purported to show that rather than storing specific information about candidates and retrieving this information at the time of making a decision (i.e., memory-based processing), people instead acted like on-line processors. They forgot the specifics, although those specifics still affected their final judgments through an on-line, affective tally.

The main implication of their work is that voters can make decisions about candidates that are based on previously learned information, e.g., issue positions, even when they cannot remember that information. Since the average voter will likely not remember all the specific information previously learned during a campaign, as documented time and again by public opinion survey data, on-line processing represents an almost-miraculous remedy.

This body of work had a profound impact on public opinion research in three ways. First, Lodge and colleagues changed how political scientists thought about how citizens stored information. Political knowledge was no longer just specific representations of information that citizens could retrieve and express verbally, it could also be a general, affective representation that is derived but is independent from “memory-based” political information. Second, their studies shifted the focus away from measures of memory that exclusively looked at citizens’ capacities to retrieve specific political information. Instead, they argued that researchers should examine citizens’ political evaluations as indicators of whether information exposure produced effects. Finally and most critically, these studies reached a different conclusion from the earlier

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5 As Lodge and colleagues (1995) stated in the concluding section of “The Responsive Voter”, “Rather than judge the citizen as we would a student taking an exam, we think it far more valid to judge the citizenry in terms of how much impact this information has on their judgments” (pg. 322).
literature. Voters, they argued, can be responsive to campaign information even though voters are unable to recollect accurately the considerations that went into their political evaluations.

Lodge and colleagues’ work has been highly influential in the public opinion literature in that memory and on-line processing are the prevailing ideas used by political scientists to explain how voters form and update their attitudes about candidates and issues (Redlawsk 2006; Chong and Druckman 2010). Though this existing work is an improvement over previous research, I will introduce a conceptual framework that draws from recent developments in cognitive neuroscience and argue why this view of memory should be incorporated into political science research as work in this field has considerable bearing on debates about citizen political performance.

**Cognitive Neuroscience of Memory**

Modern research on the cognitive neuroscience of memory presumably began in 1957 when Brenda Milner described a patient who became known by his initials, H.M. (Scoville and Milner 1957). As a treatment for his epilepsy, H.M. underwent surgery and had the medial portion of his temporal lobe removed. Though the surgery decreased the occurrence of his epileptic seizures, it also severely impaired his capacity to form new long-term memories, a condition referred to as “anterograde amnesia.”

Patient H.M. exhibited profound forgetfulness even though his motor, intellectual, and perceptual functions were preserved.

When exposed to new people, places, or events, H.M. and other amnesic patients cannot explicitly state that they have learned new information. However, later studies showed that even though they were incapable of explicitly identifying new information to which they were exposed.

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6 Although amnesic patients generally do have the capacity to form new everyday memories, they do retain the capacity to retrieve remote memories or information that they learned before the onset of their amnesia.
previously exposed, their behavior showed evidence of prior exposure. The evidence for this type of learning has been shown for a variety of domains and circumstances. For example, amnesic patients have the capacity to learn new motor skills (Milner, Corkin, and Teuber 1968), they show enhanced performance in perceptually identifying objects or words that they were previously exposed (Warrington and Weiskrantz 1968), and they can demonstrate caution to individuals to which they previously had a negative interaction (Claparede 1911/1951; Tranel and Damasio 1993).

This influential body of work showed that the capacity to have one’s performance shaped by training experiences is distinct from one’s capacity to recollect consciously the training experiences themselves. Many memory researchers attributed this dissociation to the operation of distinct forms of memory that are tied to different brain systems—where the memory system dedicated to the encoding, storage, and retrieval of facts and events were theorized as dependent on the medial temporal lobe structures that are damaged in amnesia. Thus, these early observations of amnesic patients and subsequent studies on both normal human and nonhuman animals provided one of the key insights of modern memory research: memory is not a single entity but consists of distinct and separate capacities, with each mediated by a different brain system. This idea that memory is expressed in many ways by multiple, functionally distinct brain systems is often described as “multiple memory systems.”

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7 For reviews, see Cohen and Eichenbaum (1993) and Eichenbaum and Cohen (2001).

8 One of the earliest evidence of this was an experiment done by the Swiss neurologist Claparede. He described an amnesic woman whose hand he pricked with a hidden pin while he greeted her with a handshake. Even though the woman could not explicitly remember meeting with Claparede earlier, she subsequently refused to shake his hands again.
Over the past several decades, many memory researchers have made 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. That is, such memories can be manipulated and used in a wide range of novel contexts.\(^9\)

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. Nondeclarative memory includes capacities such as procedural learning, emotional memory, conditioning, priming, etc. Unlike declarative memory, expression of nondeclarative memory is highly inflexible, and most often influences automatic, procedural, and habitual behavior. Indeed, its inflexibility is evident in that it is most likely to be expressed under conditions that mirror the original learning episodes. Thus, unlike declarative memory which can be used flexibly in the face of changing situational demands, nondeclarative memory is largely characterized as the learning of context-dependent stimulus-response rule-like relations.

Declarative memory exhibits properties that are quite different from nondeclarative memory. In the next section, I discuss the relevance of these differences between declarative and nondeclarative memory to citizen decision making and political performance.

\(^9\) Including those that differ considerably from the circumstances in which the information was initially learned.
Multiple Memory Systems and Political Performance

The memory and on-line processing model have been highly influential in the candidate evaluation and political attitude literatures. Lodge and colleagues’ on-line processing is a nondeclarative, emotional learning account of voting behavior. This work has been presented as a rebuttal to critical depictions of the democratic citizen. However, these studies neglect a critical feature from multiple memory systems research. It does not take into account key differences in the operating properties of these systems. These differences are relevant in that they may promote or hinder sound political decision making.

In particular, evidence from memory research suggests that we should not expect nondeclarative memory to perform as well as declarative memory during political decision making. Nondeclarative memory has three general properties that make it highly unlikely to be as robust as declarative memory in its use across multiple, political decision making contexts.

First, nondeclarative memory is characterized by its inflexibility—that is, nondeclarative representations are usually expressed under testing conditions that closely mirror the original learning contexts. For example, consider a nondeclarative process such as priming. Priming involves initial presentation of a list of words or pictures of objects and then subsequent exposure to fragments or the whole item. In the reexposure phase, learning is assessed by the participant’s increased ability to reproduce the whole item or from his or her increased speed in making a decision about an item.

Chapter 2 will describe and elaborate on this claim in further detail.

Declarative memory is not critical for priming effects given that these effects remain intact in amnesic patients (Graf et al. 1984).

This is a specific form of priming known as “repetition priming.” This form of priming is one of the most heavily studied forms of memory in amnesic patients.
Priming is highly sensitive to changes in the superficial qualities of items on the retention test. For instance, changes in the font of words or modality (visual or auditory) of presentation between initial exposure and later testing can sometimes diminish the level of priming. This is unlike declarative memory, or explicit remembering of an item, in which its expression is not tied to a specific modality or context.

Second, learning through nondeclarative memory usually involves an incremental and slow process of repetition. The preponderance of evidence for this claim stems from work on category and skill learning. For instance, data from amnesic patients suggests that their capacity to learn novel categories occurs incrementally and involves gradual improvement in performance following specific regularities in many stimulus-response sequences (Knowlton et al, 1994, 1996). In contrast, declarative memory is fast and specialized for one-trial learning, such as the rapid acquisition of associations, propositions, or items within a given context (for reviews, see Squire, Knowlton, and Busen 1993).

Finally, a defining feature of nondeclarative memory is that the influence of a learning experience is made evident through a change in behavior or performance. But the learning experience leading to the change is not consciously accessible (for reviews, see Eichenbaum and Cohen 2001). On the other hand, declarative memories are accessible to conscious awareness—a very powerful form of access that allows information to be scrutinized, used, and manipulated across a wide range of different and dynamic situations.

What do the distinctions between declarative and nondeclarative memory imply for the study of politics? The main implication is that we should not expect nondeclarative memory to support robust, flexible and sound decision making, when compared to declarative memory,
across a wide range of informational environments. Nondeclarative memory may aid political decision making, but they should do so only under a narrow set of conditions.

For instance, political learning and decision making usually involves learning and testing conditions that differ considerably in terms of their contexts. Thus, expression of nondeclarative memory during testing might be limited. For example, consider that information about candidates presented during a campaign is usually disseminated via visual (e.g., candidates’ photos, videos) and auditory cues. However, during voting (i.e., the “testing” condition) information about candidates is usually presented in a completely different modality (i.e., their names in a ballot). Nondeclarative memory is particularly sensitive to such superficial shifts in modality.

The slow, incremental form of learning that characterizes nondeclarative memory suggests that changing implicit impressions about candidates and issues may take a long time and involve constant repetition or presentation of information. Additionally, this also suggests that misinformation that is instantiated in nondeclarative memory may persist longer in time and may be harder to correct or change.

Given that information contained in nondeclarative memory is largely inaccessible to conscious awareness, it is less amenable to scrutiny in its use during political decision making. This suggests that political information that voters subjectively consider to be a normatively irrelevant factor when making their decisions may still exert an influence, without the voters’ awareness, via nondeclarative memory systems.
Outline of the Dissertation

The studies in this dissertation represent the initial steps in identifying the conditions under which nondeclarative memory may aid or hinder political decision making. The remaining chapters proceed as follows. Chapter 2 critically examines the nature of the evidence in the seminal studies on-line processing and argues that they actually fail to provide strong evidence for the claim that the retrieval of declarative information is not necessary for issue-proximity voting. In order to provide evidence for this claim and overcome the limitations of previous research, I use patients with anterograde amnesia. In addition, I introduce the multiple memory systems framework in the context of voting and discuss how issue-based voting can occur in the absence of policy facts retrieval.

Chapter 3 examines the complex interactions between declarative and nondeclarative memories among normal voters in a relatively simple informational environment. I use behavioral and event-related potential measures of memory to show that nondeclarative knowledge structures (i.e., partisan schemas) can create political misinformation that the brain cannot distinguish from veridical information. This study further highlights the relative inflexibility of nondelcarative memory systems and shows how they can lead to the creation of confidently held political misinformation.

Finally, Chapter 4 summarizes the results and conclusions of the empirical chapters. It discusses the implications of each study for research on citizen political performance and discusses avenues of future research that focuses on the interaction between memory systems and the informational environment.
Chapter 2

Remembering and Voting: Theory and Evidence from Amnesic Patients

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.\textsuperscript{13} 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.\textsuperscript{14}

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. Researchers generally found that many citizens cannot recall the issue positions of candidates and that issue positions rarely shaped votes or judgments (Lazarsfeld, Berelson, and Hazel 1944; Berelson, Lazarsfeld, and McPhee 1954; Campbell et al. 1964; Converse 1964). 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

\textsuperscript{13} This chapter is reprint of material that will appear in the American Journal of Political Science, forthcoming. Coronel, Jason C., Duff, Melissa C., Warren, David E., Federmeier, Kara D., Gonsalves, Brian D., Tranel, Dan, and Cohen, Neal J. I was the primary author and investigator of this paper.

\textsuperscript{14} 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; Lau and Redlawsk 2006).
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’ inabilitys to remember issue positions of candidates, as revealed in survey data, need not impugn people’s capacity to make issue-based voting decisions.

However, we argue below, 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 (Scoville and Milner 1957; Cohen and Squire 1980; Squire 1992; Gabrieli 1998). 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 associations 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 et al.’s 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.”

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

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15 For reviews, see Eichenbaum and Cohen (2001) and Squire (2004).
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.

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 (Zajonc 1980; Johnson et al. 1985; LeDoux 1996). 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. 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). In particular, they

16 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 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.

17 But also see Kitchener and Squire (2000) for an examination of the conditions under which this type of categorization can or cannot occur.
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 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. Participants were then given a brief distractor task, after which they were asked to provide affective and character trait evaluations of the candidate. 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.

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18 The preponderance of other empirical work in 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 (Redlawsk 2001; McGraw et al. 2003; Lau and Redlawsk 2006; Mitchell forthcoming). In contrast, the Lodge et al. studies were designed to examine political decision making under conditions where participants were (1) 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.

19 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.
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 candidate’s 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 (1989) showed robust recognition memory performance for previously learned information (Table 2, pg. 407). 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.

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20 Participants’ recognition memory scores were robust despite the fact that “don’t know” responses were not included.
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 (1995), at least forty percent of the participants were able to recall at least one piece of previously learned information (pg. 314). 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 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 (Table 21).

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21 The researchers did not check the factual accuracy of the recollected information (i.e., whether the issue was correctly associated with the right candidate).
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; Scoville and Milner 1957; Cohen and Squire 1980). 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 (Corkin 1968; Cohen and Squire 1980; Johnson et al. 1985; Knowlton and Squire 1993; Cohen and Eichenbaum 1993; Tranel and Damasio 1993; Bechara et al. 1995; Todorov and Olson 2008; Feinstein, Duff, and Tranel 2010). 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 towards 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 are 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.

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22 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; Squire 1992; Gabrieli 1998).
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.\(^\text{23}\)

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 (one female) with anterograde amnesia following bilateral hippocampal damage, each displaying severe impairments in declarative (i.e., relational) memory (Konkel et al. 2008). For three of these patients (1846, 2363, 2363) amnesia was due to an anoxic/hypoxic episode resulting in damage limited to the hippocampus bilaterally; for the other patient (2308), amnesia resulted from herpes simplex encephalitis and resulted in more extensive bilateral medial temporal lobe damage including hippocampus, amygdala, and surrounding cortices (See Tables 2.1 and 2.2). Three of the patients had bilateral hippocampal damage confirmed by structural MRI. For participant 2563, who wears a pacemaker and was unable to undergo the MRI examination, anatomical analysis was based on computerized tomography, and only damage in the hippocampal region was visible. For patients 1846 and 2363, high-resolution

\(^{23}\) 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).
volumetric MRI analyses showed hippocampal volumes decreased by Studentized residuals of 2.5 and 4, respectively, compared to age-matched comparison subjects (Allen et al. 2006).

Table 2.1 Patients’ Demographic, Neuropsychological, and Anatomical Characteristics

<table>
<thead>
<tr>
<th>Patient</th>
<th>Sex</th>
<th>Handedness</th>
<th>Education</th>
<th>WAIS-III FSIQ</th>
<th>WMS-III GMI</th>
<th>Etiology</th>
<th>Hippocampal Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1846</td>
<td>F</td>
<td>R</td>
<td>14</td>
<td>84</td>
<td>57</td>
<td>Anoxia</td>
<td>-4.23</td>
</tr>
<tr>
<td>2308</td>
<td>M</td>
<td>L</td>
<td>16</td>
<td>98</td>
<td>45</td>
<td>HSE</td>
<td>N/A</td>
</tr>
<tr>
<td>2363</td>
<td>M</td>
<td>R</td>
<td>16</td>
<td>98</td>
<td>73</td>
<td>Anoxia</td>
<td>-2.64</td>
</tr>
<tr>
<td>2563</td>
<td>M</td>
<td>L</td>
<td>16</td>
<td>94</td>
<td>63</td>
<td>Anoxia</td>
<td>N/A</td>
</tr>
</tbody>
</table>

*Note: WAIS-III, Wechsler Adult Intelligence Scale-III; FSIQ, full scale IQ; WMS-III, Wechsler Memory Scale-III; HSE, Herpes simplex encephalitis. Hippocampal volume Studentized residuals represent the combined (left and right hemisphere) hippocampal volumes relative to a group of comparison subjects (Allen et al. 2006).*

Table 2.2 Demographic Information on the Amnesic Patients

<table>
<thead>
<tr>
<th>Patient</th>
<th>Age (2010)</th>
<th>Onset</th>
<th>Sex</th>
<th>Race</th>
<th>Partisan ID</th>
<th>Ideology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1846</td>
<td>47</td>
<td>1993</td>
<td>F</td>
<td>Caucasian</td>
<td>Republican</td>
<td>Moderate</td>
</tr>
<tr>
<td>2308</td>
<td>54</td>
<td>1999</td>
<td>M</td>
<td>Caucasian</td>
<td>Strong Democrat</td>
<td>Strongly Conservative</td>
</tr>
<tr>
<td>2363</td>
<td>54</td>
<td>1998</td>
<td>M</td>
<td>Caucasian</td>
<td>Democrat</td>
<td>Liberal</td>
</tr>
<tr>
<td>2563</td>
<td>55</td>
<td>2000</td>
<td>M</td>
<td>Caucasian</td>
<td>Republican</td>
<td>Conservative</td>
</tr>
</tbody>
</table>

*Note: “Onset” refers to the beginning date of a patient’s amnesia.*
Materials

Photos were used to represent each candidate. All photos were obtained from the websites of law firms, and each depicted a Caucasian man of middle age. Each candidate was paired with policy statement facts personalized for each participant. To determine for which policies each participant had strong and stable preferences, participants filled out the same political attitude questionnaire on at least two separate occasions. If the participant provided the same response to a given policy issue on at least two occasions, separated by at least one month, then the preference for that given issue was classified as stable. More specifically, a response was considered stable if the participant’s response had the same directionality on both occasions.\textsuperscript{24}

Issues for which the participants consistently selected “no opinion” during at least two different time points were also collected. We intentionally used a certain number of obscure policy issues in the questionnaire in order to elicit consistent “no opinion” responses (e.g., “The statute of limitations on the award of the Congressional Medal of Honor should be eliminated.”). Thus, the policy statements included a mix of issues that patients supported, opposed, or for which they had no opinion. For the patients, there was at least one month between administrations of the political attitude questionnaire. For the normal comparisons, there was at least one week between administrations of the survey.

\textsuperscript{24} For example, a response of “strongly agree” at time one and a response of “agree” at time two would be classified as a stable response. However, a response of “disagree” at time one and a response of “agree” at time two would not be classified as stable.
Experimental Procedure

The main experiment employed a straightforward study-test method (see Figure 1.1). Before the start of the experiment, participants were shown faces of unfamiliar middle-aged, white males and asked to rate each face on a seven-point Likert scale on the following four criteria: attractiveness, likeability, competence, and trustworthiness. After this individualized norming phase, the participants were given a five minute distractor task consisting of arithmetic problems. The two faces that were rated equally on each of the four criteria were picked and used as the candidates for the study phase. For every trial in the experiment, there were at least two faces to which each amnesic and normal comparison participant rated equally on the four dimensions.25

During the study phase, the participants learned about each of the candidates. Candidates were represented using two unique faces selected as described above, and in order to further differentiate the candidates, the faces were positioned on opposite sides of the display for presentation; only one of the two faces was presented at a time. Below each photo, an issue position endorsed by the fictitious candidate was presented in text. Participants were asked to read each issue position aloud once and then asked to look at the candidate’s photo for five seconds. Then, the next candidate-issue pair was presented. Each candidate was paired with a total of nine issues. Each candidate-issue pair was presented in alternating blocks where the first three candidate-issue pairs would be of candidate X, the next three of candidate Y, the next of candidate X again, and so forth. The participants were not told that they would be asked to vote for one of the candidates later or that they would be given a memory test.

25 Each experimental condition had a unique set of faces.
Alignment of the two candidates’ issue positions with those of the participant were varied according to three unique within-subject conditions. In the congruent-incongruent condition, the participants learned about a candidate who completely agreed with the participants’ political issue positions and another candidate who completely disagreed with the participants’ positions. In the congruent-neutral condition, one candidate was associated with issues the patient agreed with and the other candidate associated with “neutral” issues (issues on which the participants said they have “no opinion”). Finally, the neutral-incongruent condition presented one candidate associated with neutral issues and another associated with issues with which the participant disagreed. In addition, the location on the screen of each type of candidate during the study phase was counterbalanced across the three conditions.

After the study phase in each version, patients were asked to solve new arithmetic problems for 12 minutes as a distractor task. The arithmetic problems were relatively difficult. For example, many of the problems involved multiplication of a two digit number by a two digit number. This was done in order to make the patients expend a great deal of cognitive effort in doing the problems, thus making it difficult for them to rehearse the declarative information they learned during the study phase.

In the subsequent voting phase, photos of the two candidates were presented simultaneously on the screen, and the participants were asked to vote for one of the candidates. Afterward, participants were asked to provide a rationale for their vote choice, and also to explain why they did not vote for the other candidate. After voting, the participants were given an open-ended free recall test wherein they were asked to remember as much information about
the candidates as possible. The participants were told to take as much time as they needed during the free recall test.

The recall test was followed by a recognition memory test. Each of the candidates was paired with all nine old issue positions and nine new issue positions that were not previously studied. The participants stated whether the candidate-issue pairing was “new” or “old.” The participants were also told that some of the candidate-issue pairings presented during the study phase were switched. Some of the issues that were associated with a particular candidate in the study phase were not paired with that same candidate in the recognition memory test. They were instructed to classify such candidate-issue pairings as “new.” However, in reality, there were no items consisting of switched candidate-issue pairs included in the recognition test. The participants were given these instructions in order to encourage the participants to pay attention to the candidate-issue pairs and to prevent the participants from making their decisions based on solely looking at the issue positions and trying to ascertain their familiarity.

The new issue positions also aligned with the valence condition of the candidates (e.g., if the candidate was “congruent”, then the new issue position was one that the patient also supports). This was done in order to determine if the amnesic patients were employing an inference strategy based on valence. For example, the patients could reason as follows: “I like this candidate and I like this issue so they must have been paired together before.” Such a strategy would be reflected in a high false alarm rate.

In order to ensure that patients had no memory of the test materials and the experimental procedures, a period of at least one month separated the patients’ exposure to the three
experimental conditions. For the normal comparisons, a period of at least one week separated their exposure to the experimental conditions.

In the free recall test, a recollected candidate-issue policy item was considered “correct” if (1) the named specific policy was associated with the correct candidate during the study phase (e.g., if an issue was paired with candidate X during the study phase but the participant said that the issue was paired with candidate Y, such an outcome would be classified as “incorrect”) and (2) the participant was able to provide the direction of support of the candidate for the given issue (e.g., saying “He said something about abortion,” would be considered “incorrect” while “He’s against women having abortions,” would be categorized as “correct”).

Recognition memory was assessed using the discriminability index $d'$ (MacMillan and Creelman 2005). The statistic D-prime is calculated by subtracting the inverse cumulative Gaussian distribution value associated with the false alarm rate, the proportion of new items mistakenly classified as “old” by participants, from the inverse cumulative Gaussian distribution value associated with the hit rate, the proportion of old items correctly classified as “old.” In order to eliminate a 0 or 1 hit rate or false alarm score and avoid an infinite $d'$ score, a standard correction was applied in which 0s were transformed into $1/2N$ and 1s were transformed into $1-(1/2N)$ where N equaled the number of critical lures or old items. In this study, N equaled 18 for both old items and critical lures. A $d'$ prime score of 0 or below indicates that a participant is unable to discriminate between old and new items.
Figure 2.1 Schematic Diagram of the Experimental Design

1. Face Norming
   Rating 20 faces on competence, likeability, attractiveness, and trustworthiness
   Two faces equally matched on all four criteria are used as the candidates

2. Distractor Task
   \[12 \times 54 = ?\]
   Five minutes of arithmetic problems

3. Study Phase
   Exposure to two candidates and their issue positions
   He believes that all adults should have the right to own handguns.

4. Distractor Task
   \[27 \times 93 = ?\]
   12 minutes of arithmetic problems

5. Voting and Reasons for Vote Choice
   Who would you vote for?
   Why did you vote for this candidate?
   Why did you NOT vote for the other candidate?

6. Recall Test
   What can you remember about this candidate?

7. Recognition Test
   He supports mandatory recycling programs.
   Was this candidate previously paired with this issue?
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 ($p < .001$, binomial test, two-tailed).\textsuperscript{26} 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 2.3). However, unlike the normal comparisons, the patients were unable to recall the issue positions associated with candidates during the free recall test (Table 2.3). 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)\textsuperscript{27}.

\textsuperscript{26} One of the normal comparison participants voted for the incongruent candidate in the neutral vs. 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.”

\textsuperscript{27} We conducted non-parametric 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).
### Table 2.3 Voting Outcome and Free Recall Performance

<table>
<thead>
<tr>
<th>Experimental Conditions</th>
<th>Voting Outcomes “Right” Votes/Total Voting Trials</th>
<th>Average Correctly Recalled Candidate-Issue Pairs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Amnesics</td>
<td>NCs</td>
</tr>
<tr>
<td>Congruent vs. Incongruent</td>
<td>6/7</td>
<td>7/7</td>
</tr>
<tr>
<td>Congruent vs. Neutral</td>
<td>6/7</td>
<td>7/7</td>
</tr>
<tr>
<td>Neutral vs. Incongruent</td>
<td>6/6</td>
<td>6/7</td>
</tr>
</tbody>
</table>

Amnesic patients’ striking deficits in memory for specific candidate-issue pairs was substantiated by their performances on the recognition memory test. Recognition memory was assessed using the standard discriminability index D-prime ($d'$). 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 ± .07 s.e.m.) whereas normal comparisons showed robust performance ($d'$: 2.94 ± .22 s.e.m.) ($p = .003$, two-tailed) (Figure 1.2).
Figure 2.2 Recognition Memory Scores

Note: Mean (± SEM) recognition d’ scores for patient and normal comparison participants (NCs). Patient 1846 was matched to one comparison participant while 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.

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 2.4). Whereas the normal comparisons always gave issue-based rationales for their voting decisions, the amnesic patients primarily provided non-issue 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.”

**Table 2.4 Sample of Reasons Provided by Amnesic Patients (highlighted) and Normal Comparisons (NC) for Vote Choices**

<table>
<thead>
<tr>
<th>Participant</th>
<th>Why did you vote for candidate <em>X</em>?</th>
<th>Why did you NOT vote for candidate <em>Y</em>?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1846</td>
<td>I don’t know. He just seems more likeable.</td>
<td>He just seems to look more stuck up.</td>
</tr>
<tr>
<td>NC 1846</td>
<td>Because most of his views were more aligned with the Democratic Party’s position which I pretty much agree with.</td>
<td>Because of his stances on immigration, homosexuality, and the military.</td>
</tr>
<tr>
<td>2308</td>
<td>He’s dressed a little bit better. He has more style.</td>
<td>He’s not dressed as well.</td>
</tr>
<tr>
<td>NC 2308</td>
<td>I didn’t like the other person’s stance on the issues.</td>
<td>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.</td>
</tr>
<tr>
<td>2363</td>
<td>I think he looks more trustworthy.</td>
<td>I just didn’t feel like he was the candidate of choice.</td>
</tr>
<tr>
<td>NC 2363</td>
<td>He doesn’t have much going in terms of a strong platform but the other guy seems anti-rights and environment.</td>
<td>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.</td>
</tr>
<tr>
<td>2563</td>
<td>He’s the first one I saw.</td>
<td>No reason.</td>
</tr>
<tr>
<td>NC 2563</td>
<td>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.</td>
<td>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.</td>
</tr>
</tbody>
</table>
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 abilities 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 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 to 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.\(^28\) 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

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\(^{28}\) 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.
or hinder political performance.\textsuperscript{29} The literature on multiple memory systems introduced above can provide researchers with the appropriate conceptual and measurement tools to tackle this question.\textsuperscript{30}

In addition, this study exposed amnesic participants to issues 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.

\textsuperscript{29} 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 forthcoming). Other studies suggest that nondeclarative memory processes distort what is later retrieved in declarative memory (Coronel et al., submitted).

\textsuperscript{30} For instance, most studies in 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 et al., submitted.
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.\(^{31}\) 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 political elites, individuals within one’s social network, or even internal generation by citizens themselves.\(^{32}\) 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.

\(^{31}\) For a review on the inflexible nature of nondeclarative memory, see Cohen and Eichenbaum (1993).

\(^{32}\) See Kuklinski et al. (2000) and Coronel et al., submitted.
Chapter 3

Event-Related Potential Evidence Suggesting Voters Remember Political Events that Never Happened

Election Day provides voters the opportunity to hold politicians accountable for their actions and promises. They can reward politicians who have supported or proposed what the voter believes are good policies and punish those who have endorsed views with which the voter disagrees. Under this view of democratic elections, political accountability requires that voters possess accurate memories of what elected officials accomplished in office and what promises such politicians made during their campaigns. However, voter memory is far from perfect, and voters make consistent errors in recalling and using relevant political information about candidates.

In particular, voters tend to misattribute issue positions that are consistent with candidates’ party affiliation (e.g., attribute a pro-life view to a Republican candidate), even when these candidates have never stated or endorsed such views (Lodge and Hamill 1986; Lodge, McGraw, and Stroh 1989; Norpoth and Buchanan 1992). For example, during the 1988 presidential election, most Americans believed incorrectly that it was Michael Dukakis, and not his opponent, George H.W. Bush, who promised to be the “education president.” Likewise, most thought that it was Bush, not Dukakis, who favored making a build-up of conventional military forces the top defense priority (Norpoth and Buchanan 1992). Such issue misattribution is a well-documented phenomenon among voters, who have been found to make systematic errors when performing memory-based evaluations of political candidates. These misattributions also distort

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33 This Chapter is a reprint of an article that is currently submitted, Coronel, Jason C., Federmeier, Kara D., Gonsalves, Brian D. I was the primary author and investigator of this paper.
voter evaluations of candidates, such as character judgments (Lodge, McGraw, and Stroh 1989; McGraw, Lodge, and Stroh 1990).

Currently, there is not a good understanding of how and why such errors arise. Therefore, the aim of this study is to examine the psychological mechanisms underlying errors in issue attribution. We will first describe the prevailing view in political science that points to educated guessing as the source of issue misattributions. We propose an alternative account and suggest that these errors can also be due to the formation of false memories. Next, we outline how event-related potential (ERP) measures of memory can be used to determine whether issue misattributions are the product of educated guessing or false memory processes. We then present results of an experiment using ERPs to examine whether issue misattributions can be due to false memories. A final section discusses the implications of this study for research on false memories and candidate evaluation.

**Potential Sources of Issue Position Misattribution**

The prevailing view in political science is that voters misattribute candidates’ issue positions because they make educated but incorrect guesses (Feldman and Conover 1983; Lodge and Hamill 1986; Conover and Feldman 1989). According to this account, voters who are queried about a candidate’s stance on a particular issue may recognize that they have no memory of whether or not that candidate has endorsed a particular position. They therefore use general knowledge about the candidate, such as his or her party affiliation, to make an educated guess about the candidate’s likely position on that issue. For example, voters might reason that since George H.W. Bush is a Republican, and Republicans have traditionally been associated with a “pro-military” stance, then Bush must have been the candidate in favor of expanding
conventional military forces. A critical feature of this account is that voters lack a memory representation of a specific candidate-issue pairing. Thus, they rely instead on decision-based strategies, such as educated guessing.

However, an alternative explanation for voters’ mistakes, which has not been considered in political science, is that they arise from false memories. False memories refer to the vivid recollection of an event that did not occur or to familiarity-based errors of commission (for reviews, see Brainerd and Reyna 2005; Gallo 2010). An extensive body of theoretical and empirical work has examined the mechanisms by which false memories are generated. One theory, the activation-monitoring account, provides an explanation for voter issue misattributions. This account suggests that false memories arise from a combination of schema-based activations during encoding and source monitoring errors during retrieval. According to this account, information is stored in the form of schemas, consisting of an organized network of semantically related nodes, representing concepts. For example, in the domain of politics, concepts such as “conservative”, “pro-life”, “against gun control”, and “supports tax cuts” might be linked together to comprise one’s schema of a “Republican.”

When a concept is encountered, its corresponding node becomes active and that activation spreads to surrounding nodes within the network (Collins and Loftus 1975). Therefore, particularly when several related concepts are activated, incidental activation of the related, non-encountered items could summate and form a long-lasting memory representation. A false memory occurs when an individual retrieves this memory representation and misattributes its source, mistakenly thinking that they encountered information that was, instead, internally activated (Johnson, Hashtroudi and Lindsay 1993).
The activation-monitoring account has been used to explain experimentally induced false memories in the laboratory. For example, in the Deese-Roediger-McDermott (DRM) procedure (Deese, 1959; Roediger and McDermott 1995), participants are presented with a list of words that are all semantically related to a non-presented critical lure word. For instance, the words “sick”, “medicine”, “health”, “hospital”, “patient”, and “stethoscope” are all associated with the word “doctor”—the critical lure. Later, when participants are asked to recall or recognize words from the studied list, they have a strong tendency to retrieve incorrectly the critical lure (Roediger et al. 2001; McDermott and Watson 2001) and report it as “old”, often with a high level of confidence (Miller and Wolford 1999; Roediger and McDermott 1999).

Educated guessing and false memories are qualitatively distinct mechanisms that might engender issue misattributions in voters. Understanding the processes that underlie issue position misattributions is crucial given that the degree to which such misattributions affect political decisions could very well be contingent upon the processes that led to their creation. For example, evidence suggests that people may treat false memories the same as veridical memories (Pezdek and Hodge 1999; Geraerts et al. 2008). For instance, they report similar subjective experiences for (Payne et al. 1997; Roediger and McDermott 1995) and similar levels of confidence in (Miller and Wolford 1999; Roediger and McDermott 1999) real and falsely remembered events. Thus, correcting issue misattributions due to false memories could prove difficult given that voters believe that they are recalling something a candidate actually said.

Event-Related Potential Measures of Memory

The goal of the present study is to determine whether issue misattributions can arise from false memories. To do this, we took advantage of the functional specificity afforded by event-related
brain potential measures. In particular, electrophysiological studies of memory have identified brain activity that is sensitive to memory signal strength: the ERP “Old/New effect.” Across different stimulus types and task conditions, the response to correctly classified old items (“hits”) has been found to be more positive than that to correctly classified new items (“correct rejections”) over posterior scalp electrodes between about 300 and 800 ms post-stimulus-onset (for reviews, see Friedman and Johnson 2000; Rugg 1995).

The Old/New effect likely reflects multiple subcomponent processes related to memory retrieval, including both nondeclarative aspects of memory, in the form of amplitude reductions of the N400 component (for a review, see Voss and Paller 2008)\textsuperscript{34}, and more explicit aspects of memory and memory judgments, in the form of amplitude increases in the late positive complex (LPC), which is sensitive to encoding depth (Rugg et al. 1998; Curran 2004), level of recollective detail (Duzel et al. 1997; Rugg et al. 1998; Curran 2000), and the availability of source information (Donaldson and Rugg 1998; Curran et al. 2001; Woroch and Gonsalves 2010).

Taken as a whole, the ERP Old/New effect provides a useful metric of the presence and strength of memory signals activated in response to a stimulus. Indeed, Old/New effects have been successfully used to reveal the nature of errors that occur in memory tasks, including those that typically elicit false memories. Several studies employing paradigms, such as the DRM, that are designed to create schema-based false alarms have found that ERP responses associated with false alarms are similar to those associated with hits—both more positive than responses to correct rejections (Duzel et al. 1997; Johnson et al. 1997). This supports the activation

\textsuperscript{34} The N400 is sometimes termed “FN400” in the memory literature; see Voss and Federmeier 2011, for a discussion
monitoring account in suggesting that items engendering false alarms in these paradigms do so because they elicit an actual memory signal during the test phase, created by the implicit activation of the lures during encoding (see Urbach et al. 2005 for a discussion of the nature of those encoding effects).

Critically, however, false alarms that are believed to have a different source elicit different effect patterns. For example, in Windmann, Urbach, and Kutas (2002), participants performing a recognition memory task were divided into a high and a low bias group based on their tendency to classify items as “old”. The groups did not differ in their recognition accuracy, and both groups showed similar ERP Old/New effects for correctly classified items. However, ERPs to false alarms differed across groups. In the low bias group, false alarms patterned with hits, a pattern similar to that seen in studies eliciting false memories. In contrast, in the high bias group (the group more likely to say “yes”), false alarms patterned with correct rejections. Thus, ERP patterns can reveal when errors arise from decision processes or response biases, rather than at the level of memory itself.

**Predictions**

The current study takes advantage of findings from previous ERP studies of memory by measuring ERP responses in the context of memory decisions about political candidates and their issue positions. We do this in order to assess whether memory errors are associated with a strong memory signal, suggesting false memories for those candidate-issue pairings, or without a strong memory signal, suggesting the use of decision strategies such as educated guessing.

We asked participants to read issue positions associated with pictures of fictitious political candidates. In a surprise memory test, they are then shown a studied or new issue.

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35 The high bias group made more “old” classifications than the low bias group.
position and then a photo of a candidate. They are asked, while looking at a candidate’s photo, to indicate whether the preceding issue position was or was not specifically endorsed by that candidate. Among the new issue positions are lure items, which were never studied in any form but are consistent with the candidate’s general partisan schema (i.e., Democrat or Republican). We examined ERP responses to the candidates’ photos to determine whether participants generated memory signals for candidate-issue pairs. We expect that if the candidate’s photo matches the memory representation activated by the issue position, responses will be more positive than if the photo does not match—creating an Old/New effect pattern for comparisons between candidates that are correctly identified by participants as associated with an old issue position (hits) as compared with those correctly identified as not being associated with a new issue position (correct rejections).

Critically, the educated guessing and false memory accounts make distinct predictions regarding what the ERP signals should look like to candidate photos that are incorrectly endorsed as having been previously associated with an issue position (false alarms). The false memory account predicts that false alarms to new partisan consistent issue positions should resemble ERP responses to hits, as in the Duzel et al. (1997) and Johnson et al. (1997) studies. Such an outcome would indicate that schema-based activations create a memory signal that is erroneously associated with the candidate, as opposed to being recognized as internally generated. Importantly, however, this account predicts a different pattern for false alarms to new partisan inconsistent issue positions, as these are unlikely to be subject to schema-based activations. These false alarms, therefore, should pattern instead with correct rejections. The current paradigm, therefore, allows a very specific test of the false memory account, as different ERP patterns are predicted for the same behavioral error (i.e., false alarms to candidates paired with
new issue positions) in the context of different item types (see Figure 3.1). In contrast to the predictions of the false memory account, the educated guessing account predicts that ERP responses associated with false alarms to either a new partisan consistent or a new partisan inconsistent issue position should pattern with correct rejections (as in Windmann, Urbach, and Kutas 2002), since no memory signal should exist for any of these items (Figure 3.1).

**Figure 3.1 ERP Predictions to False Alarm Items**

*Theoretical Account*

<table>
<thead>
<tr>
<th>False Alarm Type</th>
<th>Educated Guessing</th>
<th>False Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partisan Schema-Consistent Candidate-Issue Pairs</td>
<td><img src="image1" alt="Educated Guessing" /></td>
<td><img src="image2" alt="False Memory" /></td>
</tr>
<tr>
<td>Partisan Schema-Inconsistent Candidate-Issue Pairs</td>
<td><img src="image3" alt="Educated Guessing" /></td>
<td><img src="image4" alt="False Memory" /></td>
</tr>
</tbody>
</table>

*Note:* The N400 timewindow (250 – 550 ms) is highlighted.
Methods

Participants
We analyzed data from fifty-seven participants (30 females, mean age 21, age range 18 – 32) who were recruited from the University of Illinois and compensated with money or course credit; we did not use data from seven additional participants due to excessive artifacts in the EEG. We recruited participants from upper level political science and from introductory psychology courses, thereby representing a range of background knowledge about politics. All participants, by self-report, had no prior history of psychiatric or neurological disorders and none were using psychoactive medications. Two of the participants were left handed. Fifty-five participants were native speakers of English while two learned English as a second language.

Materials
The stimuli consisted of 205 policy statements. More specifically, two hundred and forty-four college students from introductory political science courses took part in the pre-testing study (139 females, mean age 19.4, age range 18-25). Participants were given 322 issue positions and asked to identify each as either likely to be held by someone who is a “Democrat” or a “Republican” and to rate their confidence in their classification (e.g., somewhat sure, sure, very sure). Issue positions for which there was less than 60% agreement when considering only “sure” or “very sure” responses were discarded, as were any additional items for which there were not at least 10% “very sure” responses.

Two experts on politics (professors in political science) examined the remaining issue list to ensure that there were no anomalies (e.g., an issue that experts would consider to be associated with Democrats identified as one associated with Republicans). Of the 205 policy statements that
passed criteria from the pre-testing data and expert post-check, 103 were judged to be associated with the Democratic Party and 102 with the Republican Party.

Of the 205 policy statements that passed criteria from the pre-testing data and expert post-check, 103 were judged to be associated with the Democratic Party and 102 with the Republican Party (see Table 3.1 for examples).

Issue positions were paired with four different fictitious candidates. Each candidate was represented by a single color photograph of a Caucasian man of middle age, obtained from the websites of law firms. Candidates were also paired with a total of 24 items that described personal information, such as wife’s name, children’s names, etc. These were included in order to vary the types of information presented about each candidate, thus mirroring more closely real world informational environments.

**Table 3.1 Sample of Issue Positions**

| Supports increasing the minimum wage |
| Supports giving illegal aliens path to citizenship |
| Is in favor of universal health care |
| Wants mandatory recycling programs |
| Supports embryonic stem cell research |
| Supports a pre-emptive military strike against Iran |
| Opposes the legalization of marijuana |
| Supports decreased funding for public housing |
| Supports amendment banning flag burning |
| Supports federal funds to faith-based organizations |
| Against preferential treatment by race in college admissions |

**Experimental Procedure**

The main study employed a standard study-test design, with incidental encoding. Before the start of the experiment, participants were presented with a sheet that contained a list of all the issue positions that were used in the experiment. Participants were instructed to state the extent to
which they agreed or disagreed with each position and to identify issue positions with which they were unfamiliar. Participants were taught about any issue positions with which they were not familiar. This was done in order to familiarize participants with all the issue positions and thus to prevent them from using simple item-based familiarity as a means of discriminating between the items during the test phase of the experiment.

Participants were tested in a single experimental session conducted in an electrically shielded, sound attenuating chamber. During the study phase, participants learned about four political candidates. Each candidate was paired with 19 issue positions and six personal facts. Two of the candidates were “Democrats” (15 of their issue positions were ones that were generally associated with the Democratic Party while the remaining four were generally associated with the Republican Party). The other two candidates were “Republicans” (15 of their issue positions were ones that were generally associated with the Republican Party while the remaining four were generally associated with the Democratic Party). However, participants were not given explicit information about each candidate’s partisan identification since we wanted to determine whether participants would spontaneously use their knowledge of political parties despite not being cued or instructed by the experimenter to do so.

Participants were instructed to pay attention to each of the four candidates’ issue positions and personal information, as they would be asked to “vote” for one of the candidates after the study phase. They were not informed that there would be a memory test for the candidates’ issue positions.

During the study phase, a trial consisted of an issue position or personal fact shown in the middle of the screen, followed by a fixation cross, and then a photo of one of the four candidates (Figure 3.2). The study phase was divided into four blocks. Participants had the option of taking
a 2 to 5 minute break between blocks. In order to allow a consistent schema to be established for each candidate, issue positions that were inconsistent with a candidate’s partisan identification were not shown until the third and fourth blocks.

After the study phase, participants were given a sheet containing photos of the four candidates and were asked to vote for one. They were also asked to rate each candidate on a likeability scale. The participants were then given a 10 to 15 minute break (sitting in the recording chamber) before the test phase. They were then informed that their memory for the candidates’ issue positions would be tested. In the test phase, each of the four candidates was paired with the same 19 issue positions as in the study phase (old pairs) as well as with 18 new issue positions not presented during the study phase (new pairs). Of the new pairs, 14 were consistent with the candidate’s partisan identification, and four were inconsistent.

As shown in Figure 3.2, each trial began with an issue position presented the middle of the screen. A fixation cross was shown next, followed by a photo of a candidate. Once the participants saw the photo, they were instructed to report, via a button press, whether the pairing between the issue position and the candidate was “old” or “new”—that is, whether or not they had been shown that particular pairing during the study phase. Immediately following each old/new decision, participants also made a confidence judgment (“somewhat sure” or “very sure”) on their recognition decision. Participants were told to make their old/new and confidence judgments as quickly but as accurately as possible. The hands used for the old/new and confidence judgments were counterbalanced between subjects. ERPs were timelocked to the candidate photos.
Figure 3.2 Schematic of the Experimental Design

**Study Phase**

- Supports gun control laws
- 3000 ms
- 6000 ms

**Test Phase**

- Participants make High or Low Confidence judgments
- ERP timelocking point
- Is in favor of universal healthcare
- 3000 ms
- 6000 ms
- How sure are you?
- Participants make “Old” or “New” judgments
- Until participant responds

Respond
**Electroencephalogram Recording Parameters**

The electroencephalogram (EEG) was recorded from 26 evenly-spaced silver/silver chloride electrodes (see Figure 3.3). These sites were referenced on-line to the left mastoid and then rereferenced offline to the average of the left and right mastoids. Blinks and eye movements were monitored via electrodes placed on the outer canthus of each eye and the infraorbital ridge of the left eye. Electrode impedances were kept below 5 kOhms. EEG was processed through Sensorium (Charlotte, VT) amplifiers set at a bandpass of 0.02-100 Hz. EEG was continuously digitized at 250 Hz and stored on hard disk for later analysis.

**Data Analyses**

ERPs were computed from EEG epochs consisting of 100 ms prior to picture onset to 920 ms after. Epochs containing artifacts from amplifier blocking, signal drift, excessive eye movements, or muscle activity were rejected offline before averaging. On average, 11% of trials were lost due to artifacts. Averages of artifact-free ERPs were created for each picture classification during recognition, after subtraction of the 100-msec prestimulus baseline. Prior to measurement, ERPs were digitally filtered with a bandpass of 0.2-20 Hz. Main effects of electrode site are not reported, as they were of no theoretical significance. All statistical tests are repeated measures analyses of variance (ANOVAs), with degrees of freedom adjusted by the Huynh-Feldt correction for the violation of sphericity. Reported $p$-values for all $t$-tests are based on two-tailed tests.
Results

Behavioral Performance

Raw hit and false alarm scores from the recognition memory test are presented in Table 3.2. Participant memory performance was assessed using the discriminability index $d'$. General recognition memory was robust. As a group, participants demonstrated above-chance performance on recognition memory for both partisan schema-consistent, $t(56) = 19.8$, $p < .001$, and partisan schema-inconsistent candidate-issue pairs, $t(56) = 15.75$, $p < .001$. Mean recognition $d'$ was $.99 + .05$ s.e.m for partisan schema-consistent items and $1.26 + .08$ s.e.m. for partisan schema-inconsistent pairs. In the context of overall good memory for candidate-issue pairings, however, we nevertheless observed relatively high rates of false alarms for partisan schema-consistent lures (mean = 28%).

Table 3.2 Raw Hit and False Alarm Scores

<table>
<thead>
<tr>
<th></th>
<th>Partisan Schema-Consistent</th>
<th>Partisan Schema-Inconsistent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Confidence</td>
<td>.28 (.14)</td>
<td>.32 (.18)</td>
</tr>
<tr>
<td>Low Confidence</td>
<td>.35 (.11)</td>
<td>.27 (.14)</td>
</tr>
<tr>
<td>All</td>
<td>.63 (.11)</td>
<td>.59 (.15)</td>
</tr>
<tr>
<td><strong>False Alarm</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High Confidence</td>
<td>.09 (.09)</td>
<td>.05 (.08)</td>
</tr>
<tr>
<td>Low Confidence</td>
<td>.19 (.07)</td>
<td>.13 (.11)</td>
</tr>
<tr>
<td>All</td>
<td>.28 (.13)</td>
<td>.18 (.14)</td>
</tr>
</tbody>
</table>

*Note:* Participants had higher rates of false alarms for partisan schema-consistent candidate-issue pairs than partisan schema-inconsistent pairs, $p < .001$ (highlighted). Means and standard deviations of raw hit and false alarm scores are shown for each category of items.
ERPs

Old/New Effect

This study obtained an Old/New effect that is similar in timecourse and distribution to ones reported in previous work (see reviews, see Friedman et al. 2000; Rugg 1995) (see Figure 3.3). In this dataset, the Old/New effect is larger in the earlier (250-550 ms; N400) than in the later (550-800 ms; LPC) time window, $F(1, 56) = 39.09, p < .001$, and over the 15 posterior as compared with the 11 anterior sites, $F(1, 56) = 20.26, p < .001$. Therefore, subsequent analyses will be constrained to these posterior electrodes and focused within the 250-550 ms interval; however, patterns in the LPC time window were consistent with (albeit often reduced relative to) those in the N400 time window.
Figure 3.3 ERP Old/New Effect

Note: Hits differ from correct rejections from about 250 to 800 ms. Difference wave ERPs were obtained by subtracting correct rejections from hits from combined partisan schema-consistent and inconsistent items.

Partisan Schema-Consistent Items

The false memory account predicts that false alarms to new partisan schema-consistent issue positions should resemble ERP responses to hits, whereas the educated guessing account predicts that these responses should pattern with correct rejections. To test this, we measured ERP amplitudes between 250 and 550 ms over 15 centro-posterior channels (see bold points on head icon in Figure 3.4) from 57 participants. We analyzed ERP responses with a two-factor repeated
measures ANOVA with 3 levels of Condition (hits, correct rejections, false alarms) x 15 levels of Electrode sites. There was a main effect for Condition, $F(2, 112) = 19.57, p < .001$. Hits (mean 4.00 $\mu$V) elicited more positive voltages than correct rejections (mean 1.93 $\mu$V), $t(56) = 7.29, p < .001$. False alarms (mean 3.00 $\mu$V) were intermediate between hits and correct rejections, as they were less positive than hits, $t(56) = 2.44, p = .01$, but more positive than correct rejections $t(56) = -3.54, p < .001$ (see Figures 3.4 and 3.5).

False alarms may have been intermediate between hits and correct rejections because they were a mix of response types, some generated by guessing and others the product of false memories. In order to explore this possibility, we separately examined false alarm responses across confidence levels, as high confidence judgments are sometimes considered a hallmark of false memories.
Figure 3.4 ERP Responses to Partisan Schema-Consistent Items

Note: False alarms are intermediate between hits and correct rejections in the 250-550 ms (N400) timewindow (highlighted).
Figure 3.5 ERP Responses to Partisan Schema-Consistent Items Across Posterior Electrode Sites

Note: False Alarms are intermediate between hits and correct rejections.
Partisan Schema-Consistent Items by Confidence

Nine of the 57 participants had no data in one of the critical subconditions. We analyzed data from the remaining 48 participants with a three-factor repeated measures ANOVA with 3 levels of Condition (hits, correct rejections, false alarms) x 2 levels of Confidence (high, low) x 15 levels of Electrode sites. There were main effects for Condition, $F(2, 94) = 12.91, p < .001$, and Confidence, $F(1, 47) = 10.03, p = .03$. There was also a significant Condition x Confidence interaction, $F(2, 94) = 4.75, p = .01$; see Figure 3.6.

There was an Old/New effect for high confidence items. High confidence hits (mean 4.98 $\mu$V) elicited more positive voltages than high confidence correct rejections (mean 1.86 $\mu$V), $t(47) = 5.37, p < .001$. Critically, high confidence false alarms (mean 5.01 $\mu$V) did not significantly differ from high confidence hits $t(47) = -0.12, p = .90$ and were more positive than high confidence correct rejections $t(47) = 3.89, p < .001$.

There was also an Old/New effect for low confidence items. Hits (mean 3.2 $\mu$V) were different from correct rejections (mean 2.27 $\mu$V), $t(47) = 2.38, p = .02$. Low confidence false alarms (mean 2.86 $\mu$V) were not different from low confidence hits $t(47) = -.75, p = .46$, or from low confidence correct rejections $t(47) = -1.28, p = .20$. 
Figure 3.6 ERP Responses to Partisan Schema-Consistent Items by Confidence

Note: High confidence false alarms are identical to high confidence hits for partisan schema consistent candidate-issue pairs in the 250-550 ms (N400) timewindow (highlighted). In contrast, low confidence false alarms are indistinguishable from low confidence hits and correct rejections.

Partisan Schema-Inconsistent Items

Because it was important not to change the partisan schema associated with the candidates during the test block, only a few partisan schema-inconsistent items could be included for each candidate. There were thus not enough trials to split into high and low confidence responses; as a significant portion (71%) of false alarm responses to partisan schema-inconsistent items were endorsed with low confidence, it is most appropriate to compare the pattern of effects to that for low confidence responses to partisan schema-consistent items.

Five of the 57 participants had no false alarms to partisan schema-inconsistent items. We subjected ERPs for the remaining 52 participants to a two-factor repeated measures ANOVA with 3 levels of Condition (hits, correct rejections, false alarms) x 15 levels of Electrode sites.
There was a main effect of Condition, $F(2, 102) = 5.79, p = .004$. Hits (mean 4.8 $\mu$V) were associated with more positive voltages than correct rejections (mean 2.47 $\mu$V), $t(51) = 4.44, p < .001$. Critically, false alarms (mean = 2.49 $\mu$V) were less positive than hits $t(51) = -2.38, p = .02$, and were indistinguishable from correct rejections $t(51) = -0.03, p = .99$ (see Figures 3.7 and 3.8).
Figure 3.7 ERP Responses to Partisan Schema-Inconsistent Items

Note: False alarms are identical to correct rejections and different from hits in the 250-550 ms (N400) timewindow (highlighted). See Supplemental Material for more electrode sites.
Figure 3.8 ERP Responses to Partisan Schema-Inconsistent Items

Note: False alarms are identical to correct rejections and are different from hits.

Discussion

The goal of the present study was to determine whether issue misattributions could be due to the formation of false memories. Based on prior literature (Duzel et al. 1997; Johnson et al. 1997), we expected false alarms based on false memories to be more likely for candidate-issue pairs where the positions matched the partisan schema for a given candidate. Such misattributions would then be expected to elicit an ERP pattern wherein responses to false alarm items were similar to those for hits. In contrast, false alarms based on educated guessing—or other errors at
the decision/response stage, as distinct from memory—should elicit instead a pattern in which false alarms were similar to correct rejections (as in Windmann, Urbach, and Kutas 2002).

Our test phase ERP data replicated previous findings in the memory literature in that hits to candidate-issue pairs were consistently more positive going than correct rejections. As predicted, different patterns emerged for different categories of false alarms. High confidence false alarms to partisan schema-consistent items, in particular, clearly showed the pattern expected of false memories. In contrast, false alarms to partisan schema-inconsistent items, which we did not expect to be activated during encoding, were indistinguishable from correct rejections. This suggests that these errors were not based on the presence of a memory signal and were thus likely the product of guesses. This is consistent with the observation that these false alarms were also more likely to be given a low confidence judgment.

Although this study was not designed to tease apart the contributions of nondeclarative and declarative memory processes to these errors, the fact that effects were strongest in the early window suggests the possibility that such false memories arise implicitly, through spreading activation in the conceptual network, as suggested by the activation-monitoring account (Roediger, Balota, and Watson 2001). As mentioned previously, the early part of the Old/New effect has been linked to modulations of the N400 component (particularly when this effect has a posterior distribution), which, in turn, has been associated with implicit activation in long-term semantic memory (Kutas and Federmeier 2011).

The evidence provided here thus suggests, for the first time, that misattributions of political information are not exclusively the product of educated guesses, as they can be associated with memory signals that are similar to those elicited by repetitions of events that
were actually previously experienced. This finding provides several contributions to research on false memories and political behavior.

First, this work expands the pool of real world domains by which to study the impact of false memories. A substantial body of research has already examined false memories in a variety of real-world domains, such as eyewitness testimony (for a review, see Wells and Loftus 2003), and this study introduces politics as another rich domain for false memory research. Misinformation, in the form of a demonstrably false belief, is a prevalent phenomenon among American voters (see Kuklinski et al. 2000), and such false beliefs tend to be held in high confidence by voters and are highly resistant to corrective information (Kuklinski et al. 2000; Nyhan and Reifler 2010). The results of this study establish that at least some types of political misinformation could be due to the formation of false memories, making politics a compelling natural environment for testing and refining theories of false memories.

The political realm also provides a rich environment in which to study the intersection of false memories and decision making. Politics is a critical societal domain in which people employ memory during decision making, and in which important, large-scale outcomes arise through the aggregation of many individual decisions. Confidently-held misinformation that systematically affects the decisions of a large number of voters could have a profound impact on elections and public policies. Thus, politics provides a useful and important arena for studying how true and false memories shape decisions at both the individual and collective level.

For political science, this study makes two direct contributions. The first is methodological. Political scientists have generally been interested in examining how explicit and implicit aspects of memory interact and how such interactions affect voter decisions and evaluations of policy issues and candidates (Lodge, Steenbergen, and Brau 1995; Redlawsk
2001). However, most studies in this area rely exclusively on verbal self-reports as a means of measuring what are theorized to be implicit or nondeclarative memory processes. This study illustrates how event-related potentials can be used to investigate the contribution of implicit aspects of memory on political belief formation.

Finally, and most critically, this study expands our conceptual understanding of the nature and source of political misinformation. Political scientists have traditionally thought about misattributions of issue positions, as well as other forms of erroneous political knowledge and beliefs, primarily through the lens of decision-based strategy theories such as educated guessing. This study provides evidence for the importance of an alternative mechanism for the formation of false beliefs in the political realm.
Political scientists have conceptualized and measured memory in different ways. These different attempts generated different conclusions regarding the political performance of voters. Much of the early research in public opinion either implicitly or explicitly conceptualized memory as information to which voters had conscious access—what we would refer to today as “declarative memory.” They used survey-based recall or recognition measures to determine the extent to which citizens could retrieve political information from memory. Data from these studies suggested that citizens were generally unable to retrieve, and thus did not use, political information when making political evaluations and judgments.

Approximately 20 years ago, Lodge and colleagues changed the way political scientists thought about memory. They introduced the concept of on-line processing—a mechanism that would be considered as a form nondeclarative memory in the framework of modern day memory research. Instead of measuring the capacity of voters to retrieve political information from declarative memory, they instead examined whether voter performance exhibited evidence of previous information exposure. Through a series of laboratory studies, they purported to show that voters were responsive to campaign information, even though they were incapable of explicitly retrieving previously learned political information.

Since that time, on-line processing has been viewed as part of the larger literature in public opinion that claims that certain psychological processes can compensate for the inability
of voters to retrieve explicit political information. My dissertation makes several contributions to this strand of research.

First, I critically examined whether data from the seminal studies on on-line processing can support the claim that retrieval of previously learned issue position information is not necessary for sound decisions. I argued that they do not as no study to date has been able to completely remove the capacity of voters to retrieve previously learned declarative information. I then asked what type of data would be necessary to support such a claim, and I conducted a study that specifically examined voting under conditions in which amnesic voters could not retrieve previously learned declarative information, and showed that sound decisions were nevertheless possible.

Second, I described research on the operating characteristics of declarative and nondeclarative memory. Even though nondelcarative memory, via on-line processing, has been used as a refutation to critical portrayals of the citizen, memory research suggests that we should have a skeptical view of such a claim. In particular, in contrast to declarative memory, nondeclarative memory is characterized by its inflexibility, slow rate of learning, and lack of conscious access and scrutiny. Thus, nondeclarative memory should not be as robust as declarative memory in its use in political decision making across different informational environments.

Finally, following from the above prediction, I examined the role of nondeclarative memory structures (i.e., partisan schemas) in a simple informational environment (i.e., consisting mostly of policy issues). I showed that these structures can generate political misinformation that

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36 This body of work includes the literature on heuristics (Popkin 1991; Sniderman, Brody, and Tetlock 1991) and Affective Intelligence (Marcus, Neuman, and MacKuen 2000).
the brain (as measured by ERPs) cannot distinguish from veridical information. Behaviorally, such misinformation is also held in high confidence by voters.

**Where to Go Next: The Interaction of Memory and the Informational Environment**

One of the main limitations of the studies I presented here is that I did not vary the nature of the informational environment. For the most part, the informational environment was simple and consisted largely of policy positions. Given the general properties of nondeclarative memory, the extent to which nondeclarative memory may aid or hinder political decisions critically depends on the nature of the political informational environment. For example, properties such as whether the political learning and testing contexts are relatively similar to one another, whether certain kinds of political information are presented repeatedly to voters, and the extent to which the environment is saturated with “relevant” and “irrelevant” information, are key characteristics of the environment that will shape how nondeclarative memory is expressed and used during decision making.

In the context of the amnesic study, the informational environment was very simple. It consisted largely of relevant issue positions. The policies associated with each candidate were grouped together such that they would be consistently associated with a particular valence (i.e., positive, negative, neutral). The learning and testing episodes were also very similar to one another. In other words, the learning and choice environment were such that use of nondeclarative processes promoted sound decision making. The outcome might have been

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37 There were also a handful of innocuous and neutral policies and personal facts.
38 For example, the photos were on the same side of the screen during voting as they were during testing. The same exact photos of the two candidates were used during voting.
different had I introduced irrelevant affective charged information or varied the learning and testing conditions.

Different from real world campaigns, I did not also include partisan identification in the two studies. In the false memory study, I did not provide explicit information about each candidate’s partisan identification as I wanted to see if participants would spontaneously form and make use of partisan schemas. Providing explicit information about party identification would seem likely to have increased the rate of false alarms and false memories, as partisan identification is perhaps the central organizing concept in a voters’ partisan-schema network.

Future studies that examine the interactions between multiple forms of memory and the informational environment will require the use of the tools from modern memory research. This is particularly important for measuring nondeclarative memory. For instance, most studies in 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 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). As I demonstrated across the two studies, these techniques provide a unique and powerful way of examining the ways in which citizens use memory over the course of decision making.

Finally, the studies in this dissertation show the promise of using conceptual and methodological tools from cognitive neuroscience to answer fundamental questions about the nature of citizen decision making in democratic governance. As I showed throughout the
chapters, different conceptualizations and characterizations about memory led to different assessments of citizen political performance. As a discussed previously, the current way in which we think about memory is the product of research in cognitive neuroscience. This research in the role of memory in citizen performance is, in my view, exemplifies how knowledge about the brain will change political science research. In short, it will fundamentally change how we think about basic concepts such as memory, emotion, attention, and cognition. Changes in these concepts will alter our understanding of how citizens navigate the political world.
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