The role of memory in voter decision making
A process tracing study of a presidential election campaign

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For many years the Holy Grail of voting behavior study has been accurately predicting elections. Beginning with the Columbia studies (Lazarsfeld, Berelson, and Gaudet, 1948; Berelson, Lazarsfeld, and McPhee, 1954) through the Michigan model (Campbell, Converse, Miller, and Stokes, 1960) and its disciples, continuing with Downsian rational choice (Downs, 1957) and on to the present day, political scientists have searched far and wide for models which would explain why voters make the choices that they do. Some findings over the years have shown us the power of group affiliations and developed the concept of the "cross-pressured" voter (Lazarsfeld, *et al*., 1948). Other efforts have focused on the importance of party identification, and its function as a "perceptual screen" (Campbell, *et al*., 1960). Still another school of thought has focused on voters as rational calculators, seeking to maximize the value of their vote (Downs, 1957). There is no question that many of these efforts to find the antecedents of the vote have been successful. Many 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, political scientists appear to have come quite close to seizing their Holy Grail.

Even so, the quest has often been troubling. The early researchers started out with the belief that they would find well-informed voters who paid careful attention to the information available to them about the election campaign. A democracy such as ours presumably rests, in part, on the linkage between votes cast and policies made. Voters who pay attention to what their officials do can express their pleasure or displeasure at the voting booth, each time an election cycle appears. In doing so, the ultimate power would continue to rest with the people, through their representatives. Unfortunately for 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 American Voter authors, in their hierarchical "levels of conceptualization" saw the vast majority of the public as less than aware of the issues of the day, and unable to cast votes based on those issues. From that time on, with a few exceptions[1] most views of voters were relatively uncharitable. Political scientists became convinced that because voters could not easily articulate the reasons for their vote, and because they often seemed unable to place candidates on

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[1] Beginning in the late 1960's, a large amount of space in professional journals was devoted to the question of whether voters had become more issue-oriented in the elections of 1964 and 1968, when compared to earlier elections. The question, of course, was whether these elections represented a public better able to carry out its civil obligations, through greater knowledge of the issues. While this controversy continued for several years, its seems clear that those arguing that the 1960's elections did not represent some great shift towards issue-oriented voters prevailed, and the political science view of voters did not change very much. For some of the considerations on both sides of the issue, see Nie, Verba, and Petrocik, (1976), especially Chapter 10; Smith, (1989); Pomper, (1972); Converse and Markus, (1979); Nie and Anderson, (1974); and Achen, (1975), among many others.

the various issue scales, that the public was just not capable of paying a lot of attention to politics. These two key factors -- inability to verbalize about political subjects, and lack of issue constraint -- have been taken to indicate that many voters are making voting decisions based on something less reasonable than an educated understanding of the political environment.[2]

This view may be doing a disservice to the American electorate. For it stems from a belief that politics is important enough that people ought to follow it closely and from the particular methodology usually used to study voting. Political scientists treat elections very much as if they were static events, happening at a particular point in time. In other words, we usually focus on "the vote" which does occur at a particular place and time, and presume that all of what led up to the vote is encapsulated in the memories voters bring to the booth. So we use a survey-based methodology wherein we ask people to indicate their policy preferences, their interests in the various candidates, and their vote choice. From this we develop linear models of the vote which are capable of great predictive accuracy. In so doing we make some very important assumptions. First, we assume that respondents have maintained a reasonable representation in memory of the information to which they were exposed. Second, we assume that they search that memory in order to answer our questions. Third, we assume that when we ask why a particular vote was cast, respondents can really report reasons, not rationalizations of the decision after it has been made. Perhaps someone for whom politics is an important part of their life might, in fact, meet these assumptions. However, for most people, most of the time -- even during elections -- politics is just not that important. Research in political cognition has shown that people are limited information processors (Simon, 1956;1985) who cannot devote the mental time and energy needed to learn about candidates in detail and to store all of the knowledge gained for later accurate recall when voting (Fiske & Taylor, 1991). Further, most people do not have the well developed cognitive structures that would facilitate the incorporation and recall of large amounts of information about political candidates. People must make voting decisions the way they make other decisions: with limited information, limited time to process that information, and a limited ability to adequately store and recall the information.

During election campaigns voters are exposed to large amounts of information about candidates. In some cases voters can choose whether to pay attention, while in other cases the information is so ubiquitous that voters can hardly avoid it. But in all cases, the flow of information is dynamic -- one day information on a candidate's position on an issue is readily available; the next day it can hardly be found. Yet, nearly all of the studies that form the basis of our view of voters have relied on survey research as the methodology of choice, despite the fact that surveys can capture only one moment in time. Even

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[2] Converse (1964) went so far as to suggest that not only did voters show little issue constraint, but that the opinions of the vast majority as expressed on surveys represented “non-attitudes,” that people were essentially guessing in response to the questions. A small group, to be sure, held true attitudes, according to Converse, but these represented a tiny portion of the population, and were masked by the random fluctuations of those with non-attitudes. This seems a particularly negative view of the ability of citizens to participate in the civic world. Zaller (1992) might have an answer that at least partially rehabilitates citizens: answers to survey questions may appear somewhat less than stable due to how an ever changing political environment is reflected in public opinion. Zaller’s model argues that survey responses are a factor of whatever “considerations” are at the top of a respondent’s head when questioned. Which considerations are evaluated during the response process is a factor of political communications that have been received by the respondent in the recent past. Thus, shifting attitudes may simply represent non-valence issues which generate multiple positions competing for prominence. In this view, voters are not acting randomly in answering questions; instead they are giving consideration to multiple sides of a question, expressing preference based on a mixture of own beliefs and information received from the media.

panel studies only give us a snapshot of a few moments in an ongoing, dynamic campaign. So, we are forced to rely on respondent's memories of what they have seen and which campaign information affected them. The election's dynamic nature is missing. It should not be a surprise that voters who are asked to reconstruct the campaign in response to post-election surveys are less than perfect in articulating their reasons for supporting candidates or in placing themselves and candidates on 7-point issue scales. One important result of this mismatch is that while we can make good predictions of the outcome of an election, we do not do nearly as good a job describing how voters actually make their choice. That is, we may be able to model the *behavior*, but in doing so, we do not necessarily understand the *process*.

Models of the vote

Current accepted voting models are all "memory-based" in that they implicitly (*e.g*. Columbia, Michigan) or explicitly (*e.g*. Kelly & Mirer, 1974) require the voter to maintain information about the campaign in memory and then to access and use that information at the "moment of decision" in order to evaluate candidates and make a choice. These models have been built on the basis of survey research in which voters were asked to reveal their vote choice as well as their various preferences, linear models have been developed linking the vote with reported likes and dislikes of the candidates and candidate positions. These respondents' reports have been assumed to come from reasonably accurate memories of factors that motivated the vote decision. The models may differ in how the evaluation itself is calculated; for example, spatial models (e.g. Enelow and Hinich, 1984) argue that voters use a complex calculus to find the issue loss for each candidate (the spatial distance between the candidate and the voter aggregated across issues) and choose the candidate with the least loss; while Kelly and Mirer (1974) suggest the comparison is a simple matter of adding up the things the voter likes and dislikes about each candidate, and choosing the one with the highest score. And the Michigan model (e.g. Markus and Converse, 1979) sees party identification as a mediating variable, with other information focused through its lens, when encountered and when recalled. But all have in common the assumption that voters search the contents of their memories at the time the choice is to be made. Kelley & Mirer probably provide the clearest example. They propose that as voters encounter campaign information it is stored in memory. When the time comes to vote, the memories for each candidate are recalled and the likes and dislikes that they represent are added up. The candidate who emerges with the highest affective score is then chosen. If there is a tie, party affiliation becomes the tie-breaker.

If voters do work from memory, then we can be relatively sanguine about our ability to tap the "true" reasons for the vote choice through survey research and the use of linear models based on survey data. If making a vote choice is a matter of searching memory, then polling at the appropriate time, i.e. close to the decision point, should allow us to tap the same memories used in making the vote choice. If those memories can be tapped, then it is reasonable to have faith that existing voting models that rely on a memory-based process are not only *predicting* the vote with accuracy (as we must concede they are), but *explaining* the vote as well. And we can be comfortable that when we ask the voter for reasons behind a vote choice, or we ask the voter to locate candidates on an issue continuum, we are asking them merely to recall information the voter already has readily available.

Unfortunately, however, psychologists are generally agreed that people just do not and cannot process information this way. While long term memory appears to be limitless, short term memory -- the working memory where people actually process information -- is extremely limited, perhaps to as little as 7 +/- 2 chunks of information at any given time (Miller, 1956). It is in this working memory

bottleneck that all conscious processing occurs, requiring retrieval of appropriate memories from long term memory before they can be used. Moving memories from short to long term, and back again, is time consuming, and requires additional processing effort. These limitations suggest that, at best, if voting is a memory-based process, it can not be based on very many memories. Add to this the fact that politics is not very important to most people most of the time -- even during a presidential election -- and it becomes even less likely that voters will routinely make the processing effort necessary to support memory-based models of the vote. So, while political scientists have been developing models which require a significant investment of cognitive energy, psychologists have been showing us that people are cognitive misers (Fiske & Taylor, 1991).

A cognitive miser uses resources efficiently. This efficiency translates into processes for decision-making that do not conform to the memory-based models that political scientists have favored. Recently, Lodge and colleagues at SUNY-Stony Brook (Lodge, McGraw, and Stroh, 1989; Lodge, Steenbergen, and Brau, 1995) have proposed a new way of looking at how people process political information. Borrowing a well-established concept from social and cognitive psychology (see Hastie and Park, 1986), the Stony Brook model argues that candidate evaluations are formed in an "on-line" process where voters receive new information about a candidate, process that information in working memory, and use the evaluation of the new information to update an "on-line tally" (OL Tally) retrieved from long term memory which contains a global evaluation of the candidate. The newly updated OL Tally is then returned to long term memory, and the new information *can safely be discarded.* This means of processing information has been found in many different situations in which an evaluation is required (Wyer & Srull, 1986). Lodge, et al., argue that candidate evaluation during a political campaign is not much different from any other kind of person perception that involves evaluation (see also Rahn, Aldrich, Borgida & Sullivan, 1990, for a detailed discussion of this point) and thus it is reasonable to believe that the on-line processes found for other situations would also be used for political choices. [3]

An application of an on-line processing model to the vote decision would suggest that as campaign information is attended to by the voter, a pre-existing affective tally[4] about the candidate is recalled from memory. This tally, which contains a running score for each candidate, is then updated based on the voter's reaction to the new information. The updated tally is then restored to long term memory, and the information that was used to update it can be safely discarded. When the time comes to vote, one need only retrieve the tally for the candidates, compare each, and vote for the one with the more positive value. There is no need to search memory for information learned about the candidates; in fact, little of the information which informed the tally can be expected to remain in memory. Lodge and his colleagues, recognizing that voting is ultimately an evaluation task, argue that the on-line model is a better descriptor of how people process campaign information. Their numerous experiments have consistently shown people do appear to use an on-line tally, rather than some type of memory process

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[3] One well-known theory of the meaning of party identification works very much like an on-line tally. Fiorina's (1981) model of party identification as a repository for prior evaluations of party performance in office acts quite similar to an on-line tally. Partisans may not be able to tell exactly why they support a particular party, but despite this, there is a lot of information encompassed in the party attachment. Further, Fiorina envisions party identification as fluid, changing as new information is encountered about party performance.

[4] If there is no pre-existing tally, as would be the case for the first encounter of a new political figure, then a new tally would be created based on whatever information is first encountered. The new tally would then be stored in memory.

when evaluating political figures. They have routinely shown that there is no connection between the contents of memory and the evaluations their subjects report. The cognitive miser does act efficiently.

Implications of the Cognitive Miser

But, why does it matter whether people function as cognitive misers? Since political scientists agree that existing models of the vote do an very good job of predicting vote choice, why should there be any concern about how people process the information which leads to their decision? If voting *behavior* can be modeled accurately, of what value is it to understand the decision *process*? One reason has already been alluded to above -- existing research paints a negative picture of the voter as citizen. Unable to give a good account of his or her vote, and unable to tell us much in detail about politics and elections, we find voters to be almost derelict in carrying out their civic duty. Existing ways of looking at voter decision-making makes political scientists wonder how voters could ever manage to pick the candidate who is "right" for them. Even recent explanations for voter accuracy, such as Popkin's (1991) low information rationality, take as given that vote choices are made with very little real information.

Of course, if it were only political scientists who held a dim view of voters, this might not matter much at all. But, our view of voters has become the conventional political wisdom -- issues don't matter, and flash is everything. The pictures we paint affect how politicians view voters and how they then respond to them. Further, an electorate that is truly uninformed and making vote decisions on the flimsiest of data, is an electorate that cannot exert reasonable control over its representatives. If politicians believe that voters are not paying attention to what they do, they begin to believe that they can make decisions with impunity. The link between those who govern and those who are governed is easily broken. But, if the on-line model is an accurate description of how people process information, then voters may well be taking large amounts of information into account in their evaluations of candidates -- large amounts that they cannot later regurgitate to the survey researcher. Why not? Because by processing it on-line and making evaluations on the fly, voters have no need to keep the details in memory, once they are included in the on-line tally. That information that does end up in long term memory is but a small portion of what actually went into the decision.

Taking this to its logical conclusion there is no reason for memory to play any role whatsoever in voter decision making, and Kelly & Mirer are simply wrong. If this is the case, then anything voters tell us after the decision has been made represents rationalizations, rather than memories. Recent research by Rahn, Krosnick, and Breuning (1994) has come to a similar conclusion. They find strong evidence that our standard open-ended National Election Study questions elicit responses which simply do not connect with the actual vote choice. They argue that our traditional survey based methods of getting at vote choice cannot be counted upon to measure what we have thought they were measuring. This methodological problem, then, represents a second reason why it is important to understand how voters reach their decisions.

The standard approach to determining the reasons for a voters choice is to ask a series of open-ended questions requiring respondents to list their likes and dislikes about the candidates. This questioning takes place after the election, after the decision has been made. Voters are expected to recall from memory reasons why they supported or opposed a candidate. But, if Lodge, and Rahn, and the psychologists who tell us that we make most evaluations on-line are correct, these recollections do not necessarily represent the reasons that really went into the voter's decision. Several problems arise in considering these statements to be good indicators of the reasons for a vote decision. First, there is no reason to expect that the contents of memory after the election either contain exactly all of the

information that was encountered, or even an accurate subset of it. Instead, memory is selective and non-permanent. Memories that are retained are biased (Lodge, McGraw, and Stroh, 1989) and thus non-representative of the information that went into the decision. The information that does make it into long-term memory is not always readily accessible once the task of voting is complete. Once the election is over there is no reason to access the memories about the candidates, and the links that allow access begin to degrade. (Lodge, Steenbergen, and Brau, 1995.) A survey researcher asking open ended questions after the election is over should not expect to hear detailed responses that meaningfully relate to the actual decision.[5]

Process Tracing Methods

If the on-line model accurately represents how voters process campaign information, then survey methods cannot adequately capture the data necessary to understand how people use campaign information; we must go beyond reliance on survey techniques, both cross-sectional and panel. Psychologists have long used a methodology called "process tracing" in order to understand decision-making in many different realms. Process tracing starts with the basic assumption that decision-making in any realm is best studied by collecting data while the decision is actually being made (Ford, Schmitt, Schechtman, Hults & Doherty, 1989; Jacoby, *et al*, 1987). Two major techniques have been developed to study this process, verbal protocols (Ericsson & Simon, 1980) and information boards (Payne, 1976). With verbal protocols, subjects are asked to "think aloud" while they are making a decision. These protocols are recorded and later transcribed and coded. Information board techniques present subjects with an m x n matrix of information. (See Figure 1). Subjects then choose among several alternatives (columns of the matrix) which differ on one or more attribute (rows). This technique has been widely used in consumer research, where subjects turn over cards containing attribute labels in order to read the detailed information about that alternative-attribute pair. The researcher records the order in which items are chosen and then analyzes this protocol to determine the types of search patterns employed during the information acquisition process. The amount, type, and direction of the information searched has a direct impact on the decision made.

Insert Figure 1 about here

Process tracing techniques seem to be readily applied to decision making in a number of contexts, including selecting between product brands (Bettman & Park, 1980) and choosing an

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[5] Voters may not be able to respond to survey questions in a comprehensive way not because they did not pay attention to the issues, but simply because once they extracted what they needed from the information about issues in order to update their OL Tallies, they saw no reason to keep the details. Thus, the lack of consistency found in answers relating to candidates and elections may simply represent the cognitive miser at his or her best. It is important to note that the on-line model is a model of person perception. That is, it purports to describe a process by which voters evaluate a political candidate. It does not describe how people might perceive and maintain information about issues themselves. Thus, it does not negate the possibility that survey research might continue to be a good way to understand where people position themselves on issues and to what extent they think about those issues. What it does suggest is that those parts of surveys dealing directly with candidates -- "Why did you vote for X?"; "Where does X stand on issue Y?"; "What do you like/dislike about X?" and the like should be suspect.

apartment (Staelin & Payne, 1976). But, while these boards have had a long and fruitful history in the study of decision making, they have rarely been applied to making decisions between candidates. Only two studies appear to have used this technique. Herstein (1981) used a traditional information board to trace evaluation of two candidates on a number of different attributes. In addition, he had his subjects "think aloud" as they viewed information about the candidates. His analysis of both the information search patterns and the verbal protocols were groundbreaking, resulting in little evidence for the standard voting models. He proposed a fairly simple, yet powerful, model of the vote decision based on the cognitive abilities of his subjects.[6] More recently, Riggle and Johnson (1995) have begun to employ a computerized information board (still designed in the classic matrix form) to study age differences in political decision-making, using a senatorial election as the decision task. They identified seven prototypical search patterns, finding that older subjects were much more likely to engage in searches within candidate, using a satisficing strategy (Simon, 1956) to determine their final choices.

While both studies use process tracing techniques effectively, they rely on static information boards, with all possible candidate-attribute pairs always accessible to subjects and where subjects could spend as much time as they wished learning about the candidates with no risk of missing any information. This, despite the fact that political campaigns are dynamic events, where the information environment is constantly changing. Because elections take place over a significant period of time, information about candidates comes and goes, as the media focus first on one event, and then on another. Information that is available about a candidate today might not be available tomorrow. Further, information available about one candidate may or may not be available about another.

Most people learn about political candidates through the mass media. In some types of media -- generally print media -- the information "flow" is primarily under the control of the voter. That is, the reader can choose to read some stories, ignore others, and skim still others. While the occasional large photo, or headline, might be viewed almost involuntarily, readers still have most of their information acquisition options fully under their own control. The electronic media, on the other hand, is far less under that control. Where it is easy to jump around in a print story, skipping a part and paying attention to another part, it is generally impossible to do so with television and radio. Likewise, one may tend to store print materials and read them at another time, while few people tape the news on television to do the same. However, all media share the same feature of transience. That is, stories that appear on one day as "news" will not often appear the next, unless there is an ongoing story. But even stories over several days eventually die out. Thus, the voter who is not paying attention while the media cover allegations of misdirected campaign funds, for example, will find it hard to get that information once the story is over. Clearly, a static information board approach to studying this process fails to take into account this transience. Yet, survey research can do little better. What is needed is a process tracing methodology that can model the dynamic flow of electoral information. Process tracing has proven itself

[6] In addition, Herstein came up with the singularly surprising conclusion from this research that party identification was not very important in determining the vote choice. This result, I believe, is an artifact of the static nature of the information board and the easy accessibility of all types of information, as well as a choice made in analyzing the data. Herstein made an inaccurate assumption that a subject would choose party identification for both candidates, in the same way that one would look at an issue stand for both to get all necessary information. However, unlike issue positions, once a subject chose party for one candidate, the party of the other was automatically known, meaning there would be no need to choose that card. Because of the way Herstein counted accesses of information, party then appeared to be much less important, since it was not accessed across both candidates on a regular basis.

as a good way to understand complex decision making. And, from a political science point of view, voter choice during a political campaign is certainly a complex decision.

In order to better understand this complex process, Richard Lau and I have revised the traditional static information board, modifying it into a dynamic, ever changing design, which better mimics the flow of information during a presidential campaign season (Redlawsk, 1992; Lau and Redlawsk, 1992; Redlawsk and Lau, 1995; Lau and Redlawsk, in press). Where the static board allows subjects to have access to all available information at all times, the revised 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 mock 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. Where standard information boards are static and easily managed by the subject, we believe that election campaigns are dynamic and unmanageable. Thus, our election simulation overwhelms subjects with information. Where standard information boards allow all information to be available whenever a subject wants it, information during a real election campaign contains a "here today; gone tomorrow" quality, as does our simulation. And, where the standard information board would make all types of information, from positions on arcane issues to party identification, equally accessible, our simulation models the relative ease or difficulty of finding certain kinds of information at different times during a campaign.[7]

We accomplished these goals by designing a radically revised information board in which the information (or rather, the attribute labels) "scrolls" down a computer screen, rather than remaining fixed in place. (See Figure 2 for an example of the screen.) There are only a limited number of attribute labels visible on the computer screen at any one time. Most include a candidate's name and the particular information that would be revealed if this label were accessed. (e.g. "Martin's stand on Star Wars") The rate of scrolling is such that most people can read two or three labels before the position changes. Subjects access the information behind the label by using a mouse to click on the label. The scrolling continues in the background while the detailed information is read, creating a "cost" in terms of missed information and mimicking the dynamic nature of election information flow. This scrolling format allows only a small subset of a very large database of information to be available at any one time, and it makes the task of processing campaign information much less manageable for the subject. In addition, the relative likelihood of any particular piece of information becoming available is controlled, so that some information (like party identification) is much easier to get (appears much more often) than other types of information (such as an obscure policy position).

Insert Figure 2 about here

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[7] To make the probability of different types of information becoming available realistic, Lau conducted an elaborate study of the prevalence of different types of information in newspapers during the 1988 presidential election (Lau, 1992.) The probabilities were modeled after the actual prevalence of those types of information during the 1988 campaign.

On-line versus Memory-based Processing

It might be useful to summarize the points made so far. First, traditional voting models require the commitment of significant memory resources on the part of voters. Second, open-ended survey questions give us the impression that voters take very little real information into account when they make their decision. But, Lodge has suggested that it is not the voters who are flawed, but our understanding of what they really do. If, as he argues, voters process the election in an on-line manner, then our open-ended questions are eliciting rationalizations, rather than reasons. Rahn's recent work seems to support this position. I argue that the way to get at this question is through the use of a dynamic process tracing technique. A dynamic process tracing methodology allows a better comparison the two competing models -- on-line and memory-based -- than other methods previously available. But there is a far more interesting question that needs to be explored than simply a comparison of the two models. Despite the effectiveness of Lodge's argument in favor of on-line processing, there is a potentially serious flaw in the design of the experiments he and his colleagues have used to develop their model. It is likely that this design flaw has seriously understated the role of memory in a real-world election campaign.

Lodge suggests that memory should play no role at all in the decision making process, given the existence of the on line tally. Yet, in previous studies Lau and I have completed using our dynamic process tracing design, we have found that memory does count (Lau and Redlawsk, in press). Importantly, memory appears to us to be a critical variable in whether a voter manages to pick the "correct" candidate to support.[8] Voters in our studies who show a more effective use of memory also show a greater likelihood of casting an accurate vote. Even so, it is clear that much of the evaluation that takes place, does so on-line. Memory appears to play its important role when information comes at the voter in a chaotic, unorganized fashion, which is, of course, the essence of a political campaign. However, the Lodge model as currently formulated has been developed primarily from experimental research involving single political figures. Lodge (1995) suggests the process that would be used in an election would parallel that used in his single candidate studies. Voters are thought to maintain distinct tallies for each candidate tied to the long term memory knowledge structure of that candidate. Upon being called to make a choice (which does not have to be in the voting booth,) the voter retrieves each OL tally and makes a comparison between them, choosing the candidate with the highest value. Direct comparisons are not otherwise made between candidates, as is required by spatial models. Indeed, in this respect Lodge's approach is similar to Kelley and Mirer (1974) who argue that voters simply sum up likes and dislikes about each candidate and choose the one with the best score. Though the similarity is striking, Kelley and Mirer see the "summing up" as a process that takes place from information in memory when the choice is to be made. Lodge also differs from Kelley and Mirer in arguing that the OL tally does not represent an additive total of each piece of information. Instead, it represents an *averaging* process, where each new piece of information is averaged with existing information, rather than simply added to it. Lodge takes this to mean that early information carries more weight than later information,

[8] By correct we mean the candidate in our simulation closest to the voter on issues, ideology, and group affiliations. See below for a description of how this measure is developed in this paper.

making the order in which information becomes available during the campaign an important factor in vote choice.[9]

A primary reason why Lodge's studies have consistently shown memory to be unimportant may be that until recently, all of his reported studies used only one political figure. Subjects were not asked to choose, as they do in an election, but simply to evaluate one politician. Under such circumstances people could be expected to use an on-line evaluation process.[10] There can be little doubt that an on-line evaluation process pertains to evaluations of single political figures, outside of the election environment. It is less clear whether these findings hold in an election contest. Elections entail two or more candidates who must be compared to each other as well as to the voter's own ideal point. This may generate a different process altogether. Recognizing this, Lodge has recently extended his basic experiment to a two candidate condition. (Lodge, Steenbergen, and Brau, 1995) Yet there continues to be no role for memory to play in Lodge's model. This result is not surprising. The Stony Brook research does not attempt to mimic the dynamic flow of a campaign in the experiments. Instead, in the two candidate design, information was presented to subjects in an easy to read and compare form -- with one candidate next to the other, much like the static information board approach. Thus, subjects could easily make comparisons between the candidates, greatly facilitating their decision task, and eliminating the need to remember specifics. This flaw would be of no consequence if information during a dynamic real-world political campaign were organized in such a fashion, so that whenever one candidate's position on an issue was presented, the other candidate's position would be listed as well, in easily comparable form. But, in the real world, this rarely happens. Instead, voters may receive candidate A's position on welfare today, and candidate B's next week. In order to make a direct comparison, it is necessary for that voter to remember candidate A's position, when encountering candidate B's stand. Thus, the voter who wishes to make direct comparisons between candidates is required to find some way to maintain information beyond the requirements of the on-line model.

Extending the on-line model to the two (or more) candidate election is necessary in order to fully realize the power of this model to actually explain how voters make a decision. If the model holds only for evaluation of single political figures, then it does not move us very far to understanding voting, which is inherently a contest between multiple candidates. On the other hand, there is every reason to think that the basic model will hold for elections, which are inherently more complicated than the evaluation of a single candidate. After all, one of the values of the on-line model is that it accounts for the limited information processing capacity of humans. If this simplifying process is used in the relatively simple case of forming impressions of a single individual, then it would be all the more likely to be used in the more complicated case. But this must be tested. Further, conditions under which on-line processing is likely to appertain during an election must be established. Do all voters approach election campaigns in this manner? Or are some voters motivated by various factors to attempt to maintain greater memory stores which they actually do consult in order to make a decision? Perhaps there is a difference in a relatively simple election campaign -- two candidates of significant ideological distinction compared to a multi-candidate election in which ideology is blurred. It may also be that the

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[9] This represents a "primacy" effect, where information that is learned first is more important than that which is learned later. Lodge reports that studies in their laboratory have shown that the importance of new information and its ability to adjust the OL tally decreases in a curvilinear fashion.

[10] In fact, Lodge and colleagues (1989), following Hastie and Park (1986), note that subjects can be expected to default to on-line processing, when the task is defined as an evaluation task. Lodge's experiments include a manipulation designed to force subjects into memory-based processing, by short-circuiting the evaluation process.

information flow during the course of an election campaign has an impact on the use of memory. Perhaps some voters actually are interested in making direct comparisons about candidates. If so, information flows during campaigns are rarely accommodating. Instead, information may appear about one candidate at one point, and the same information may appear about another candidate at another point in time. This would then require the voter interested in making these comparisons to store the first candidate's information in memory, in order to use it later to make the comparison. Thus, there may be a set of voters for whom memory is a more important factor than the on-line model currently specifies. This project is designed to investigate the conditions under which memory plays a role in voter decision-making. To examine memory and its impact on information processing during an election campaign, several questions are explored in this paper.

Question 1: What types of memories are reported and who reports them?
Question 2: How does memory compare to the information actually viewed by voters during the election campaign? Is memory a veridical representation of the information encountered, or are some types of information more likely to be remembered?
Question 3: Are the memories reported by voters accurate?
Question 4: Does memory "matter"? Can memory be used to improve predictions of the vote choice? Are subjects with more accurate memories more likely to make a better quality decision?

Experimental Design

An experiment using the dynamic process tracing methodology described above was designed to examine the questions raised about the use of memory by voters. The experiment had at its heart the simulation of a presidential primary election campaign, presented on a computer screen over a twenty minute time period. Subjects participated in this mock primary election by viewing labels describing information about the candidates, and using a computer mouse to select labels of interest. These labels scrolled down the screen at a fairly high rate of speed, creating an environment in which a great deal of information was available. Behind each label was a more detailed statement about the candidate. There were six candidates in the primary election, split between the two parties. Subjects had to register for one of the parties prior to the election, and then could only vote for the candidates from within the chosen party. The six candidates were designed to be very realistic and were dispersed along the ideological lines appropriate for their party. However no candidate seemed too much like an existing "real-world" candidate. 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.

Three manipulations were embedded in the primary election, in order to test the hypotheses about processing modes and memory, resulting in a 2 X 2 X 3 design. Manipulation one was designed to place subjects into one of the two processing modes, either memory-based or on-line. One half of subjects were randomly assigned to each condition. Research has clearly shown that on-line processing is the default method by which people evaluate social information (Hastie and Park, 1986; Lodge, McGraw and Stroh, 1989; Lodge 1995). Given that all subjects knew they had to vote for one candidate, the incentive to form an evaluation and thus process on-line was strong. To counter this, 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. Further, they were also instructed that they would have to justify their vote choice to the experimenter (Lodge, 1995). These instructions, at the

beginning of the primary election simulation, were presumed to create a barrier to on-line processing, and to force subjects to operate in a memory-based mode.

The second manipulation varied the number of candidates a subject would face 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 other subjects had only two candidates to choose from in their party. This manipulation was added 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 made ideologically distinct.

Finally, a third manipulation was designed to force subjects to make evaluations at different points in the campaign. One third of subjects were forced to select a candidate in a "Gallup Poll" that came just over 6 minutes into the simulation (about one-third of the way through the campaign). The second third answered the poll at about 13 minutes. The final third was never polled, and thus made their evaluation at the end of the campaign by voting. This manipulation served to test arguments of the on-line model that suggest choice is simply a matter of recalling tallies, rather than searching contents of memory. Recalling the OL Tally should take no greater time whether done early or later in the campaign, where searching the contents of memory could be expected to require more time as the election went on. On the other hand, it is possible that easily accessible memory is saturated very quickly, so that even one-third of the way into the campaign, the subject has "filled" memory. If this is the case, rather than taking any longer later in the campaign to search memory, subjects may simply be searching the same amount of memory space, but filled with only the most recent memories. The results of this manipulation will be explored elsewhere.

The experiment was in the field from October through December 1994. During that time 102 subjects were recruited from central New Jersey using incentives to groups to have their members participate. Three subjects were unable to complete the experiment, leaving 99 subjects for analysis. Each subject who completed the experiment earned $20 for his or her time, which was usually donated to the group to which they belonged. With the exception that roughly two-thirds of subjects were female, those recruited were broadly representative of residents of central New Jersey, though no particular effort was made to ensure this.[11]

Upon arrival, subjects were given a consent form to read and sign, and the basic outline of the process was explained. The session began with a standard political attitudes questionnaire, but with a twist. After four open-ended questions on paper, subjects self-administered the rest of the questionnaire on the computer. This served to simplify data coding for the experimenters and to familiarize subjects with the use of the computer and mouse. In addition, the data collected by the questionnaire was used to assess the closeness between each candidate and the subject on a number of dimensions. This allowed me to form an assessment of whether a subject voted for the correct candidate, as well as determine the difficulty of the choice made by each subject.[12] Upon completing the questionnaire, subjects were then assigned by the computer to one of the twelve experimental conditions for the mock presidential primary election.

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[11] The average age of subjects was 49.2 years. The pool was relatively well educated, 89% had attended college and 58% had earned a BA or higher degree. 13% of subjects had a household income under $25,000; 62% had incomes of $25,000 to $74,999, and 25% earned over $75,000. 93% were white. Partisanship, including independent leaners was distributed as 57% Democrat, 7% Independent-Independent, and 36% Republican.

[12] See Lau and Redlawsk, 1992, for a complete discussion of the many options for determining a correct vote. The particular method used in this analysis is detailed below.

During the campaign simulation statements about candidate's issue positions, personal traits, group endorsements, and polls were available to subjects. Subjects used the computer mouse to choose the information they wanted to examine. In addition, from time to time, campaign videos which were not under the subject's control appeared on the screen. Further, there were headlines simulating walking past a newsstand, that appeared and disappeared with regularity. The type of information available to subjects changed as the campaign went on.[13] Upon completion of a twenty minute election campaign simulation, subjects voted, evaluated the candidates, and took a memory test (unexpected for those in the on-line condition). The memory test consisted of six pages, each headed by the name of a candidate. Subjects were told to list everything they could remember about each candidate, no matter how trivial. They were then given a separate sheet of paper and asked to list everything they liked and disliked about their preferred candidate. The experimenter then read each listed memory to the subject and asked for an assessment of whether the memory made the subject "feel good, bad, or neutral" about the candidate, coding the answer on the memory form.

At this point an extensive debriefing began.[14] Subjects were shown the script of all information chosen during the campaign. The experimenter went through the script step by step asking the subject to recall what he or she was *thinking* while reading the information. This detailed debriefing is a modification of the Ericsson and Simon (1980) "think-aloud" protocols, which provided critical data on the nature of the ongoing evaluations. This approach was chosen to minimize the intrusiveness, while still retaining the ability to collect data on subjects' thoughts as they processed information. By using a cued recall process an accurate recollection of subjects' attribute by attribute evaluations can be developed. Subjects were also asked to evaluate the information they viewed as positive, neutral, or negative. This debriefing was tape recorded to ensure accuracy. Finally, the purposes of the study were explained and subjects allowed to ask questions. The total time required for each subject was about 2 1/4 hours.

Coding and Key Variable Construction

A note about the construction of the decision accuracy variable is in order. The purpose of this measure is to assess whether or not subjects managed to find the "correct" candidate in their primary election. Each party had four candidates available, from which either two or four were selected by the computer, depending on the candidate number manipulation to be faced by the subject. When subjects faced four candidates in their party, the four were arrayed across the party spectrum, including one "extreme" candidate (very conservative Republican or very liberal Democrat), one "modal" candidate (to look like a typical Republican or Democrat), one "moderate" candidate (a liberal Republican or a conservative Democrat) and a "crossover" candidate (taking positions on both sides of the political spectrum). When faced with only two candidates in her party, a subject saw only the "extreme" and the "moderate" candidates from her party.[15]

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[13] A Study by Lau (1992) of newspaper coverage of the 1988 presidential election campaign was used to help develop the probability of any given type of information being available to subjects at any particular point in the campaign. See Lau & Redlawsk (1992) for details on how these probabilities were determined.

[14] It is not strictly appropriate to call the process a *debriefing* although I use that term for convenience. Where a typical debriefing is to answer any questions the subject may have and to inform the subject as to the purposes of the study, this debriefing process is integral to the data collection effort of this project.

[15] Note that subjects always saw six candidates in all -- those seeing four in their own party, also had two candidates from the other party during the campaign, while those in the two candidate condition for their own party, had

For any given subject it is possible to use various approaches to construct an indicator of the distance between the subject and each of the candidates in the subject's party. There are several models that could be applied in this case. For this analysis I chose to use the Rabinowitz and MacDonald (1989) directional theory of issues in order to determine the issue distance between candidates and subjects.[16] However, issues are not the only information available to subjects -- and for many, issues might not be terribly important at all.[17] Accordingly, the calculation of distance between subject and candidates included issue distance, group endorsements, and candidate traits. Since the focus was on a primary election, party was constant across the set of candidates from which a subject could choose. Figure 3 shows how each of these factors was computed.

Insert Figure 3 about here

Two versions of each measure were developed. In the first, the normative assumption from the rational voting literature that voters should examine all of the information of importance for all of the candidates before making a decision was employed. Each distance was calculated assuming that subjects should have looked at all available information. This is the "full information" version. Alternatively, and more realistically, given time and information processing capacity limitations, distances could be assessed based on the information subjects actually examined during the campaign. That is, the calculations could use the subjects own "revealed preferences" to determine closeness to each candidate. In this latter configuration, only information actually viewed for at least one candidate was included in calculating issue, group, and trait distances.

After computing the distances between subject and candidates (and standardizing the results across subjects) the resulting values must be combined into a single measure of distance between subject and each candidate. Again, multiple approaches are available. One is to simply combine the three separate measures by giving equal weight to each. However, a more reasonable approach is to weigh each measure by the subject's own assessment of importance. As part of the pre-experiment questionnaire, subjects were asked to indicate their most important, next most important, and least important reasons for their presidential vote choice in the 1992 election. A list of ten reasons was presented. Included were reasons corresponding to issues, group endorsements, and candidate traits. The values subjects placed on each of these were then used to weight the relative importance of each distance measure.

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information available for four candidates from the other party. Of course, a reasonable thing for subjects to do, given that this was a primary election, was to focus only on their own party, and ignore all other candidates. However, because subjects knew nothing at the beginning about any of the candidates, to use this strategy would require first determining the party for each candidate.

[16] The more standard spatial model (Enelow and Hinich, 1984) was tested as well, and little difference was found between the two approaches. The directional model was chosen primarily because it seems to better describe the way voters conceive of issues and candidate positions on the issue, as comprising two parts: direction and intensity.

[17] Lau (1989) describes how different people may process political information in different ways, depending on their political schemata. For some people politics appears to be structured around issues, but for others group endorsements, political party, or candidate personal factors may be more important schemas.

Once a score was attained for each paring of candidate and subject, the final measure of decision accuracy was created by comparing the distance measure of the candidate the voter chosen with the value for the next closest candidate. If the subject chose correctly, the resulting measure would be positive, while an incorrect vote would result in choosing a candidate further away than the best choice, giving a negative value. The analysis on voting accuracy was carried out on both the "full information" measure of accuracy and the "revealed preferences" measure, using these importance weights as the means for combining the separate components.

In order to determine the contents of memory after the election campaign, subjects were instructed to list everything they could remember about each of the six candidates (including those within the subject's party and those from the other party). The memories were counted for each candidate for each subject. In addition, coders assessed whether each memory could be considered to show issue, group, party, hoopla (polls and "horserace" information), or trait content, and labeled each accordingly. Memories that could not be assessed for content were included in an "other" category. In order to determine whether memories of the candidates were accurate or inaccurate, a comparison of each memory was made to the information from which it appeared to have come. Most memories could be easily scored as accurate or inaccurate. Those that could not were ignored for this measure.

Memories were also coded for valence, as either positive towards the candidate, negative, or neutral (where the valence could not be ascertained.) A summary measure was created for each candidate, which simply subtracted negative memories from positive memories to give an overall memory affect score. For the analysis attempting to predict the direction of the vote, the memory affect score for each candidate was used to predict which candidate would have been preferred by this measure. That prediction was then used as one of the independent variable to attempt to predict the actual vote. The memory accuracy score for each candidate was also used to predict a memory accuracy-based vote, which was entered into the analysis of the direction of the vote as well.

Results

What types of Memories are Reported?

As an initial step, it is important to determine whether the memory/on-line manipulation worked as anticipated. One simple check is to examine whether there are any systematic differences in the information that was examined between the two conditions. The most obvious difference might be in the amount of information acquired by subjects during the course of the campaign, as measured by the number of unique items that were examined by each subject. Even though the order in which information became available on the screen was randomized, every subject had the opportunity to access every piece of information in the simulation. Table 1 describes the amount of information selected by subjects. The first section of the table examines the main effects of the processing mode and task demand manipulations. The overall mean number of items viewed during the twenty minute campaign was just over 74 unique pieces of information. No significant difference is found in either of the two manipulations; whether facing a two candidate primary or four candidate primary, subjects chose about the same number of items to study. Likewise, the mode of processing -- on-line or memory-based -- seemed to have relatively little impact on the number of items viewed; although on-line processors examined slightly more information, the difference is not significant. Because political expertise might

be a factor in whether subjects examine information, subjects were assigned to either low expertise or high expertise, based on their responses to factual questions during the initial questionnaire, with an arbitrary split at the 50th percentile. As can be seen, however, there is also no difference in the amount of information examined for subjects with greater expertise compared to those with less knowledge about politics.

Insert Table 1 about here

However, because there was a large difference in the difficulty of the task faced by subjects based on the number of primary candidates in any given subject's political party, it makes sense to examine the processing manipulation further. While the two candidate condition was relatively easy -- candidates were ideologically distinct and subjects needed to keep track of information about only two candidates -- the four candidate condition could be expected to put greater strains on the cognitive processing of subjects. Thus, while the instructions to memory-based subjects that they would have to recall information might not interfere much in the two candidate condition, for those facing a choice among four candidates and a demand that they recall information and justify their choice, memory processing might require more time spent on any given item, thus limiting the number of items that could be viewed. As the second part of Table 1 shows, a significant difference in the amount of information examined does exist for the four candidate condition only. Subjects in the two candidate condition show no difference whether they are in the on-line or memory condition. But for those in the four candidate condition, on-line processors were able to look at significantly more information than memory processors (79.8 items *vs*. 67.0 items, $p < .05$). It is clear that under certain conditions -- for example a more difficult choice -- the experimental manipulation to force subjects out of their default on-line processing mode was successful.

Turning the focus to the memories reported by subjects, we find, as we might expect, far fewer memories reported than number of items actually examined. Table 2 lists the overall number of memories reported by subjects, along with a breakdown by type of memory. Overall, subjects reported a mean of 11.20 memories across all six candidates. Memories were much more likely to be positive than negative (5.76 positive memories compared to 2.86 negative memories per subject). In general, issues led the way, with subjects reporting more memories that related to issue positions by the candidates than any other. Person memories were next, followed by party memories.[18] Reports of endorsements (group

[18] Note that the upper limit on the number of party related memories is six, since this is simply a count of whether or not the subject noted the party of each candidate on the memory form. The fact that party is third in the number of memories is not to say that party is not important to subjects. Overall, 73% of the memories reported were listed for candidates from within subjects' political party. Only 27% were listed for the candidates outside of the party. For those subjects with only two candidates in their party, nearly 63% of memories were for those two candidates, compared with an expected 33% if party did not matter at all. For those in the four candidate condition, 82% of memories were attached to those four candidates. Of course, since this was a primary election, one could argue that subjects should not have looked at all at the other party, focusing only on their own. As it turns out, while subjects recognized they could not vote for candidates from the other party, many noted in debriefing that they were interested in who the other party might be supporting in the general election, and therefore spent some time looking at candidates outside of their own party.

memories) and campaign hoopla (polls, slogans, etc.) trailed behind. These summary measures mask some significant differences in memory recall across experimental conditions, particularly differences between those subjects facing a relatively easier campaign (only two candidates from which to choose) and those facing a more difficult choice (the four candidate primary election). As shown in Table 3, there is a significant difference in the total number of memories reported by those in the two candidate condition and those in the four candidate condition, with subjects in the less demanding situation reporting more memories ($t=2.34$; $p<.05$). Subjects who had a harder time distinguishing their choice appeared to have been unable to retain nearly as much information in memory. In particular they reported fewer issue and group based memories. In addition, they were less likely to note the party of the candidates on the memory form. Interestingly, however, nearly all of the difference between the two groups can be accounted for by the difference in negative memories. That is, those in the four candidate condition reported significantly fewer ($t = 3.81$, $p < .001$) negative memories than those in the easier condition. It appears that unfavorable feelings about the candidates are more quickly forgotten when task demands become greater.

On the other hand, there appears to be no difference in the types or amounts of memories reported based on mode of processing. Whether subjects were in the on-line processing condition (presumed to be the default condition) where the main goal was evaluation and choice, or in the memory-based condition where subjects knew they would have to list what they remembered about the candidates, about the same number of memories were reported (Table 4). In fact, if anything, those in the on-line condition reported slightly more memories than those in the memory condition! On-line subjects reported slightly more hoopla memories and person memories, while memory processors reported more issue, party, and group memories; however, none of these differences reached significance. This result, however, cannot be interpreted as a failure of the processing manipulation, as there is no reason to expect differences in the raw numbers of memories reported. Since working memory is severely limited (Miller, 1956) and subjects had available extremely large amounts of information compared to memory capabilities, it is likely that working memory filled quickly whether subjects were in the memory-based or the on-line condition. When called upon to report memories later, both groups were limited by this bottleneck.

Insert Tables 2, 3 and 4 about here

Memory as a veridical representation of information encountered

In their analysis of the lack of importance of memory in an on-line evaluation process, Lodge, McGraw, and Stroh (1989) argue that the contents of memory for their subjects are not a good representation of the information that was actually viewed by the subjects. Using both recognition and recall memory, they show that subjects have a significant amount of inaccuracy in their memories. There are two parts to this inaccuracy. First, people may not retain in memory a veridical representation of that which they encountered. That is, the memories that are reported may not correlate with that which was viewed in the first place. And second, the information they do actually manage to retrieve from memory may be inaccurate. Table 5 explores the first of these points; the degree to which the memories reported by subjects in the election simulation relate to the items actually viewed during the

campaign. The first column represents the share of each type of information viewed during the campaign.[19] On average, issue and person information were most often examined, each with a 35% share of all the information viewed. Hoopla and group information follow. The second column of Table 5 shows the average share of each type of memory reported. It is immediately clear that the items reported from memory across all subjects are not very representative of the items actually viewed. Instead, issue information is greatly overrepresented in the memories listed, while all other types of information are underrepresented. This pattern holds whether subjects were in the two or four candidate primary. It also holds for the processing type manipulation -- in all cases subjects overreport issues and underreport most of the other types of items. During this mock election campaign voters actually viewed candidate centered information to a greater degree than issue information, but they uniformly across manipulations recalled issue information to a much greater extent.

Patterns of reported memories do not appear to differ very much either across or within the task demands and processing manipulations with one exception. In the processing manipulation, there is a significant difference between subjects who were in the on-line condition and those in the memory condition in the share of issue-based, and to a lesser extent, person-based information they remembered as shown at the bottom of Table 5. Those in the on-line condition reported a significantly smaller share of issue-based memories than those in the memory condition ($t=1.67$; $p<.10$) while reporting a larger share of person-based memories ($t=1.55$, $p<.15$). There seems to be a bias towards reporting issue memories among those who were told they would have to report their memories after the simulation. Yet, there is no difference in the amount of issue-based or person-based information these two groups examined. Thus on-line processors viewed the same information as memory processors, and recalled about the same number of memories, but their memories are skewed away from the issues and more towards the candidate. In either case, however, reported memories do not match closely the items actually viewed during the campaign.

Insert Table 5 about here

Memory Accuracy

In addition to the question of whether memories truly represent what was originally encountered there is the question of whether the memories that are reported are accurate ones. Table 6 examines the overall accuracy of memories reported for all candidates, for candidates only from within the primary party, and for the candidate ultimately selected by the voter. Not every memory listed by subjects could be scored for accuracy. Memories that did not include enough detail about a position or trait (for example, a subject might simply list "his foreign policy" as a memory) could not be scored for accuracy in many cases. However, across all subjects an average of more than 85% of memories that subjects listed could be scored for accuracy. This did not vary much across all memories, party only memories,

[19] 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. This means that party memories are not directly comparable to party information accesses, and therefore are dropped from this analysis.

and memories for the voter choice. Overall, an average of nearly 10 memories per subject could be scored for accuracy. In general, these memories were highly accurate, with about 4 in 5 statements correctly remembered. This, too, did not vary whether the memories were global or focused on 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.

However, some type of screening did affect the likelihood of reporting memories at each level. Table 7 reports the proportion of all memories and of accurate memories compared to the number of items viewed for all candidates, candidates only from the subject's party, and the chosen candidate. The first part of Table 7 shows that information search was directed; random search would have resulted in an equal share of 16.67% of items viewed for each of the six candidates. However, subjects concentrated search on their party with in-party candidates each receiving an average of 21.6% of all unique items viewed. As subjects found a candidate they liked, they became more focused, so that the candidate subjects voted for received nearly one-quarter of all accesses of information.

Turning to reported memories in the middle section of Table 7, subjects had, on average, memories representing about 12% of the pieces of information they viewed for all candidates. For the information viewed within the subjects' party, this climbs to about 14%, while for the candidate they ultimately chose, subjects remembered about 19% of the information they viewed. Subjects clearly remembered more relative to what they viewed for the candidate they voted for, compared to all candidates ($t=7.60$; $p<.001$). In fact all combinations of differences between the three levels of memory are significant. The same pattern holds true for accurate memories. Subjects not only remembered more about the candidate they chose, relative to the number of items viewed for that candidate, 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, but they remembered a greater percentage of that which they viewed, and they remembered it fairly accurately.[20]

Insert Tables 6 & 7 about here

Memories clearly are not a veridical representation of the information that went into creating them. Voters showed a significant difference between the types of information they accessed during the campaign and the information that they reported as memories. However, what they did remember, they remembered with fairly good accuracy. Subjects were particularly good at reporting memories for their own party and for the candidate they ultimately selected.

How does Memory Affect the Vote?

[20] No significant differences were found in any of the measures of accuracy for on-line versus memory-based processors. For the task demand manipulation, some differences 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 would be expected, and are not reported here.

Traditional voting models focus on predicting the direction of the vote, using various personal characteristics of the voter along with candidate information such as issue positions to predict which candidate was chosen in the election. Table 8 lists a similar model obtained from the current project. Because of the task demands manipulation some subjects faced a choice from among two candidates, while others had to choose from four. In order to account for this problem, the vote choice was operationalized as a dichotomous variable with a moderate vote coded high and a more extreme vote coded low.[21] Because the resulting variable was dichotomous, logistic regression was chosen to assess the importance of memory in the vote choice. Logistic regression predicts the probability of an event occurring or not occurring, which is appropriate for determining whether or not a subject voted for the moderate candidate, compared to the more extreme option. (Norusis, 1994). Predictor variables included the experimental manipulations[22] and subject self-placement on a standard 7-point ideology scale, along with measures for the on-line tally and memories. The on-line tally measure was computed in accordance with the Stony Brook model, with each item examined by subjects compared to subjects' own position on the item and averaged into the overall evaluation for each candidate. The summary evaluations for the candidates were then combined into a single measure of a relative on-line tally.[23] For each memory reported by subjects, an affective value was also provided by the subject, so that each memory could be scored for "like", "dislike", or no feeling. A net affective memory score was then calculated for each candidate and then combined into a single comparative measure of affect associated with memories in the same fashion as the on-line tally measure. An interaction term between the processing mode and each of the on-line tally and the recall memory affect measures was also calculated. This was done to account for the presumed differential processing between subjects in the on-line condition compared to the memory condition.

The results of the logistic regression shown on Table 8 are quite clear. [24] Both the on-line tally and the memory affect predictors are substantial and significant, while no effects are discovered for the experimental conditions or subject ideology. The model predicts voting direction with a high degree of accuracy: over 90% of subjects are correctly classified. Despite the insistence of the Stony Brook model, there seems to be a role for memory to play in the vote choice itself -- those memories that subjects like or dislike about the candidates are predictors of the vote choice, even in the face of the on-line tally. The

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[21] In the two candidate condition, this coding represents the actual choice faced by subjects. In the four candidate condition, a vote for either of the two moderates was coded "0" and a vote for either of the two more extreme candidates a "1".

[22] The poll interruption manipulation was coded as two dummy variables to represent the contrast between those interrupted by the poll one-third of the way through the experiment and those interrupted two-thirds of the way through with those subjects who were not interrupted by the poll.

[23] The relative on-line tally measure was created by first calculating the on-line tally for each available candidate. Then, if the subject voted for one of the two extreme candidates, the tally for that candidate was assigned as the "extreme candidate tally." Likewise, if the vote was for a moderate candidate, the tally for the candidate selected was assigned to the "moderate candidate tally". In the two candidate condition, the tally for the candidate not chosen was assigned to the opposite category (extreme or moderate) from the vote choice. In the four candidate condition, the mean of the tallies of the two candidates in the opposite group was used. In both cases, the resulting "extreme candidate tally" was subtracted from the "moderate candidate tally" to create the comparative on-line tally measure.

[24] Interpretation of the coefficients from a logistic regression is not as simple as in linear regression. The model being tested is the probability of a correct vote, which is calculated as:

$$\text{Prob(Correct Vote)} = 1/1+e^{-Z} \text{ where } Z=B_0+ B_1 X_{1+ \ldots +} B_p X_{p.}$$

interaction terms make the nature of the role of memory and the on-line tally fairly clear. The interaction term between the on-line tally and memory processing is large, but not significant. Its negative sign indicates that the on-line tally is less diagnostic for subjects in the memory processing condition, but the lack of significance leaves little confidence in this finding. Instead, a more reasonable interpretation of these terms shows that the on-line tally matters even for memory processors. The effects of recall memory affect, however, seem to be strongest for on-line processors. The affect attached to memory was less important for subjects in the memory condition, as evidenced by the negative sign on the significant interaction term. Even so, it seems clear that both the on-line tally and memory seem to matter, especially for subjects in the on-line experimental condition, despite prior reports from Lodge and his colleagues.

Insert Table 8 about here

The affect attached to memories about the candidates clearly has an influence on the direction of the vote, even after accounting for on-line evaluation. I turn now to the question of whether memory affects the accuracy of the vote decision That is, are subjects who are able to remember more -- whether using on-line or memory processing -- better able to choose the candidate closest to their own positions? Using the accuracy measures described above, we can first examine whether voters are at all accurate in their decision-making. Table 9 lists some descriptive statistics that are quite telling. Overall, just under one-half of subjects voted correctly, using the revealed preferences measure. But this result masks significant differences created by the experimental manipulations. In particular, subjects who faced only two candidates from whom to choose in their party's primary (along with four candidates from the other party) were readily able to distinguish between them, with nearly 75% voting accurately. On the other hand, in the more difficult case of four candidates, subjects did very poorly, with only one-quarter picking the correct candidate. This result is not unexpected -- the four candidate condition included candidates who were quite close to each other in their issue positions and therefore hard to keep straight in the minds of subjects. The mode of processing appeared to have limited affect on accuracy. Subjects who were in the on-line condition were slightly more likely to be accurate, although the difference does not reach statistical significance. On-line processors should find their task somewhat easier than those who actively attempt to remember everything they can, since the process of remembering the information may well interfere with the evaluation process. In particular, as the bottom section of Table 9 shows, subjects who were expecting to be asked to remember things about the candidates and who faced four candidates were especially bad at finding the appropriate choice from among the four.

Insert Table 9 about here

To examine the impact of memory on the ability of subjects to choose the correct candidate multiple measures of accuracy were developed and tested. I began by analyzing the decision accuracy using first a normative measure (full-information) and then a more realistic revealed preferences

measure. OLS regression was chosen to test the models.[25] Initial models were constructed without memory. Independent variables included the experimental manipulations, measures of the difficulty of the choice and measures of the type of information search employed during the campaign, along with some basic subject background variables.[26] At the second stage, measures of accurate memories within the subject party and accurate memories for the chosen candidate were added. Within party memory, rather than all memory, was because the campaign was a primary election and memories for candidates outside of the subject's party should not be very important in the final decision. Once memory was added the difference between the models assessed.

Table 10 reports the results of these regressions. In the first part of the table, the results of the logistic regression without memory are shown. While it is beyond the scope of this paper to discuss the effects of each of these coefficients, it is clear that an accurate vote is affected by task demands and difficulty measures, as would be expected. Those subjects facing four candidates or facing candidates they find difficult to choose between are less likely to vote accurately. On the other hand, there were no effects on accuracy from the processing manipulation, nor were there any interaction effects between the manipulations.[27] Somewhat unexpectedly, the poll interruption manipulation degraded decision accuracy, for those subjects who were interrupted two-thirds into the campaign.[28] On the other hand, the measure of user difficulty -- that is, the trouble subjects had selecting the items they wished from the scrolling screen rather than accidentally clicking on something else -- had no effect on decision accuracy.

Of particular interest in the initial model, however, are the effects of the information processing variables in both models. The manner in which voters move between pieces of information seems to

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[25] The decision accuracy measures reported here suffer from being truncated at the high end. In order to assess decision accuracy the closeness calculation (distance between the candidate and the subject) for the preferred candidate was compared to the closeness calculation for the "best" candidate not selected by the subject. If a subject chose the best candidate, a score of "1" was assigned for accuracy. If she chose some candidate other than the best one, then the difference between the two candidates was assigned as the accuracy measure. Thus, a subject choosing the wrong candidate but for whom the two candidates are nearly indistinct, would receive a score close to 1, while a subject making a bad choice between two very different candidates, would receive a score much lower than 1. Forty-seven of 97 subjects voted correctly on the "revealed preferences" measure used here, while 50 subjects chose incorrectly. The truncated nature of the dependent variable is problematic for OLS regression; however, analysis with other constructions of the accuracy variable without the truncation problem produced similar results. The truncated decision accuracy variable was used because it's construction is more readily described and therefore clearer to the reader.

[26] The measure of difficulty was computed from the distance between the candidate selected and the next closest candidate, compared to the subject on issues, endorsements, and candidate personality traits. Interaction terms were computed between the manipulations, as appropriate, in an initial model test. No interaction terms showed statistical significance and were removed from the final equations. Information search was measured as the proportion of transitions from one piece of information to another which were within candidate (intra-candidate search) or within information types (intra-attribute search). (See Lau, 1995, for a detailed discussion on these measures.) The share of items on the computer chosen by mistake as reported by subjects was used as a measure of the difficulty of using the computer. Finally a measure of the degree to which subjects' issue positions were constrained on a liberal-conservative spectrum were included. Data for this measure were gathered during the on-line attitudes questionnaire preceding the experiment.

[27] The interaction terms were never significant or substantial and were removed from the final models.

[28] Although in hindsight, it seems reasonable to suppose the interfering with the process of examining campaign information to ask a poll would interrupt information processing. The interruption took the form of a screen which appeared stating that a Gallup Poll taker was calling and asking for an opinion of the form: "If the election were held today, which candidate would you choose" with the available candidates listed on the screen. The subject simply clicked on her preferred choice (one could not refuse to take the poll) and was returned to the campaign headline screen.

matter a great deal, especially in the revealed preferences model. When they choose to search for the same piece of information across multiple candidates -- intra-attribute search -- accuracy is improved significantly. On the other hand, when subjects search within candidates -- examining a single candidate on several dimensions in a row -- accuracy suffers. It appears that engaging in the kind of search required to compare candidates improves the accuracy of the decision.[29] This is so even though in this experiment intra-attribute searches might require a subject to have some patience since information common to multiple candidates was not always available at the same time. Subjects who waited to make sure they could access the same information for multiple candidates were rewarded by making a more accurate vote choice.

The second part of Table 8 shows the changes in the models when accurate memories are added as independent variables. Accurate memories clearly improve decision accuracy in both the revealed preferences and the full information models. However, the nature of this effect is somewhat unexpected. Rather than unequivocally improving decision accuracy, the effects of memories depend on what types of memories are being considered. Accurate memories for the candidate ultimately selected result in a more accurate choice, It would seem that the more subjects can accurately recall about their preferred candidate from memory after the campaign is over the better they did in making a choice, regardless of processing condition or task demands. But memories for the rest of the candidates in the primary election do not work the same way. A strong and consistent effect is found across all analyses that suggests that memory accuracy can also degrade voting performance, when the memories are for the less preferred candidates. Given limited information processing capacity and the working memory bottleneck, it would appear that memory accuracy has both a benefit and a price in terms of the quality of the decision.

Insert Table 10 about here

Discussion

What can now be said about the role of memory in political information processing? Do the memory based models which have predominated our thinking about how voters make decisions accurately describe the process? Or are Lodge and the other Stony Brook researchers accurate in their assessment that we should expect no real connection between the contents of memory and the vote decision? The issue is not simply one of academic interest. If voters routinely process campaign information in the on-line mode, then prior research may have systematically underestimated the factors that actually go into the vote decision, by focusing on what voters could remember after the election. This, in turn, may have led to a view of voters as uninformed and less able to fully participate in the election process. In an attempt to contrast the two models, this project was designed to place some

[29] Lodge (1995) argues that processing campaign information on-line, voters do not make direct comparisons, and do not need to engage in intra-attribute search. However no evidence was found in this experiment to support Lodge's position -- there were no differences between on-line and memory-based processors in the types of information search they use. Both were just as likely to search within attributes and across candidates, as if making direct comparisons.

voters into a memory processing mode, while allowing others to process is their usual, presumably on-line, mode. The resulting similarities and differences between the two groups are instructive.

On-line processors appear to be slightly more efficient, examining somewhat more pieces of information than did those in the memory mode, especially when the campaign is complicated by a large number of candidates. Subjects who did not expect to have recall what they saw examined about 18% more information in the four candidate primary, obviously spending less time on each item they viewed. On the other hand, there were no differences in the number of memories reported by the on-line processors compared to the memory subjects. This finding is somewhat unexpected, as Lodge argues that there is no reason to keep information in memory, and therefore, one would presume, less information available for recall when the unexpected memory test is given. In fact, since the memory processors, by definition, expected to have to recall information, it seems especially interesting that they could not recall any more details than those in the on-line condition. Further, those in the on-line condition were no less accurate in their recall than those in the memory condition. It seems that more campaign information actually is retained and organized in memory than would be expected based on the standard on-line model. This does not mean that Lodge is wrong and that voters make their decisions in a memory-based process. The nature of the memories reported tends to be quite general, in keeping with Gant and Davis (1984), rather than showing much detail. In effect people report summaries of what they viewed, and seem to be able to report these summaries whether or not they process the information on-line.

This study does confirm the long-standing recognition that the contents of memory do not necessarily reflect accurately the information that went into their development. The reported memories of subjects in this study consistently over-reported memories for issue positions, compared to the amount of issue information that they viewed. This finding is consistent across both the task demands manipulation and the processing mode manipulation. Issue information was generally well behind candidate based factors as the information viewed most by subjects. Yet, in nearly every case, more issue memories were reported, while memories for other information, person, group, and hoopla, were less prevalent than the information examined. Memory based processors had the largest difference, reporting a much greater share of issue memories at the expense of all others. On the other hand, on-line processors were more evenhanded, reporting the same share of issue and person based memories, although they examined significantly more person items. This finding might lead one to consider that more issues go into the decision making process than credit has been given for in the past. It may be true that issue information is less prevalent in the political environment (this was certainly true in this experiment). Yet, even so, voters cut through much of the noise and focused quite consistently on the issues as the memories that they reported. Even if the on-line model is correct, and memories are not closely linked to the decision choice, the fact that memory processors (where the decision and memories *are* linked) and on-line processors show the same pattern suggests that issues may have more power in the decision than might otherwise be expected.

Memories do appear to be focused much more on the candidate that is ultimately chosen than on the remaining candidates. This, of course, makes sense, since the voter has also generally spent more time examining information for the candidate ultimately selected. Across all manipulations, subjects consistently viewed more information for candidates within their party than those from the other party (which is completely expected for a primary election). Further they gave a significantly greater share of their attention to the candidate they ultimately chose, even compared to other candidates within the

party.[30] Total memories and accurate memories, as a share of information viewed, show the same pattern. What is striking is that the increase in memories for the selected candidate is quite strong; it is an increasing percentage of an increasing number of items viewed. Not only are more items examined for the candidate selected, but a larger percentage of those items result in recalled memories. Once again, this pattern holds true for on-line as well as memory processors. Both groups of subjects apparently organized memory in such a fashion that those memories representing their party and their final choice were easier to recall than memories for other candidates. But, interestingly, subjects were no more accurate in their recall of memories for their preferred candidate compared to any other candidate. Once again, there is some evidence for a memory process occurring, even in the on-line processing condition.

The Stony Brook on-line model has no place in it for memory. On-line processors, it is argued, do not need memory in order to make their evaluations. However, the model is predicated on the results of experiments which have mostly consisted of the evaluation of a single political figure using information in an easy to access, easy to study format. In the one two candidate experiment that has been reported (Lodge, Steenbergen, & Brau, 1995) subjects were handed an information sheet which listed the candidate positions side by side, much like a traditional information board. However, unlike an information board, the experimenters could not track the order in which subjects viewed the information, because all information was always in view on the page. Thus, strong statements that voters do not make comparisons across candidates when processing information on-line are generated not from empirical evidence, but from assumptions about how on-line processing proceeds.

The empirical evidence presented in this paper -- from an experiment which more realistically presents campaign information -- argues strongly for a rethinking of the role of memory in political information processing. This is not to say, however, that voters do not process on-line. In fact, they may process the vast majority of information they encounter in just such a fashion, evaluating it as they encounter it, updating a tally, and discarding the information. But, for some campaign information voters want to be able to make comparisons. To do so, they either have to have the information for each candidate and position they want to compare readily at hand (as in the Stony Brook experiments and some newspapers on occasion, but not much of the rest of the real campaign world) or they must rely on memories for candidate positions in order to make the comparisons. The evidence from the current experiment, along with that reported previously (Lau & Redlawsk, forthcoming) shows that memory does matter in two ways. As a factor in the vote choice, the affect attached to memories remains a strong predictor of the choice even after accounting for the on-line tallies effects on choice. While this does not prove with any certainty that these memories are not simply rationalizations (see Rahn, *et al.*, 1992) the ability of *accurate memories* to predict *decision quality* cannot be so easily countered. Clear evidence exists that the accuracy of voters' memories matter in the voters' ability to select their preferred candidate from among several choices. While the effects of memory accuracy are not straightforward, with some types of memories improving decision quality while others degrade it, memory clearly plays a role. The lack of any significant interaction effects between memory and the processing mode

[30] The debriefing held following the experiment, during which subjects were walked through every item they examined, confirms this process. Voters started out somewhat randomly, since they knew nothing about the candidates at the beginning. Once determining party, they generally began to focus more on the candidates of their own party. Finally, as a candidate appeared who was more attractive, subjects show a tendency to focus more on that candidate, to confirm or deny, their initial beliefs.

manipulation argues that whether or not subjects were expecting to have to use their memories of the campaign at a later stage in the experiment, memory mattered. Thus, this study calls into question the assertions of the on-line model that memory is an unimportant factor in voting.

Sources

Achen, C. H. 1975. Mass political attitudes and the survey response. American Political Science Review 69:218-231.

Berelson, B., Lazarsfeld, P.F., and McPhee, W.N. 1954. *Voting: A study of opinion formation in a presidential campaign*. Chicago: University of Chicago Press.

Bettman, J.R. and Park, C.W. 1980. Effects of prior knowledge and experience and phase of the choice process on consumer decision processes: A protocol analysis. *Journal of Consumer Research* 3:233-240.

Campbell, A., Converse, P. E., Miller, W. E., and Stokes, D. E. 1960. *The American voter*. New York: Wiley.

Converse, P. E. 1979. Plus ca change: The new CPS election study. *American Political Science Review* 73:32-49.

Converse, P.E. 1964. Attitudes and non-attitudes: Continuation of a dialogue. In Edward Tufte, (ed.) *The quantitative analysis of social problems*. Reading, Mass: Addison-Wesley.

Downs, A. 1957. *An economic theory of democracy*. New York: Harper & Row.

Enelow, J.M., & Hinich, M.J. 1984. *The spatial theory of voting: An introduction*. New York: Cambridge University Press.

Ericsson, K.A., & Simon, H.A. 1980. Verbal reports as data. *Psychological Review* 87:215-251.

Fiorina, M. P. 1981. *Retrospective voting in American national elections*. New Haven: Yale University Press.

Fiske, S.T., & Taylor, S.E. 1991. *Social cognition* (2nd ed.) New York: McGraw Hill.

Ford, J.K., Schmitt, N., Schechtman, S.L, Hults, B.M., and Doherty, M.L. 1989. Process tracing methods: Contributions, problems, and neglected research questions. *Organizational Behavior and Human Decision Processes* 43:75-117.

Gant, Michael M. and Davis, Dwight F. 1984. Mental economy and voter rationality: The informed citizen problem in voting research. *Journal of Politics* 46: 132-153.

Hastie, R., and Park, B. 1986. The relationship between memory and judgment depends on whether the task is memory-based or on-line. *Psychological Review* 93:258-268.

Herstein, J.A. 1981. Keeping the voter's limits in mind: A cognitive process analysis of decision making in voting. *Journal of Personality and Social Psychology* 40:843-861.

Jacoby, J., Jaccard, J., Kuss, A., Troutman, T., and Mazursky, D. 1987. New directions in behavioral process research: Implications for social psychology. *Journal of Experimental Social Psychology* 23:146-175.

Kelley, Jr., S., and Mirer, T.W. 1974. The simple act of voting. *American Political Science Review* 68:572-591.

Lau, R.R. 1995. Information search during an election campaign: Introducing a process tracing methodology for political scientists. In M. Lodge & K. McGraw (eds.) *Political information processing*. Ann Arbor: University of Michigan Press.

Lau, R.R. 1992. *Searchable information during an election campaign*. Unpublished manuscript, Rutgers University.

Lau, R.R. 1989. Construct accessibility and electoral choice. *Political Behavior* 11:5-32.

Lau, R.R. 1986. Political schemata, candidate evaluations, and voting behavior. In R.R. Lau and D.O. Sears (eds.) *Political cognition*. Hillsdale, NJ: Lawrence Erlbaum.

Lau, R. R. and Redlawsk, D. P. In press. An experimental study of information search, memory, and decision making during a political campaign. In J. Kuklinski (ed.), *Political psychology and public opinion*. New York: Cambridge University Press.

Lau, R.R., and Redlawsk, D.P., 1992. *How voters decide: A process tracing study of decision making during political campaigns.* Paper presented at the annual meeting of the American Political Science Association. Chicago, IL

Lazarsfeld, P.F., Berelson, B., & Gaudet, H. 1948. *People's choice.* New York: Columbia University Press.

Lodge, M. 1995. Toward a procedural model of candidate evaluation. In M. Lodge & K. McGraw (eds.) *Political information processing*. Ann Arbor: University of Michigan Press.

Lodge, M., McGraw, K., and Stroh, P. 1989. An impression-driven model of candidate evaluation. *American Political Science Review* 83:399-419.

Lodge, M., Steenbergen, M., and Brau, S. 1995. The responsive voter: Campaign information and the dynamics of candidate evaluation. *American Political Science Review* 89:309-326.

Lodge, M. and Stroh, P. 1992. Inside the mental voting booth. In S. Iyenger & R McGuire (eds.) *Political Psychology*. Durham, NC: Duke University Press.

Lodge, M., Stroh, P., and Wahlke, J. 1990. Black-box models of candidate evaluation. *Political Behavior* 12:5-18.

McGraw, K., Lodge, M., and Stroh, P. 1990. *Processes of candidate evaluation: On-line or memory based? A review and synthesis of four experiments.* Unpublished manuscript, Department of Political Science, SUNY Stony Brook.

McGraw, K., and Pinney, N. 1990. The effects of general and domain-specific expertise on political memory and judgment. *Social Cognition* 8:9-30.

Miller, G. 1956. The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review* 63:81-97.

Nie, N. H. and Andersen, K. 1974. Mass belief systems revisited: Political change and attitude structure. *Journal of Politics* 36:541-591.

Nie, N. H., Verba, S., and Petrocik, J. R. 1976. *The changing American voter*. Cambridge: Harvard University Press.

Norusis, M. J. 1994. SPSS for Windows Advanced Statistics Release 6. Chicago: SPSS, Inc.

Payne, J.W. 1976. Task complexity and contingent processing in decision making: An information search and protocol analysis. *Organizational Behavior and Human Performance* 16:366-387.

Pomper, G. M. 1972. From confusion to clarity: Issues and American voters. 1956-1968. *American Political Science Review* 66:415-428.

Popkin, S. L. 1991. *The reasoning voter: Communication and persuasion in presidential campaigns.* Chicago: University of Chicago Press.

Rabinowitz , G. and MacDonald, S. E. 1989. A directional theory of issue voting. *American Political Science Review* 83: 93-121.

Rahn, W.M., Aldrich, J.H., Borgida, E., and Sullivan, J.L. 1990. A social-cognitive model of candidate appraisal. In J.A. Ferejohn & J.H. Kuklinski, (eds.*)* *Information and democratic processes*. Chicago: University of Illinois Press.

Rahn, W.M., & Krosnick, J.A., and Breuning, M. 1992. Rationalization and derivation processes in political candidate evaluation. *American Journal of Political Science* 38:582-600.

Redlawsk, D. P. 1992. *Using hypermedia to develop a political science simulation.* Paper presented at the 25th annual meeting of the Association of Small Computer Users in Education. (ASCUE) Myrtle Beach, SC.

Redlawsk, D. P. 1995. *How voters use campaign information: On-line versus memory based processing in a presidential election.* Paper presented at the 91st annual meeting of the American Political Science Association, Chicago.

Redlawsk, D. P. and Lau, R. R. 1995. *The miserly voter: Heuristics and rational voting behavior*. Paper presented at the annual meeting of the Midwest Political Science Association, Chicago.

Riggle, E. D. B. and Johnson, M. M. S. 1995. *Age differences in political decision-making: Strategies for evaluating political candidates.* Paper presented as the annual meeting of the Midwest Political Science Association. Chicago.

Shaffer, W. R. 1972. *Computer simulations of voting behavior*. New York: Oxford University Press.

Simon, H. 1955. A behavioral model of rational choice. *Quarterly Journal of Economics* 69:99-108.

Simon, H. 1956. Rational choice and the structure of the environment. *American Psychologist* 63:129-138.

Simon, H. 1957. *Models of man*. New York: John Wiley and sons.

Simon, H. 1985. Human nature in politics: The dialogue of psychology with political science. *American Political Science Review* 79:293-304.

Sniderman, P.M., Brody, R.A., & Tetlock, P.E. 1991. *Reasoning and choice: Explorations in political psychology*. New York: Cambridge University Press.

Smith, E. 1989. *The unchanging American voter.* Berkeley: University of California Press.

Staelin, R. and Payne, J.W. 1976. Studies of the information-seeking behavior of consumers. In J.S. Carroll & J.W. Payne, (eds.) *Cognition and social behavior*. Hillsdale, NJ: Erlbaum.

Wyer, T., and Srull, R. (1986). Human cognition in its social context. *Psychological Review* 93:322-359.

Zaller, J.R. 1992. *The nature and origin of mass opinion.* New York: Cambridge University Press.