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You Must Remember This: A Test of the On-Line Model of Voting

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Milton Lodge and his colleagues at Stony Brook have argued that voters process campaign information on-line, summarizing their affect toward candidates as campaign information is encountered. Consequently, recall of campaign information and vote choice are believed by Lodge to be a weak predictor of actual vote decision, which is determined almost solely by the on-line tally. The claims made by the on-line model have not been tested in a dynamic election context, however, in which two or more candidates compete for the vote. This study uses a new experimental methodology that more accurately depicts the realities of a campaign environment to assess the relative importance of memory and the on-line tally in predicting both the direction and accuracy of the vote choice. Findings do not support the pure Stony Brook on-line model, as they show that in all cases voter memory plays an important role in decision making and suggest that a mixed decision-making model is more appropriate.

For many years, the Holy Grail of voting behavior study has been accurately predicting election outcomes as political scientists have searched far and wide for models that would explain why voters make the choices that they do. Many of these models can claim great accuracy in predicting vote results, often correctly classifying upwards of 90% of the survey sample used to test them (Lau 1986). Unlike the unfortunate Sir Galahad, we political scientists appear to have come quite close to completing the quest.

Even so, the quest has often been troubling. The early researchers started out believing that they would find well-informed voters who paid careful attention to the information available to them during the election campaign. Any democracy was presumed to rest, at least in part, on the linkage between votes cast and policy decisions made. Unfortunately for this theory, researchers found that

voters could not be counted upon to articulate clear, meaningful reasons for their vote decisions. In fact, many Americans appeared to have little conception of what politics was about and what their candidates stood for. The authors of *The American Voter* (Campbell et al. 1960) viewed the vast majority of the public as unaware of the issues of the day and therefore unable to cast votes based on those issues. Since that time we have become convinced that because voters have difficulty articulating the reasons for their decisions and often cannot even place the candidates on the various issues of the day, the public is just not capable of paying any reasonable amount of attention to politics. While researchers such as Kelley and Mirer (1974) argued that voters explicitly recall from memory information they need to make a choice, survey after survey showed that citizens could recall very little information about an election campaign.[1] These key factors—inability to verbalize about political subjects, lack of issue constraint, and the apparent failure to remember campaign information—have been taken as evidence that many voters make voting decisions based on something less reasonable than an educated understanding of the political environment.

The On-line Voting Model

Recently, however, new research has suggested that this conventional wisdom may be doing a disservice to the American electorate. Following models of person perception and evaluation already well-established within social psychology, Milton Lodge and colleagues at SUNY-Stony Brook argue that citizens need not maintain large memory stores of knowledge about candidates in order to have taken campaign information into account when making choices between candidates (Lodge 1995; Lodge, McGraw, and Stroh 1989; Lodge, Steenbergen, and Brau 1995; Lodge and Stroh 1993; McGraw, Lodge, and Stroh 1990a, 1990b). In fact, any information about candidates that *is* maintained in memory plays no significant direct role in voter decision making. Voters make decisions using an on-line evaluation process (Anderson 1981; Anderson and Hubert 1963; Hastie and Park 1986; Hastie and Pennington 1989; Lichtenstein and Srull 1987) during which they receive new information about a candidate, process the information in working memory, make an immediate evaluation of the new information, and then update an on-line tally containing the global evaluation of the candidate. The newly updated tally is then returned to long-term memory, and the information that informed it can be safely discarded. When the time comes to choose, the voter only needs to retrieve the tally for each candidate, compare the tallies, and vote for the candidate with the highest value. There is no need to search memory for information learned about the candidates; in fact, little of the information that informed each tally can be expected to remain in memory. Lodge and his colleagues argue that candidate evaluation during a political cam-

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[1] Some of the more recent studies that continue the theme developed in the 1960s that voters do not seem to have a lot of information at their disposal include Kinder and Sears (1985), Smith (1989), Delli Carpini and Keeter (1991), and Neumann (1986).

paign is not much different from any other kind of person perception that involves evaluation and thus it is reasonable to believe that on-line processing, well established for other situations, would also be used for political evaluations.

In their initial test of the on-line model Lodge, McGraw, and Stroh (1989) asked subjects to evaluate a fictitious member of Congress based on 40 policy statements said to be included in a campaign brochure. Among other tasks, subjects were given a memory test, the results of which were examined across experimental conditions. No relationship was found between memory and the evaluation of Congressman Williams for subjects in on-line conditions, while a significant, though relatively weak, relationship was found for subjects in the memory-based condition (Table 5, 412). They then turned to an examination of the on-line evaluation process. A measure of the on-line tally was created by summing all of the likes and dislikes for each subject across all 40 policy positions and was used to predict evaluations of Congressman Williams. This on-line tally was a significant predictor for both memory-based and on-line, whereas accurate recognition memory of issue statements by on-line subjects did not have any influence on these subjects' evaluation of Congressman Williams.

While earlier studies were all based on evaluation of a single political figure, the most recently published Stony Brook study used an experimental design including *two* political candidates supposedly facing each other in a campaign (Lodge, Steenbergen, and Brau 1995). Two significant changes to the basic design were introduced: the use of a one-page campaign fact sheet that included information about both candidates, and the introduction of a variable delay between exposure to the campaign information and the request for the recall of information. Information on the campaign fact sheet was arranged on a single page in two columns, each headed by a candidate's name and containing the 14 statements. Subjects could readily compare the issue positions for both candidates on each issue at any time.

The variable delay in the memory test portion of the study was designed to examine whether the memory of the evaluation (the on-line tally) degrades at a differential rate compared to memory for the specific information that informed the tally. As anticipated, subjects forgot detailed information at a fairly rapid pace. On the other hand, memory for the evaluation of the candidates was shown to be strong whether subjects were queried 1 day or 31 days after participating in the experiment. To test whether the lack of detailed recall was related to on-line processing or to a lack of responsiveness to the information that subjects originally encountered, the individual evaluations of the two candidates were regressed on subjects' evaluations of the seven issue positions on the information sheet, subjects' recall of those positions, and party identification. For both candidates, evaluations of the original issue positions were strongly significant, while the recall information was far less important. In fact, removal of the recall variable had no significant effect on the model, whereas removal of the original issue positions greatly reduced the fit of the model (p. 317). These subjects appeared to be responsive to the messages they received, whether or not they could actually recall the details.

Thus, Lodge argues, it is probably not very important for theories of democratic accountability and voter participation that citizens be able to recall (for survey researchers or anyone else) the details of the campaign once it is in the past.

However, the applicability of on-line processing may be limited to more sophisticated citizens, leaving some doubt as to whether enough voters can make use of the process for it to be an answer to the complaints of limited voter information. Bargh and Thein (1985) argue that individuals who find themselves overloaded during information acquisition may not be able to devote the cognitive resources required to carry out on-line processing. Using the methodology from earlier Stony Brook studies, McGraw, Lodge, and Stroh (1990b) found that subjects with greater political sophistication were more likely to process information on-line. Rahn, Aldrich, and Borgida (1994a) also test this proposition but are less certain about the sophistication effects, suggesting that "sophistication per se does not seem to influence the strength of the relationship between memory and judgement" (p. 197). Instead, they argue that for less sophisticated voters the structure of information presentation may influence the extent of on-line processing, with candidate-centered environments encouraging such processing.

Critiques of the On-line Model

In a study calling into question the on-line model, Cook, Crigler, and Just (1995) used in-depth interviews of 48 citizens in 1992 to examine the formation of attitudes and preferences during a presidential election campaign. Citing Hastie and Pennington (1989), they argue that a hybrid memory process may be active during a campaign. Rather than maintaining an overall evaluation counter on-line, as Lodge argues, Cook, Crigler, and Just suggest that voters infer conclusions about individual candidates as they encounter new information (such as a candidate's stand on gun control) and recall those conclusions from memory when the time comes to make an overall judgment. In doing so, voters use a combination of processing techniques, so that these intermediate assessments about the candidates—processed on-line—are called up at the moment of decision, and therefore the ultimate choice is at least partially informed by the contents of memory about the candidates. Something about the campaign environment may generate different information processing approaches than are engaged in evaluating single political figures.

Experimental evidence that a campaign environment is different from the methods used in the Stony Brook studies can be found in Lau and Redlawsk (1992; 2001). This series of experiments used a computer-based simulation of a presidential election to study the process by which voters select and evaluate campaign information such as candidate personality, issue stands, group endorsements, and polls. In this dynamic environment mimicking the ongoing flow of information during a real-world campaign, subjects who showed evidence of accu-

rate memories for the campaign information presented during the course of the election were more likely to choose the "correct" candidate.[2]

While the Stony Brook studies appear to make a strong case for on-line processing in the evaluation of political candidates, they do so only within a non-campaign environment. Even the study that included two candidates only asked subjects to *form an evaluation* of two political figures, not to *make a choice* between them. And, even if subjects in this study were implicitly making a choice between the two candidates, they were doing so in an environment where all information was readily available and memory need play no role, given the ease with which subjects could access information on the side-by-side comparison sheet. This suggests that while evaluation of a single candidate in a relatively controlled environment may be an on-line task, voting in a real-world election where information flows in a dynamic and disorganized fashion may implicate other processes. The ultimate goal of information processing during an election campaign is probably not just learning about candidates one at a time to make simple person-perception evaluations. Voters are likely to want to learn comparable information about all the candidates in their choice set and may therefore use approaches not considered in the relatively simple Stony Brook paradigm.

Thus, if we are to be asked to accept the on-line model as describing the vote *choice* process, it becomes important to extend the studies testing it beyond the single individual to a multi-candidate, dynamic election environment. We must also go beyond the static methodology in Stony Brook experiments where subjects read about candidates from information sheets in an easily managed, highly controlled setting, which cannot come close to duplicating the chaotic campaign environment.

Process Tracing

Most studies of voter decision making rely on a series of open-ended questions requiring survey respondents to list likes and dislikes about the candidates. Questioning takes place after the election is over and the vote decision has been made. Voters are expected to recall from memory reasons why they supported or opposed a candidate. But if Lodge and his colleagues are correct, recollections called forth do not necessarily represent the factors that actually influenced the vote. Instead, they are either rationalizations or justifications for the decision already made (Rahn, Krosnick, and Breuning 1994b). A new approach is needed to capture the necessary data for analysis of candidate evaluation and choice.

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[2] In these studies, the correct choice is simply defined as the candidate whom the subject prefers once the subject has received full information about candidates in the choice set (and after the simulation is over and the subject has voted for a candidate). See Lau and Redlawsk (1997) for a more detailed discussion of correct voting.

One approach comes from psychology where researchers have used "process tracing" methodologies to understand decision making in many different realms. Process tracing studies start with the assumption that decision making is best studied by collecting data while the decision is actually being made (Ford et al. 1989; Jacoby et al. 1987). The major research technique for process tracing studies of decision making is an information board, which presents subjects with an $m \times n$ matrix of information. Subjects choose among several alternatives (columns of the matrix) that differ on one or more attribute (rows). The researcher records the order in which items are chosen and then analyzes the resulting protocol to determine the types of search patterns employed during the information acquisition process.

Richard Lau and I have revised the traditional static information board, modifying it into a dynamic, ever-changing simulation that better mimics the flow of information during a political campaign (Lau and Redlawsk 1992; Lau and Redlawsk 1997; Lau and Redlawsk 2001; Redlawsk 1992; Redlawsk and Lau 1995). Whereas the static board allows subjects to have access to all available information at all times, the dynamic board emulates the ebb and flow of a political campaign over time. The essential feature of the static information board—the ability to trace the decision-making process as it happens—is retained while information about candidates comes and goes. Early in the campaign, for example, information about the character of candidates and hoopla and horserace features might be more available than issue positions, while later on, issues might predominate. In order to mimic the sometimes confusing and always unmanageable campaign environment, the dynamic information board potentially overwhelms subjects with information. Further, a real election campaign contains a transitory quality to its information flow, as does this simulation. And where the standard information board makes all types of information equally accessible, from positions on arcane issues to party identification, the dynamic approach models the relative ease or difficulty of finding certain kinds of information at different times during a campaign. As a means for testing the implications of the on-line model of candidate evaluation, this new information board provides a more realistic environment: dynamic, time constrained, and reasonably accurate in mimicking the flow of campaign information throughout an election campaign. Subjects are faced with making a vote choice, as they are in the real world, between multiple candidates with different backgrounds espousing various positions on the issues. Thus, the simulation provides a more realistic base from which to understand the role memory plays in voter decision making.

This study employs the dynamic information board to examine the process voters use to choose between candidates. To do so, three questions are explored, paralleling the original Lodge, McGraw, and Stroh (1989) analysis:

Question 1: What is the nature of the memories reported by voters during the election campaign? If voters store information about the campaign as they receive it then reports of memories should closely align with the particular information learned about each candidate. The Kelley and Mirer (1974) model

presumes this to be the case—that memories represent a more or less accurate and unbiased subset of the campaign to which the voter was exposed. However, Lodge, McGraw, and Stroh (1989) find that the contents of memory of their subjects are highly biased and do not represent the information to which subjects were exposed during the experiment, although accuracy rates are reasonably good. But given the very different environment the dynamic information board provides subjects, this question must be explored in a different setting.

Question 2: Do voters make direct comparisons between candidates? Lodge (1995) argues that direct comparisons are never made between candidates during on-line processing. Instead, each candidate is evaluated separately. The only comparison comes at the end of the process when the on-line tallies are weighed against each other to choose the preferred candidate. Yet the Stony Brook studies have not been able to test this assertion empirically, given their general reliance on a static environment containing only one political figure. The dynamic board allows direct testing of this important assertion of the on-line model.

Question 3: Most important, does memory matter in the context of an election, which is inherently a *choice* between two or more candidates? Can memory be used to improve predictions of the vote choice? Are subjects with more accurate memories more likely to vote correctly?

If the on-line model is accurate in the election environment, then the answers to these questions should be similar to those found in the Stony Brook studies. But if the process of *deciding between candidates* is different from simply evaluating a single figure, then the results of this analysis should show important roles for memory in voter decision making.

Method

Subjects

A total of 102 subjects were recruited from central New Jersey in the fall of 1994.[3] Of the initial 102 subjects, 3 could not complete the study due to either fatigue or inability to operate the computer. Thus, 99 subjects are available for analysis. No specific attempt was made to be representative of voters in New Jersey. Two-thirds of subjects were female, and the average age was 49 years, with the youngest 18 and the oldest 82 years of age. Overall, 22% of subjects were 65 or over. Twenty-five percent of subjects had household incomes over

[3] Subjects were recruited primarily through organizations that were invited to provide members to participate in the study, in return for the member donating the $20 payment to the organization. These organizations inclued a local YMCA, a senior citizen's center, and a day care center. Recruiting was done by the organization using parameters provided by the researchers. Subjects were told they would be participating in a study of campaigns that would include a mock presidential primary election campaign.

$75,000 per year, while the incomes of 13% were under $25,000. The racial mix included only 7% non-white, somewhat lower than the surrounding area. Finally, partisanship was distributed (assigning "leaners" to their party) as 57% Democrat, 7% pure independent, and 36% Republican.

Procedure

Subjects participated in a mock presidential primary election featuring six candidates divided between the two parties. Subjects were told that the computer would present the kind of political information that would normally be available in any real primary election and that the candidates, while all invented, were designed to represent a realistic ideological spectrum for their respective

FIGURE 1

Outline of Experimental Procedure

1. Political Attitudes Questionnaire
   Subjects asked questions to measure political preferences; political interest, participation, knowledge, and media usage; importance of different types of political information for 1992 vote choice; background/demographic information (about 30–40 minutes).
2. Mock Primary Election Campaign
   a. Practice session using the mouse to access information about 1988 presidential election (about 8 minutes).
   b. Explicit instructions and 1996 campaign scenario; random assignment to different experimental conditions (hidden from subjects) (about 5 minutes).
   c. Primary election campaign involving 6 candidates (about 22 minutes).
   d. Vote in party's primary election; evaluate all six candidates; manipulation check on difficulty of choice (about 3 minutes).
3. Memory Task
   Subjects asked to remember as much as they can about all six primary election candidates. Task was unexpected for on-line processing condition, and expected for memory-processing condition (about 10 minutes).
4. Correct Voting Determination
   Subjects presented with complete information about two candidates from primary (the one they voted for, and the candidate closest to the subject on the issues, of the remaining candidates in that same party) and asked to decide which they would have voted for if they had obtained all of this information when they actually had to make their choice during the primary election (about 10–15 minutes).
5. Detailed Protocol Analysis
   Subjects completed detailed guided protocol analysis where they explained why they had selected the items they chose to examine during the primary (about 15 minutes).
6. Debriefing
   Subjects' general impressions of experiment gathered; any remaining questions answered, etc. (about 5 minutes).

political parties. Subjects were required to register as either Democrat or Republican prior to the election and then could only vote for the candidates from within the chosen party. Thus, while subjects could actually learn about all six candidates they had strong incentive to focus only on the candidates from their own party. By creating mock candidates, crucial control was retained over the differences between subjects in prior knowledge of actual politicians. No subject knew anything about any of the candidates before the mock campaign began. The specific procedures followed by subjects are detailed in Figure 1.

Two crucial manipulations were embedded in the primary election. The processing manipulation was designed to place subjects into either an on-line or memory-based processing with half of subjects randomly assigned to each condition. Since on-line processing appears to be the default method by which people evaluate social information (Hastie and Park 1986; Lodge 1995; Lodge, McGraw and Stroh 1989) and given that all subjects knew they had to vote for one candidate at the end of the primary, the incentive to form an evaluation and thus process on-line was strong. Accordingly, no specific instruction was given to create an on-line condition since existing research strongly suggested this would be the default. Subjects in the memory-based condition were instructed that they would be required to list everything they could remember from the campaign once the election was over, in effect, being warned that memory mattered. Memory-based subjects were also instructed that they would have to justify their vote choice to the experimenter; Lodge (1995) suggests that the justification process can be effective in blocking on-line evaluation. These instructions were embedded in the general instructions subjects read at the beginning of the primary election simulation. Subjects in the on-line condition were given the same set of general instructions without the specific paragraph describing the listing and justification requirements.[4] (The specific instruction to memory subjects is presented in the Methodological Appendix.)

The second key manipulation varied the number of candidates a subject faced during the primary election. One half of subjects were faced with four candidates in their party's primary (and two in the other party), while the remaining subjects faced only two candidates in their party (and four in the other party).

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[4] The tendency to process person evaluation information on-line is very strong as long as there is an evaluation goal involved in the acquisition of information (Hastie and Park 1986). While this study argues that there is a distinction between evaluation and choice, especially in an election context, there is little doubt that evaluation does occur during a campaign. Even so, implementation of this manipulation was difficult in practice. The lack of strong effects for the processing condition in a number of the analyses could be partially attributed to difficulties in successfully placing subjects into two distinct processing conditions. However, several manipulation checks did show that clear differences occurred between the two groups. For example, those in the on-line condition took a significantly shorter period of time to make their decision (10.6 seconds vs. 16.6 seconds) and reported that their choice was easier (3.28 vs. 3.63, on a scale of 1 to 5 with 1 indicating an easy choice), both of which results would be expected for those who need only reference their on-line tallies to make a choice.

This manipulation was included to vary the difficulty of the choice, presuming that a four-candidate primary would be more difficult than a two-candidate one, particularly since the two candidates were reasonably ideologically distinct.[5]

Upon arriving for the experiment, subjects began by completing a fairly standard political attitudes questionnaire to determine their political interests, preferences, and knowledge. Following an opportunity to practice with the computer, subjects experienced a 22-minute primary election campaign presented via the dynamic information board on the computer. The flow of information in the simulation was dictated by the flow of information during "real world" presidential campaigns, based on a study by Lau (1995). Early in the primary, information about candidate attributes predominated, including polls ("horserace" information) and personal characteristics. As the primary continued, information flows changed, so that more issue positions were presented, as well as endorsements of the candidates by various interest groups. At the end of the primary, subjects voted for one candidate in their party. Subjects then took a memory test (unexpected for those in the on-line condition) consisting of six pages, each headed by the name of a candidate. Subjects were instructed to list everything they could remember about each candidate, no matter how trivial, and the order in which the pages were presented to subjects was randomized. After an exercise to establish whether subjects would have changed their vote with more complete information—whether they voted "correctly" (Lau and Redlawsk 1997)—an extensive debriefing began. Subjects were shown the script of all information they examined during the campaign, and they were asked to recall what they were thinking while learning the information and to evaluate each bit of information as positive, negative, or neutral. Finally, the purposes of the study were explained and subjects were allowed to ask questions. The total time required for each subject was about 2 1/4 hours.

Key Variable Construction

The following analysis relies heavily on four measures: contents of memory, memory accuracy, the on-line tally, and a measure of correct voting. The construction of the on-line tally is sufficiently complex to warrant an extended discussion as provided in the Methodological Appendix.

The measure of subjects' memories about the campaign was developed from the list subjects compiled of everything they could remember about the candidates. To begin, a simple count was made of all memories listed, whether accurate or not. Coders reviewed each memory listed and determined whether it fit into one of five categories: issue, group, party, hoopla (polls and "horser-

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[5] A third manipulation was also included, designed to test whether the time taken to make a decision would vary according to when the decision was made. This manipulation is not theoretically important to the current analysis. Its effects were examined but dropped where no interaction was found.

ace" information), or candidate traits. Memories that did not fit into one of these five categories were included in an "other" category. Next, coders determined whether each memory could be scored for accuracy.[6] Those memories that could be coded were compared to the information the subject was known to have examined. An accurate memory shows evidence of coming from information actually examined and correctly reflects the gist of what was in that information. Finally, memories were also scored for affect toward the candidates. Following the memory test, subjects had been asked to indicate for each memory whether it made them feel "good," "bad," or "neutral" toward the candidate to whom the memory referred. The total count of negative memories was subtracted from the count of positive memories to compute a net memory affect score for each subject for each candidate.

The net memory affect score represents a summary of feeling about the candidates collected *after* the election simulation was over and voting and evaluation complete. The on-line tally measure, on the other hand, represents a summary of feelings about candidate-specific information as it was actually encountered during the campaign. The on-line tally measure was computed by calculating the impact of each piece of information encountered based on the pre-simulation political attitudes survey. For example, if a subject examined Fischer's position on abortion, a comparison can be made between what the subject learned about Fischer and the subject's own position on abortion. If the subject agrees with Fischer, the on-line tally is incremented. If the subject disagrees, it is decremented. If the subject has no preference, the on-line tally is not changed. Thus, this measure of the on-line tally mimics the basic approach defined by Lodge, McGraw, and Stroh (1989), and because it is calculated based on information as it is encountered, its calculation has nothing to do with memory. This last point is critical—a valid OL Tally measure must not be contaminated by memory traces.

Correct voting is simple to define—it is the extent to which a subject manages to choose the candidate closest to the subject's own preferences across the range of information presented in the campaign. The measure chosen for this analysis is a subjective one, determined by subjects themselves. It is based upon Lau and Redlawsk (1997), which proposes two possible measures of correct voting, a normative measure and a voter's own fully informed assessment. In the former, the information viewed by the subject is compared to the subject's own position as reported on the pre-experiment survey and a correct vote is assessed by the researcher when the candidate chosen is closest to the subject. The fully informed subject-based assessment of correct voting is established after the election is over by showing the subject every piece of information avail-

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[6] Examples of memories that could not be coded for accuracy include statement of affect, such as "I liked his position on abortion," which failed to indicate whether the subject knew the position, and memories that were incomplete, such as "her family." Overall, more than 85% of all memories could be coded for accuracy.

able for both the vote choice and the candidate judged to be next closest to the subject based on the pre-simulation questionnaire. After examining this information, much of which had not been seen at the time of the vote decision, the subject is asked whether the vote choice would change now that full information about the candidates is available. A correct vote in this context is one a subject would not change, while an incorrect vote is coded if the subject would have preferred a different candidate from the one actually chosen. It is this latter correct voting measure that is used here.

Results

The Nature of Reported Memories

An important claim of the on-line model is that the information any voter can retrieve from memory is a limited and biased subset of the full range of information to which the voter was exposed and on which candidate evaluation is based. The evidence for this claim, both in political science and in social psychology, comes from experimental studies in which the *experimenter* determines what information a subject will receive about a candidate. Such experimental designs are fine, as far as they go, but they miss one very crucial aspect of political perception: most of what voters learn about candidates comes from their own choices of what information to pay attention to and what information to ignore. The dynamic process tracing methodology employed in this experiment overcomes this shortcoming by allowing subjects a great deal of say over what information they are actually exposed to about each candidate. Hence, my data can test one of the crucial assumptions of the on-line model in an experimental context that more closely parallels an actual political campaign.

Table 1 explores the degree to which memories reported by subjects in the election simulation compare to the items actually viewed during the campaign. In the upper half of Table 1, the first column displays the relative proportion of each of the types of information that were available to subjects during the election campaign. The second column represents the share of each type of information that was actually viewed during the campaign.[7] On average, issue and person information were most often examined, each comprising about 36% of all information that was viewed. The third data column shows the average proportion of each type of memory reported. It is immediately clear that for all subjects the items reported from memory are not representative of the items actually viewed. Instead, issue information is greatly overrepresented in the mem-

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[7]Because of the unique nature of party information, it is not included here. Due to the design of the experiment, once a subject knew the party for one candidate, she automatically knew it for all of the candidates, based on a color coding scheme. Thus, theoretically, a subject needed to access party identification only once, and in doing so would gain six bits of information—the party affiliation of all six candidates. This means that party memories are not directly comparable to party information accesses and therefore are dropped from this analysis.

TABLE 1

Information Remembered vs. Information Viewed

	MEMORY CATEGORIES		
Memory Type	Proportion of Available Items	Proportion of Items Viewed	Proportion of Memories	t (viewed v. memory)
Issue	.36	.366 (.085)	.478 (.290)	3.50***
Person	.29	.362 (.070)	.409 (.289)	1.53
Group	.08	.123 (.061)	.072 (.112)	4.28***
Hoopla	.27	.148 (.075)	.041 (.089)	9.44***

	CANDIDATES		
	All Candidates	Subject's Party Candidates Only	Subject's Vote Choice Only
Per Candidate Proportion of Items Viewed	.1667	.218 (.071)	.248 (.075)
		$t(party,all) = 7.03$***	$t(vote,all) = 10.69$***
Reported Memories as Proportion of Items Viewed	.126 (.073)	.147 (.087)	.197 (.114)
		$t(party,all) = 4.40$***	$t(vote,all) = 7.67$***

Note: Standard deviations are in parentheses. Subjects with no memories excluded from analysis. n = 94.

*$p < .01$; **$p < .01$; ***$p < .001$.

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ories listed, person information is somewhat overrepresented, and other types of information are significantly underrepresented. Further analysis shows the pattern of bias holds across all experimental conditions, thus strongly supporting one of the most basic premises of the on-line model, that memory is a poor representation of information exposure.

The nature of this bias is further detailed in the lower part of Table 1, which examines information search and memories by candidates. The first row reports the mean share of information viewed for candidates within the subject's party (column 2) and for the one candidate who was the ultimate vote choice (column 3). If information search had been random, each candidate would have received a roughly equal share (16.7%) of the items examined (column 1). The evidence shows, however, that subjects concentrated their search within their party, with each in-party candidate receiving an average of 21.8% of all views. As subjects found a candidate they liked, search became even more focused, so that the preferred candidate received nearly one-quarter of all information accesses. Both of these proportions are significantly different from random search (subject party candidates, t = 7.03, $p < .001$; vote choice candidate, t = 10.69, $p < .001$). The second row of candidate information shows that memory by candidate does not necessarily represent what was actually viewed. Subjects were able to recall, on average, about 12% of the pieces of information they viewed for all six candidates. For the information viewed about candidates within a subject's party, this climbs to about 14%, while for the one candidate ultimately chosen, subjects remembered about 20% of the information they viewed. Subjects clearly remembered more relative to what they viewed for the candidate they voted for when compared to all candidates (t = 7.60; $p < .001$).

Table 2 examines the overall accuracy of memories reported for all six candidates, for just those candidates in the subject's party, and for the candidate

TABLE 2

Accurate Memories

	All Candidates	Subject's Party Candidates Only	Vote Choice Candidate Only
Mean Number of Memories Reported	11.20 (7.32)	7.99 (5.75)	4.36 (3.04)
Mean Proportion of Accurate Memories	.80 (.22)	.78 (.26)	.78 (.30)
Accurate Memories as Proportion of Items Viewed	.089 (.066)	.103 (.079)	.141 (.110)
		t(party,all) = 3.70***	t(vote,all) = 6.01***

Note: Standard deviations are in parentheses. Subjects reporting no memories are excluded. n = 94.
  *$p < .1$; **$p < .01$; ***$p < .001$.

ultimately selected. On average, nearly 10 memories per subject could be scored for accuracy, with an average accuracy rate of 80%. Accuracy did not vary whether the memories were global or focused only on the subject's party or candidate. Whatever perceptual screening is operative when viewing candidates and recalling information, it appears not to have affected the accuracy of the memories recalled.

While memories overall appear to be fairly accurate, the pattern of memory reporting evident in Table 1 holds true for accurate memories, as shown in the bottom part of Table 2. Subjects not only remembered more about the candidate they chose, but they also had more accurate memories as a proportion of items viewed for that candidate. The process of making a choice appears to have made it easier for subjects to recall information about their chosen candidate when compared to others. Not only did voters access more information about their preferred candidate, they remembered a greater percentage of that which they viewed, and they remembered it fairly accurately.[8] Memories clearly are not a veridical representation of the information that went into creating them. So far, the data support the on-line model.

Comparisons Between Candidates

Important to the Stony Brook on-line model of voting is the notion that the evaluation of politicians in an election proceeds within-candidate, with voters making no direct comparison between candidates during the campaign. Voters are presumed to assess candidates independently of each other, focusing on what can be called within-candidate processing. The only head-to-head comparison occurs when the on-line tallies for the various candidates are compared at the moment of decision in order to make a choice (Lodge 1995).

The dynamic process-tracing methodology is ideal for examining this important assumption of the on-line model because it can be used to determine the *order* in which information was obtained. If subjects showed a marked preference for within-candidate processing, this will be shown by high levels of intra-candidate transitions. Such transitions occur when after examining a piece of information about a candidate, a subject chooses another piece of information about the same candidate. Initial analysis of the transition data appears to give support to the on-line model. Overall, approximately 40% of all transitions were intra-candidate, indicating a clear preference for searching multiple items for one candidate before switching to another candidate. If search were purely random, we would expect only one-sixth of all transitions to be intra-candidate, since there were six candidates.

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[8] No significant differences were found in any of the measures of accuracy for on-line versus memory-based processors. Some differences did appear between the two and four candidate conditions, but they are completely due to the difference in the number of candidates in the party primary, as opposed to the difficulty of the choice, and are not reported here.

Yet it seems unlikely that voters are attempting to learn about candidates individually, with no consideration for the existence of other candidates. Voters generally want to learn comparable information about all of the candidates in their choice set. Given that information about all candidates is not always readily available, it requires memory to make direct comparisons in a real election. With a *standard* information board, a goal of learning the same information about multiple candidates is indicated by a high proportion of intra-attribute search, that is, examining the same bit of information about each candidate in the choice set. But with the dynamic information board where only a small proportion of the total information is ever available for access at any given time, intra-attribute search is not often feasible. Given the amount of information available for each candidate and the design of the dynamic information board, purely random search would have resulted in intra-attribute transitions about 1.2% of the time. On average, subjects engaged in intra-attribute search about 13% of the time, significantly more than would be expected by chance.[9] Even so, given the constraints of the dynamic approach, a better indication of subjects' interest in learning the same information about multiple candidates is the proportion of all items accessed that were accessed for two (or more) candidates within the subject's party. This proportion was nearly 50%. In most cases, to make these comparisons a subject would have to rely on memory, since significant time might well have elapsed between the processing of the information for the first candidate and the subsequent retrieval and processing of the same information for a second or third candidate. Thus, memory plays an important role neither accounted for by the on-line model nor tested by the various studies that did not require subjects to make comparisons between multiple candidates in an election environment. This crucial difference in study design may well account for the lack of effects for memory in those studies. While actual voters undoubtedly make evaluations as they assess candidates, they evaluate within the context of making a vote choice. To test the effects of the on-line tally and memory on the vote decision, subjects have to be asked to make a choice.

Does Memory Affect the Vote Choice?

Because all previous studies have focused on evaluation rather than choice, I turn first to an examination of candidate evaluation. Table 3 presents the findings of a series of OLS regression analyses predicting the feeling thermometer evaluation of candidates using both the on-line tally and the affective values of

[9]Because not all information in the simulation was candidate-specific, a decision had to be made how to count transitions from candidate-specific items (such as Thomas's position on health care) to general items such as polls and endorsements, which provide information across all relevant candidates. In this analysis, transitions to polls and endorsements were counted as both intra-candidate and intra-attribute transitions. On average, 22% of all items viewed were polls or endorsements. Removing these would lower intra-candidate transitions from 40% to approximately 31% and intra-attribute transitions from 13% to 10% of all transitions.

TABLE 3

Effects of Memory and the OL Tally on Candidate Feeling Thermometer Evaluation

	On-line				Memory-based			
Subject Condition	Extreme Democrat	Moderate Democrat	Extreme Republican	Moderate Republican	Extreme Democrat	Moderate Democrat	Extreme Republican	Moderate Republican
Candidate Evaluated								
On-line Tally	.07	.24	.37*	.09	.22	.10	.05	.06
Memory	.57***	.39*	.37*	.62***	.59***	.49**	.59***	.57**
Mean On-line Tally			.19				.10	
Mean Memory			.48				.56	

*$p < .1$; **$p < .01$; ***$p < .001$.

Effects of Memory and the OL Tally on Candidate Evaluation Subjects Stratified
by Political Sophistication (Summary Results Only)

	Non-Sophisticates		Sophisticates	
Subject Condition	On-line	Memory-based	On-line	Memory-based
Mean On-line Tally	.19	.03	.28	.05
Mean Memory	.48	.49	.42	.49

Note: Table entries are mean standardized OLS coefficients. Dependent variable is feeling thermometer rating.

memories for each candidate as predictors. Because subjects in this study faced
different sets of candidates, depending on experimental conditions, the table re-
ports only the four candidates who were included in all conditions.[10] Subjects
in the on-line condition were examined separately from those in the memory-
based condition. The basic results are, in one sense, quite consistent with ear-
lier studies (Lodge, McGraw, and Stroh 1989) in that the on-line tally is
considerably stronger in the on-line condition than in the memory condition,
while memory plays a greater role in the memory-based condition. This differ-
ence is *exactly* what the on-line model predicts. However, Lodge et al. found
that on average (i.e., irrespective of information processing condition) the on-
line tally was a stronger predictor of candidate evaluations than memory (1989,
Table 5, p. 412), whereas I find that on average memory is the stronger predic-
tor. The difference is consistent with my argument that the evaluation environ-
ment studied by the Stony Brook researchers favors the on-line tally, while an
election context puts much more emphasis on memory.

Given somewhat contradictory previous findings on sophistication effects and
on-line processing (McGraw, Lodge, and Stroh 1990b; Rahn, Aldrich, and Borgida
1994a), it makes sense to consider whether a sophistication effect might be found
in these data. Perhaps the memory effects are occurring only among less so-
phisticated subjects, who might find on-line processing difficult. A further analy-
sis of the data in Table 3 in which subjects were stratified according to political
sophistication (measured as a combination of knowledge, experience, and inter-
est) does not support such an interpretation. While stronger memory effects are
shown for non-sophisticates to a small degree, memory effects for subjects in
on-line conditions occur for both non-sophisticates and sophisticates. Like-
wise, evidence of on-line tally effects occurs for both groups as well. Whatever
the sophistication effects, they seem to be minimal compared to the effects of
memory, no matter what the processing condition.

I now move beyond individual candidate evaluation to look at the actual vote
choice, using logistic regression to predict the direction of the vote. The first
step was to establish the dependent variable conceptually. Because of the task
difficulty manipulation, some subjects faced a choice set with two candidates,
while others faced a choice set of four. In order to use both groups of subjects
in this analysis, vote choice was operationalized as a dichotomous variable with
a vote for a moderate candidate (or either of the two moderate candidates in the
4-candidate condition) coded high and a vote for an extreme candidate coded
low. Likewise, net measures for the on-line tally and memory affect were cre-
ated by subtracting the on-line tally and memory scores for the extreme candi-
date in the choice set from the scores for the more moderate candidate.[11] Predictor

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[10] This analysis was also computed for the other four candidates, with similar results, although
the n in these cases is small.

[11] In the four candidate condition, the OL tally and memory affect measures were calculated by
averaging the scores for the two more extreme candidates and subtracting the resulting scores from
the average for the two more moderate candidates.

TABLE 4

Effects of Memory and the OL Tally on the Vote Choice

	Stony Brook Model On-line Tally Only		Revised Model with Memory Affect	
Sophistication	−.2667	(.2754)	−.2245	(.6583)
Net On-line Tally	.1015***	(.0350)	−.0834	(.1283)
Tally × Task Demand	−.0639	(.0352)	−.0740	(.1336)
Tally × Processing	.0029	(.0323)	−.2055*	(.1180)
Tally × Sophistication	.0715	(.0469)	.1337	(.1366)
Net Memory Affect for Candidates			1.8618***	(.5801)
Memory Affect × Task Demand			−.5308	(.3763)
Memory Affect × Processing			.8902*	(.4772)
Memory Affect × Sophistication			−.3704	(.4520)
−2 Log Likelihood	112.02		45.79	
Model Chi-square	23.18 15df p = .0803		89.42 21df p = .0000	
Difference Chi-square			66.23 6df p = .0000	
Correctly Classified	67.35%			87.76%

Note: Table entries are logistic regression weights; standard errors are in parenthesis. n = 94. Additional variables not shown but included in the full model are the experimental conditions their interactions, none of which are statistically significant. The full model is available on request from the author.

*p < .1; **p < .05; ***p < .01.

variables included the experimental manipulations, sophistication, the measures of the on-line tally and recall memory affect, plus interaction terms between the experimental conditions and sophistication, the on-line tally, and the memory measures.[12]

Table 4 presents the critical variables in this analysis, displaying only the statistically significant variables and others crucial to the hypothesis testing. The first analysis reports an initial model predicting vote choice using the on-line tally, without considering memory. Overall results are as expected, with main effects for the on-line tally. As with Table 3, no significant main or interaction effects are found for sophistication, although the interaction effect with the tally is in the direction expected, showing increased effects for the tally for more sophisticated subjects. Overall, the model is not very strong, correctly classifying only 67% of subjects. The more fully specified model, which includes the memory variable, is also reported in Table 4 and shows very different results. As is the case with candidate evaluation, memory is important to vote choice, in direct contradiction to the on-line model. Memory is somewhat more important

[12] The processing manipulation is coded so that on-line processing is 0 and memory processing subjects receive a value of 1. Thus, the interaction terms between processing mode and the on-line tally, and processing mode and memory affect, indicate the degree to which memory processors differ from on-line processors. Likewise, the task demand manipulation is coded with 1 representing the more difficult 4-candidate condition.

(and the on-line tally somewhat less important) in the memory-processing condition, as hypothesized, but the strong main effects show memory matters irrespective of processing condition. The expanded model predicts vote choice with a high degree of accuracy: approximately 88% of subjects are correctly classified. This is a highly significant improvement in fit due to the addition of memory to the model (chi-square = 66.23, df = 6, $p < .0000$). Again the political sophistication of subjects makes no statistical difference, though once more the signs point in the expected direction, with sophisticates showing greater use of the tally and less of memory. Overall, though, the analysis shows that there *is* a role for memory to play in the vote choice itself: recall memories about the candidates are predictors of the vote choice, even in the face of the on-line tally.

Going Beyond the Stony Brook Model: Does Memory Affect the Correct Voting?

The affect associated with memories for candidates clearly plays a role in candidate evaluation and vote choice in this study. I turn now to a question that goes beyond previous studies of memory effects in voter decision making, that is, whether memory influences the *quality* of the vote decision. Are voters who accurately remember what they learned about candidates more likely to "vote correctly" than those whose memories are inaccurate? The shift in emphasis here should be noted. Whereas the previous analysis focused on the affective nature of subject memories, the following analysis will concern itself with the accuracy of those memories regardless of whatever affective value they carry.

Logistic regression was used to test whether reporting accurate memories improved decision making in accordance with the Lau and Redlawsk (1997) correct voting standard, which establishes a "correct vote" as the vote that would have been cast had the voter had full information about all possible candidates in the choice set. The complete model includes as its independent variables the experimental manipulations, the amount of time required to make the vote decision, and two subject background variables that could be expected to impact correct voting—political sophistication and issue constraint.[13] Interaction terms between experimental conditions, political sophistication and the tally and memory measures are also included.

A preliminary analysis (not shown) that includes only the experimental conditions and background variables shows that voting accuracy is clearly affected by task demands as would be expected. Those subjects facing four candidates were less likely to vote correctly than those facing two candidates. However, there are neither main effects nor interaction effects on quality from the crucial processing manipulation. All three individual difference measures—issue con-

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[13] The computer measured the time subjects took to make a decision from the moment the vote screen appeared until the subject clicked on his or her choice, which is coded in seconds and tenths of a second. Issue constraint is the degree to which subject positions on the issues asked about in the initial questionnaire were consistent.

straint, decision time, and political sophistication—show the expected signs, with the lack of issue constraint negatively impacting correct voting, while taking more time to make a decision and greater political sophistication improving quality. However, none reaches statistical significance. Overall, the preliminary model, which includes neither the on-line tally nor memory, performs adequately, correctly classifying 79% of subjects.

Table 5 presents the results of adding both memory and the on-line tally to this basic model. Because subjects faced either two or four candidates in their own party, there are no single memory or on-line tally measures; instead, memory and the tally are calculated for each candidate. To estimate this model, the memory accuracy and on-line tally for the candidate who *should* have been chosen, based on candidate-subject agreement, were included, along with their interactions with the task demands, processing conditions, and political sophis-

TABLE 5

Effects of Memory on Correct Voting

	B	SE
Accurate Memory	1.4456**	(.5890)
Memory × Task Demands	.5727	(.5984)
Memory × Processing	2.4366**	(.9960)
Memory × Sophistication	.9939	(.6225)
Memory × Sophistication × Task Demands	2.5419*	(1.5175)
Memory × Sophistication × Processing	−.2609	(1.0679)
On-line Tally	−.0090	(.0660)
Tally × Task Demands	.2291	(.1559)
Tally × Processing	−.0388	(.1589)
Tally × Sophistication	.1102	(.0695)
Tally × Sophistication × Task Demands	−.0560	(.0875)
Tally × Sophistication × Processing	.0118	(.0824)
Political Sophistication	−.0069	(1.3012)
Decision Time	.1659**	(.0775)
Sophistication × Decision Time	−.1338*	(.0694)
Task Demands Condition	−5.8063**	(2.6988)
Processing Condition	−3.1508	(3.1138)
Task Demands × Processing	.9011	(2.0024)
Issue Constraint	.4033**	(.1895)
−2 Log Likelihood	53.77	
Model Chi-square	46.09 19df $p = .0005$	
Correctly Classified	86.17%	

Note: Table entries are logistic regression weights; standard errors are in parenthesis. n = 94.
Task Demands Condition: 2 candidates coded as 0, 4 candidates coded as 1.
Processing Condition: On-line coded as 0, Memory coded as 1.
*$p < .1$; **$p < .05$; ***$p < .01$.

tication.[14] The resulting model is significantly improved over the initial model (Chi-square = 36.693, df = 13, p = .0005.) Main effects are found for accurate memories for the best candidate, indicating that even in the two-candidate, on-line condition, accurate memories can improve correct voting. The significant interaction between memories and processing condition indicates that accurate memories are even more important to subjects in the memory condition. An additional indicator of the importance of memory in correct voting can be inferred from the significant effects of decision time. While in the preliminary model this measure was not significant, in the complete model, the more time a subject spends thinking about her vote choice, the better the quality of that choice, all other things equal. This finding cannot be easily reconciled with the basic thrust of the on-line model that decisions are made without the necessity of resorting to memory (other than the quick retrieval of the tally itself). It is easy to imagine that as subjects spend more time trying to make a decision, they are working harder to remember what they can about the candidates, which in turn improves the overall quality of the decision.[15]

Finally, some sophistication effects are found in the model, though not in a fashion indicating that the on-line tally operates for sophisticates only, as suggested in some prior research (McGraw, Lodge, and Stroh 1990b). Instead, sophistication interacts with memory and task demands, so that more sophisticated subjects who faced four candidates instead of two performed significantly better the more accurate their memories. While non-sophisticates also improved decision making with accurate memories, the effects were much stronger for sophisticates in the very difficult decision task. However, interestingly, the main effects for decision time and the interaction term between sophistication and decision time suggest that while spending more time on the decision helped all subjects to some degree, political sophisticates actually suffered in comparison, performing slightly worse the longer they thought about their decision. While this might suggest some functioning of the on-line tally, it seems a stretch to suggest this. The overwhelming weight of the evidence in Table 5 is that memory matters.

On-line Processing Revisited

The on-line voting model has tremendous appeal as a psychologically realistic view of how voters might process campaign information, integrate it into existing affect toward candidates, and make a decision when election day comes around. The idea that voters need only maintain an on-line tally for each can-

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[14] Candidate-subject agreement was calculated based upon the initial questionnaire completed by all subjects and the information about each candidate viewed by subjects. The "best" candidate is simply the one closest to the subject on this measure, whether this candidate was actually selected or not.

[15] Interaction terms between the processing and task demand conditions and decision time were computed and tested. The resulting predictors were not significant and were dropped from subsequent analysis.

didate, rather than searching the contents of memory in order to make an evaluation, fits far better with what is understood about how people simplify difficult cognitive tasks, than do models that presume memory-based processes. Given a complicated decision environment, it is cognitively simpler to maintain one major piece of information about the candidates—how the voter feels about each one overall—than to try to juggle detailed information about each candidate's position on the issues, personal characteristics, and the like. Cognitively speaking, simpler is certainly better.

Yet despite their appeal, the findings of this new study diverge significantly from those of previous experiments. Perhaps the most likely reason why this study is different is that for the first time subjects were asked to choose from among multiple political candidates. Prior studies presented subjects with a pure judgment task in which subjects were simply asked to make an evaluation of a political figure. The fact that the Stony Brook studies did not require a choice between candidates greatly limits the extent to which the on-line model can be applied to an election campaign. This distinction between judgment and choice is an important one that often goes unacknowledged. Choice tasks require the actor to "choos[e] among a discrete set of mutually exclusive and exhaustive courses of action," while judgments involve "evaluating alternatives on an ordered response scale" (Fischer and Johnson 1986, 59). Einhorn and Hogarth (1981) show that different cognitive processes are likely to be engaged in the different tasks of choice and evaluation. And multiple studies have shown that evaluations and choices do not always result in the same preference rankings (cf. Grether and Plott 1979; Lichtenstein and Slovic 1971; Johnson and Russo 1984). Elections clearly require a choice; the Stony Brook experiments required simply evaluation.

The Stony Brook studies clearly reaffirm that the on-line model applies to the evaluation of individual political figures, as would be expected from previous studies of person perception tasks (Hastie and Park 1986). This is important since for a large part of the time citizens are asked to do exactly this— evaluate political figures such as incumbents without reference to an election or a choice. But there is something about having more than one person to evaluate simultaneously in a choice environment that appears to change the way in which that evaluation proceeds making memory far more important than it appears in the on-line evaluation model. This something may be the desire by voters to make direct comparisons between candidates on salient issues. The on-line model explicitly rejects the idea that voters make such comparisons (Lodge 1995), but there is evidence in this study that voters proceed to search for information *as if they were* making direct comparisons. While the extent of intra-attribute search combined with the indication that subjects examine the same information for multiple candidates is not conclusive proof that the comparisons are actually made, it is strongly suggestive. It seems highly unlikely, given the random nature of the information presentation in the dynamic information board and the effort required to make intra-attribute transitions, that subjects would move from candidate A's position on issue 1 to candidate B's position on the same issue

and fail to make direct comparisons. Even though there are fewer intra-attribute transitions than intra-candidate transitions, there are still far more than would be expected by chance. If voters are making such direct comparisons, the consistent links between memory and choice found in the political science literature, and rejected by Rahn et al. (1994b) and the Stony Brook researchers as rationalizations, may be the traces remaining from those comparisons.

If these traces are attributable to direct comparison, why are the memories so weak? If the use of memory during the campaign is primarily to make comparisons across candidates, then once a comparison is made and the positions of each candidate are evaluated, it may no longer be necessary to continue to refresh the memories involved in that comparison. In a sense, voters may use memory for specific purposes and use on-line processing otherwise.

A second reason for the divergence in findings may be attributable to different operationalizations of the on-line tally itself. In the Stony Brook studies, the tally is typically computed based on the likes and dislikes of each campaign statement as expressed by the subject during the course of the experiment. This resulting measure is then taken to approximate the overall on-line evaluation (Lodge, McGraw, and Stroh 1989). In the current experiment, the on-line tally is calculated with a far greater wealth of information, including not only issues, but also group endorsements, candidate personality, and party affiliation. The evaluations of the candidate positions are generated using externally developed criteria. Subjects record their general political preferences in a preelection questionnaire that does not include any of the actual detailed issue positions used in the experiment. The candidate positions on the issues are compared to subject positions on the same general issues, and the result is combined into the tally. This difference means that the on-line tally used in this experiment is more comprehensive and less likely to be contaminated with memory than that used in prior studies.[16] Given that the memory measures used in this study are also more comprehensive, since they include memories beyond just issues, it is important that a comprehensive tally including all types of information is employed in the analysis.

Another difference between this study and previous research is that the methodology used here is dramatically different from that used in any of the previous Stony Brook studies. The dynamic information board approach provides the ability to mimic the flow of information throughout a political campaign with all the resulting confusion that real world campaigns certainly entail. Anyone

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[16] A second approach that parallels the one used in the Stony Brook studies was also considered for assessing a subject's on-line tally. This measure was created from direct reporting by the subject, captured by asking subjects during the detailed debriefing how each piece of information made them feel about each candidate. However, because these data are collected after the vote through an interview with subjects, they may be contaminated by the vote and evaluation process and memories retained by subjects. The resulting tally performed worse in head-to-head comparisons with the memory measures than did the one constructed using external criteria. Thus, the stronger on-line tally measure was chosen.

who studies a political campaign must come to grips with the fact that campaigns proceed over time. They are not static events, and the decision-making processes that voters find themselves involved in must vary as the campaign proceeds. Early on, for example, voters are simply learning the basics about the candidates, many of whom are unfamiliar faces. The initial decision for many voters, especially in a primary election, is probably simply how to find one or two candidates who look reasonable in a host of suits who all look and often sound the same. Once focused, voters have a different task at hand—to learn what they can to either reinforce their initial feelings about a candidate or to learn enough to reject and start looking through the remainder again. At this point, voters may be making the kinds of direct comparisons on salient issues that the on-line model rejects. Finally, as election day approaches, voters may spend time simply reinforcing their preferences.[17]

Steenbergen and Lodge (1998) have recently suggested that the pure on-line model may not apply in all cases. They suggest that it is possible to view "candidate evaluation as a natural progression from a memory-based process to an on-line process" (1998, 38) as long as the assumption that memory nodes are affectless is relaxed. If so, then memory-based processing may define the early stages of information search, when candidate nodes in memory are not well established and voters are less certain of their choice. The study reported here tends to support this proposition, given the significant memory effects found in all subjects. Additional work is needed, however, to identify the exact conditions under which voters may switch from memory-based to on-line processing.

Methodological Appendix

Constructing the On-line Tally

The on-line tally score reflects a measure of the overall evaluation of each candidate presumably computed by subjects as information was accessed. The tally must represent the subject's own evaluation of each piece of information as it is encountered. However, neither the Stony Brook model nor previous researchers have specified exactly what method evaluators use to compare their own position on a piece of information with that of the candidate. What is specified is that a comparison is made; what is left unsaid is exactly what formula is used to make it. In this study, the on-line tally must integrate evaluations of candidate stands on issues, candidate personality, group endorsements, and partisanship. For each of these, subjects are presumed to compare what they learn from the campaign to their own pre-existing ideal points. To do this, the on-line

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[17]This observation as to process is, at the moment, simply speculation. The scripts generated by the extensive debriefing in this experiment provide some clues to this process and are the data upon which I am basing these ideas. However, the scripts have not yet been analyzed in any systematic way, so what I write here is necessarily impressionistic.

tally was incremented or decremented for issue agreement using a simple agree/ neutral/disagree scale. For each issue encountered by the subject, an agreement value was assigned based on the known position of the candidate compared to the stated position of the subject (from the initial questionnaire). If the absolute value of the distance between the two was greater than 2.5 points (on a 1–7 scale), the subject was presumed to disagree with the candidate. Between 1.1 and 2.4 points, a neutral score was assigned. Finally, if the difference was less than 1.1 points, the subject and candidate were presumed to agree on the issue. The "known position" of the candidate was established by having seven politically sophisticated individuals rate each candidate's issue positions on a liberal-conservative scale ranging from 1 to 7. The mean rating for each candidate on each issue was then used as the known position of the candidate for that issue.

When a subject encountered information about endorsements, the tally was incremented or decremented using the likeability approach (Sniderman, Brody, and Tetlock 1991) so that an endorsement of a candidate by a group liked by the subject would add to the tally for that candidate, while an endorsement by a disliked group would reduce the endorsed candidate's tally. To establish likeability, subject feelings toward each group making an endorsement were assessed during the pre-campaign on-line questionnaire using feeling thermometers. Groups above the subject's own mean for all groups and above 50 on the scale were considered "liked." Those below the mean and below 50 were "disliked." For each endorsement of a candidate by a group liked by the subject, one point was added for that candidate. For each endorsement by a disliked group, one point was subtracted.

Candidate personality was also factored into the tally using ratings established beforehand by a separate set of 67 subjects who viewed candidate pictures and trait descriptions and rated the appeal of each picture and trait. Assessments were averaged across all raters, creating a score for each trait and picture that was then applied to the candidate to whom the trait or picture belonged. Candidates were designed to be equally "likable" in terms of physical attractiveness and personality traits, so if all subjects had accessed all personal and appearance information they would have had similar ratings for the candidates. But because subjects accessed this information in differing amounts, the "impressions" that subjects had of the different candidates were quite varied.

Finally, the on-line tally was also incremented or decremented by access of the party label. While subjects were required to choose a political party for the primary, not all subjects chose their own party as stated on the pre-simulation questionnaire, and some subjects were truly independents. Thus, when party was accessed, the on-line tally for the candidate was incremented or decremented depending on whether the candidate's party was the same as the subject's. For subjects who were independents, accessing party has no effect on the on-line tally.

Two more decisions were needed about the tally. First, the rule to be used to integrate information into the on-line tally had to be established as either aver-

aging or additive. An averaging approach would suggest that initial affect toward the candidates acts as an anchor, and subsequent information has less impact as time goes on. On the other hand, it could be that as information is encountered, the tally is updated using an additive approach in which each new feeling generated by a piece of information adds to what was there before. If this is the case, strongly affective feelings about later information are not diluted as much as they would be in an averaging approach. As an example, if a subject has looked at five issues, and using the scoring described above, scores $1,1,0,1,-1$ on those issues, the value of the tally in an averaging approach would be 0.4, while in an additive approach the tally would be valued at 2. Supposing a sixth item is encountered, the affective value is 0. In the averaging approach, this neutral affect would *lower* the tally to .333, while it would have no effect on the additive tally. The next item encountered, assuming it carried an affective value of 1, would increase both tallies: the averaging approach to .43, and the additive tally to 3. The new item has a stronger effect on the additive tally, increasing it by 50%, while it increases the averaging tally by only 30%.

An assessment of both approaches found that the empirical results favor an additive process. When the tally was calculated using an averaging process, it had little effect in the analysis. But when calculated using an additive approach, the tally is a significant variable in the analysis. Further, the additive tally was significantly correlated ($.2457, p < .05$) with the feeling thermometer evaluations of the candidates, while the averaging tally was not ($.0711, n.s$).

Next, the role of memory in the on-line tally itself was explored, with the on-line tally for each candidate calculated both assuming memory for items already examined and assuming no memory. In the former case, if memory is assumed during the on-line updating process to remind a voter that the information has already been counted, then reexamining the information should have no effect on the on-line tally. On the other hand, if there is no memory process used during on-line updating, then each time the information is accessed the tally is updated, no matter how many times the information has been seen before. The same correlation analysis between the tally and thermometer evaluations as used above showed that assuming memory is operating during updating of the tally appears to make little difference in the effectiveness of the tally measure. Both the memory and no-memory additive tallies were significantly correlated with thermometer evaluations (.2486 for memory; .2457 for no memory; both $p < .05$). Since Lodge (1995) argues that the tally proceeds without respect to memory for prior encounters, and lacking evidence to show that assuming memory makes the tally a better measure, the no-memory tally measure was used in this analysis.

Instructions to Subjects

Prior to beginning the campaign, subjects read a set of instructions about the simulation. For subjects in the memory condition, the instructions included a paragraph warning them about the memory test and justification requirement.

On-line subjects read a set that was identical except for this special paragraph. In general the instructions explained how information would flow during the campaign, how to access the information as it became available, and a description of the setting of this election, which was presented as the 1996 presidential campaign. After reading the instructions, subjects were presented with the 1996 scenario, in which President Clinton declined to run for a second term and Vice-President Gore also bowed out. This was done to present a completely new set of candidates, none of whom the subjects new anything about at the beginning of the campaign. The special paragraph designed to place one-half of subjects into the memory processing condition was embedded about two-thirds of the way through the general instructions and read as follows. The italics and line of stars offsetting the paragraph were included in the instructions in order to draw attention to it.

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Once the election is over and you have voted for your preferred candidate, you will be asked to justify your choice. That is, your experimenter will ask you to explain why you voted for the candidate you chose. In addition, you will be asked to list everything you can remember about the candidates in the primary election. So, you should do your best to remember everything you can as you look at each piece of information.

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