Older but Wiser? Effects of Age on Political Cognition

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In experimental studies of voter's information processing, Lau and Redlawsk (2006) found one control variable to have pervasive effects in their analyses: age. Age was associated with less information search, less memory, less accurate memory, and a lower probability of making a correct vote. Reexamining those experimental studies, we find that inexperience with computers and slower manual dexterity are both associated with less information access, but controlling on these factors, age continues to have a strong negative effect on information processing. In other more familiar situations, however, political knowledge can accumulate with greater experience, as it does with memories for actual presidential candidates and political parties, although this effect reverses at very advanced ages. Age has minimal effects on the probability of correct voting until the mid-60s, but we observe very sharp drop-offs thereafter. The normative implications of these findings for democratic representativeness are discussed.

Age is one of the standard demographic background variables social scientists often include in their analyses as a control, rarely giving it much thought beyond that. In any cross-sectional study, age represents both different stages of life (25-year-olds have very different concerns than 45-year-olds, who have very different concerns from 65-year-olds), and different generational-based socialization experiences (people raised during the great depression are likely to be very different from baby boomers or those raised in a post-Soviet world at all stages of life). Most political scientists are comfortable with thinking of age in this manner, as a marker for different life situations or past experiences that can lead to differences in current political preferences (see for example Huddy, Jones, and Chard 2001; Rhodebeck,1993; Watts 1999).

Furthermore, it is easy to predict that age will become of increasing political relevance for the simple reason that the U.S. population is getting older. Figure 1 displays the projected proportion of the adult U.S. population that will be age 65 or older over this century (the darker line of the figure). In 2000, 17% of the adult population (i.e., 18 and older) was at least 65 years old. According to the U.S. Census, over this century that percentage is projected to grow to almost 30% of the population. The big jump comes between 2020 and 2030, after which the increase is much more gradual. And since older people *vote* at higher rates than younger people, the percentage of the *electorate* comprised of people aged 65 and older will be even higher. Figure 1 also includes estimates of the percent of the electorate who will be 65 or older.

We want to consider another issue associated with old age, however, one which so far has fallen below the radar of most political scientists. Age is not only associated with a particular set of life concerns and prior socialization experiences; it may also be associated with declining cognitive abilities. To the extent those abilities are important for political decision making and accurately expressing one's political preferences, the level of government responsiveness, the very quality of democratic representation itself, may decline in the coming century.

We have recently published a fairly thorough examination of information processing during election campaigns that provides a surprising amount of evidence for this proposition (Lau and Redlawsk 2006). We developed a new dynamic process tracing methodology to capture a very detailed record of the information voters gathered during a mock presidential election campaign (lasting approximately 35 minutes) that simulated certain important features of modern political campaigns. This methodology will be described in more detail below. Most of Lau and Redlawsk's data came from a series of experiments run in central New Jersey; while these subjects are not

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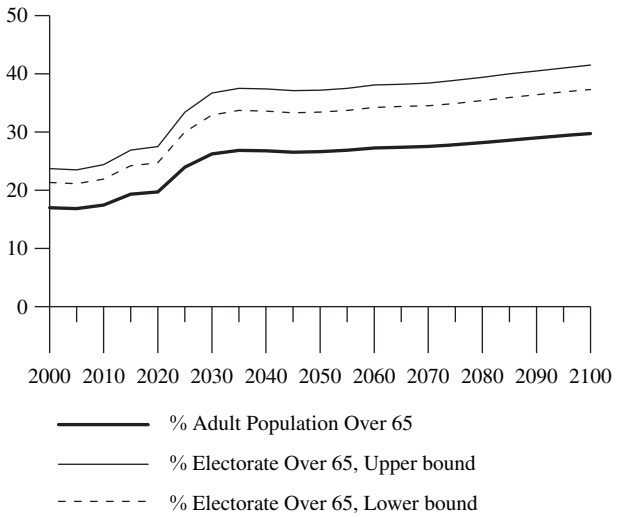
FIGURE 1 Projected Percent of the U.S. Adult Population 65 and Older and Projected Percent of Electorate 65 and Older



Note: The lower bound numbers assumes that age-based differences in turnout that were in place in 1996 continue over the next century. In fact, the turnout rate of older voters has been *increasing* over the past few decades. In 1972, for example, 64 percent of those 65 and older voted, while by 1996 turnout by people 65 and older had increased to 68 percent. The upper bound turnout figures assume that same rate of change continues into the 21st century (see Binstock, 2000).

a random sample, recruitment explicitly excluded college students, and the resulting subject pool comes reasonably close to matching 2000 census data for the county where the experiments were run (see Lau and Redlawsk 2006, Table C1). It has, of course, far more variance in education than is possible with a sample of undergraduates; but it also has far more variance in *age* than is possible with a student sample.

The experiments included a series of random manipulations of various aspects of the simulated campaigns. The number of candidates running in primary elections, their ideological distinctiveness, fit with partisan stereotypes, gender, campaign resources, and the timing and tone of their campaign advertisements were all varied. Although these manipulations were the theoretical focus in the book, we controlled for a series of background characteristics in all of the analyses. One of these background characteristics time and again proved to be a significant predictor of information processing, above and beyond the effects of any of the random manipulations: *age*. Age was by far the most consistent and strongest predictor of the *content* of information search, with older voters selecting significantly less group-based, issue-based, and person-based information. Indeed, the age effect was so pervasive that it was not the content of the information that mattered so much as its *amount*: across the board, older people looked at less information during these experimental political campaigns—about 55 items less for the oldest compared to the youngest voters—across both the primary and general election campaigns. This depth of processing result is shown on the left panel of Figure 2, which displays the statistically significant effects of age, gender, education, and political sophistication on a variety of measures of information processing.

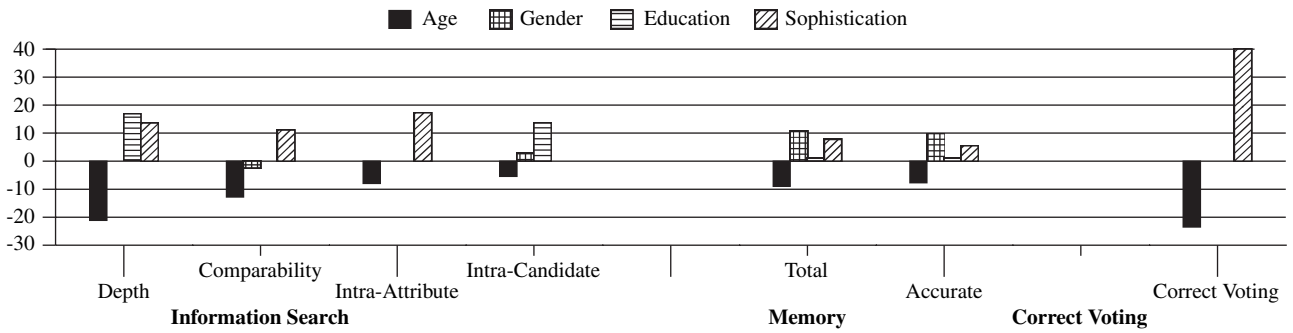
These results are perfectly consistent with the only other research we could find that explores age differences on political information processing, a study by Riggle and Johnson (1996) which employed a classic static information board.[1] They presented subjects (40 younger people between ages 18 and 35, 40 older people between ages 50 and 85) with two electoral choices, one a special senate election with six candidates, the second a city council election with eight candidates.[2] Subjects could spend as much time as they liked making their decisions. Riggle and Johnson report that their older subjects, compared to the younger group, took longer looking at each individual item, and longer overall in reaching a decision. Nonetheless they looked at less total information—about 25 items less—across the two elections. This is less than half the difference reported by Lau and Redlawsk (2006), although it was possible to access far more information in our studies compared to Riggle and Johnson's studies, and consequently there was a much greater possibility of age-based difference to arise.

There are numerous methodological differences between our procedure and Riggle and Johnson's besides the total amount of information available about the candidates, and the fact that we observe comparable age differences on the amount of information search is striking. But it was not just this depth of search where Lau and Redlawsk observed an

[1]A static information board presents subjects with alternatives and attributes for each alternative in a matrix, so that for each alternative subjects may turn over cards (or click on a computer screen) to learn about its features as the researcher records the active information search. Marketing research studies have long used this technique to understand how consumers make choices (Bettman and Park 1980; Payne 1976) and at least one older study of voting used a similar technique (Herstein 1981).

[2]Candidates in the special senate election took stands on eight different issues, while candidates for city council took stands on six different issues. Hence total information available was held constant at 48 distinct possibilities for consideration.

FIGURE 2 Effect of Age, Gender, Education, and Political Sophistication on Various Measures of Political Cognition



Note: Data come from Lau and Redlawsk (2006). The figure compares the estimated effect 50 years of age, 16 years of education, being female, and the full range of a political sophistication scale. Data come from regression equations that also controlled for ideology and strength of party identification. Only effects which are statistically significant at the $p < .10$ level or better are displayed. The scales of the dependent variables are as similar as possible, but strictly speaking the magnitude of the effects should not be compared across dependent variables.

age effect: as shown in Figure 2, older people also engaged in less comparable search across candidates, and (in the general election) less systematic search, as indicated by either intra-attribute or intracandidate search patterns.[3] This translates into older voters being less likely to employ classically ''rational'' (high information search, evenly distributed across alternatives) decision strategies. Older voters reported fewer memories, and fewer accurate memories, about the candidates. And they were significantly less likely to vote *correctly* in the primary election campaign (although not in the general election campaign).[4]

This age effect is so large, and so pervasive, that it deserves further exploration. The question this paper addresses is whether the wide-ranging age effects observed in these experiments are real—that is, generalizable to actual elections—or artifactual, a consequence of the particular experimental methods employed in Lau and Redlawsk's studies that do not exist in actual elections. We will first review the extant literature on age effects on cognitive processes. This literature is huge, and while important disagreements remain about how soon significant cognitive deficits are typically seen, no one disputes their existence at some stage of life. We then turn to a reexamination of Lau and Redlawsk's experimental data, asking whether experimental artifacts can account for most of the age effects described above. Our conclusion is that while those artifacts are important for some of the cognitive processes considered by Lau and Redlawsk, they explain well less than half of the age-related deficits reported described in Figure 2. Finally, we turn to the American National Election Studies (ANES) to see if comparable age effects can be found with survey data concerning real elections.

Age Effects on Cognitive Processing

As one might imagine, there is a great deal of research in psychology, neurology, and geriatric medicine concerning the effects of aging on a variety of cognitive processes (see, for example, Birren and Schaie 2006; Brown and Park 2003; Hess 2005; Salthouse 1991; Schaie 2005). Before reviewing this evidence, several general points should be kept in mind. First, for most tasks under consideration, normal between-individual variation (holding age constant) is greater than the changes that can be attributed to aging (Salthouse 1991). That said, the declines typically observed with age can be substantial, with the average response of adults in their 20s near the 75 percentile on many cognitive tasks, compared to an average performance of adults in their 70s near the 20th percentile. Second, both nature and nurture explain considerable variation in the performance of most of the tasks under consideration here. Thus before one attributes any observed age differences to biological/neurological changes associated with aging, we must rule out the effects

[3]Riggle and Johnson (1996) also report that older subjects seemed to engage in relatively more within-candidate search, while younger subjects preferred relatively more within-attribute or dimensional search. Both of these patterns are systematic—although it is much easier to engage in either of them with a static information board.

[4]See below for more details on Lau and Redlawsk's (1997) correct voting standard.

of declining health, hearing, or eyesight, decreased motivation, fewer opportunities to practice certain skills, social isolation, and so on, all of which are also associated with normal aging.

The major questions addressed in the field of cognitive aging are *what* cognitive changes can be attributed to normal maturation or aging, *when* during the lifetime those changes normally occur, and *how* they can be explained (Salthouse 2004). The ''how'' question is beyond the scope of this paper, but answers to questions about the ''what'' and ''when'' of cognitive declines are very relevant to politics. In terms of the ''what'' question, the effects of age on memory is perhaps the most widely researched topic in the field, and one of the most robust findings is a decline in the recall of ''episodic'' information about specific unique events, including the details of stories, lists of unrelated words, paired associations, and faces (Hoyer and Verhaeghen 2006). Similarly, significant age-related declines in the amount of information that can be retained in working (or short-term) memory are also frequently reported. In contrast, there are negligible age-related declines in ''semantic'' memory which tap the contents of cumulative knowledge.

A more general and equally consistent finding in the literature is that older adults process information more slowly than younger adults (Hartley 2006). The *speed of processing* construct is both a phenomenon in itself and an explanation for declining cognitive performance on a variety of different tasks (Salthouse 1996). In particular, it is *effortful* cognitive processing—processing speed, declarative recall, working memory capacity, verbal learning, and the ability to ignore irrelevant information—that declines with age, while more automatic cognitive processes such as recognition memory and implicit memory remain invariant or even increase slightly with age (Hasher and Zacks 1988; Hess 2005). Direct access to the knowledge people develop over a lifetime seems relatively unaffected by age, but aging may negatively affect the analysis and manipulation of the contents of memory as well as the ability to encode and operate on new information.

If there is widespread agreement on the ''what'' of cognitive declines, the largest controversies in the field concern the question of when any significant cognitive decline occurs, with leading researchers holding very different viewpoints. Schaie states that ''individual decline prior to 60 years of age is almost inevitably a symptom or precursor of pathological age changes'' (2005, 418)—that is, not something to be expected during the course of normal maturation. On the other hand, ''by the mid-70s significant average decrement can be observed for all abilities, and that by the 80s, average decrement is severe except for verbal ability'' (418). Thus according to Schaie there are clear signs of cognitive decline in most older people, but only in the last decade or two of life. The effects of age on cognitive processes are therefore *non*linear: a simple correlation with age may fail to detect those effects, but higher-order polynomial terms should identify them. On the other hand, Salthouse (1985, 1991, 2005), another leading researcher in the field, holds that ''many of the age-cognition functions appear to be roughly linear, with little indication of abrupt transitions from stable to declining performance (1991, 51). In other words, cognitive declines begin in early adulthood and proceed more or less continuously until the end of life. Thus age should be *linearly* related to declines in cognitive performance.

Part of the difference between these two views can be explained by the nature of the tasks under consideration, or those tasks deemed relevant to ''successful'' aging. In many domains of interest, the knowledge and experience that accumulates with age can partially offset any decrease in cognitive functioning that may also occur with age, such that the net effect of age on performance of familiar, everyday tasks can be a positive one (Marsiske and Margrett 2006). This could certainly be the case with the everyday low-level task of being a citizen in a democracy. We must be careful to distinguish between the performance of specific skills and the competence to complete a task, albeit by alternate procedures than those of primary interest to the researcher.

This brief review helps up put many of Lau and Redlawsk's findings in perspective and predict which are likely to be artifactual products of their experimental setting and which are likely to appear in actual elections. Before we do that, however, we should describe Lau and Redlawsk's experimental procedures in more detail.

The Dynamic Process Tracing Experiments

The basic idea of dynamic process tracing is that many—perhaps most—social situations change over time, and research tools must be able to capture that dynamism. An election campaign is one such dynamic social situation. The mock election campaign in Lau and Redlawsk's studies is presented over a period of time (about 20 minutes for the primary and 13 minutes for the general election) during which subjects may choose to learn whatever they

wish about the candidates from a very wide range of information that becomes available in a predetermined but largely random order. As in real elections, voters are overwhelmed by information, the availability of which rapidly changes. Some information is much easier to find than others, and some information (political ads) comes to voters without their actively seeking it out. But the vast majority of all information available about the candidates can only be examined through discretionary information search. This information includes personality traits, background information, issue positions, polls and endorsements, and much else. Labeled boxes (e.g., Green's stand on Welfare Reform; Singer's Family Background) scroll down a computer screen, and subjects click on a box to reveal its contents. Subjects choose what they want to learn; the system tracks everything they examine. Because the candidates are invented, subjects know nothing about them at the beginning; anything they learn must be learned by clicking on appropriate boxes that scroll from the top to the bottom of the screen. The system allows the experimenter to collect data on the order and type of information examined, the amount of time spent on any particular item, and assessments of the candidates, including subjects' recall of their issue positions. The process also allows for collecting information about what subjects remember from the campaign. For present purposes we are most interested in the experimental data that allows assessments of the amount of information subjects accessed (information search) and the memories subjects report. Both are relatively straightforward counts, collected during the campaign (information search) or immediately after it (memory). We also examine the accuracy of reported memories, assessing whether what subjects reported they remembered actually reflected the information they had been exposed to during the campaign.

The data used here were collected through a series of dynamic process tracing experiments carried out during the mid-1990s. All of the studies had many common elements. Subjects were nonstudents recruited from the central New Jersey area and randomly assigned to various experimental conditions, most of which are not directly relevant to this paper. Subjects were typically run one-on-one with an experimenter who gave instructions, administered pencil and paper portions of the study, and provided debriefing. Subjects answered a fairly standard political attitudes questionnaire given on a computer before beginning a mock presidential election campaign, also presented on the computer. This initial questionnaire, in addition to asking about attitudes, contained a political knowledge test used to assess subject's political sophistication. Most studies consisted of both a primary and a general election campaign.

Candidates were invented, but designed to represent the range of candidates who might run for president as Republicans or Democrats. Thus Democratic candidates ranged from extremely liberal to liberal to moderately conservative. Likewise, Republican voters might choose from among a moderately liberal Republican candidate, a modal (conservative) Republican and an extremely conservative Republican. In any given primary, subjects were randomly assigned to campaigns with either two or four candidates within their own party, and four or two candidates in the other party, so that there were always six candidates (of the possible eight) actually running in the primary. Following the primary, after subjects voted and evaluated candidates, the general election campaign included one Democrat and one Republican candidate, with the in-party candidate (the candidate sharing party affiliation with the subject) generally chosen from among the candidates the subject did *not* vote for in the primary.

Hypotheses

With this better understanding of the conditions under which Lau and Redlawsk gathered their data, we can make some predictions about whether their age-related findings are likely to hold up under further scrutiny, and whether they are likely to be replicated with more standard survey data gathered from actual election campaigns. The rapid, information-overload, time-constrained dynamic information board would clearly qualify as ''effortful'' cognitive processing that would put real demands on working memory, so that we have every reason to believe the age effects observed by Lau and Redlawsk are not mere artifact of the experimental material being presented on a computer. Moreover, because the candidates in the mock campaigns were all new to subjects, memory of them would be truly episodic, and again we would therefore expect the observed age effects to hold up under additional controls. Thus we first hypothesize that the age effects on political cognition reported by Lau and Redlawsk (2006) will *not* prove to be merely artifacts of their experimental procedures. On the other hand, when the dependent variable involves semantic memory that could accumulate with age, such as crystallized knowledge of

how our political system works or memories of the political parties or of actual candidates who have been on the political scene for extended periods of time, we would predict *positive* effects of age (as a surrogate for experience) on knowledge and memory.

We are less sure about the effects of age on the nature and quality of political decision making. Artifactual or not, there is no denying the fact that older voters in Lau and Redlawsk's experiments had in general gathered less information about the candidates than younger voters at the time of their vote decisions. Because the candidates in Lau and Redlawsk's experiments were realistic and very much like the type of Democratic and Republican candidates who normally run for president, it is possible that older subjects may have developed certain decision strategies or heuristics that allow them to vote correctly (Lau and Redlawsk 1997, 2006), that is to make high quality vote decisions *despite* their generally considering less information and remembering it less well than younger voters, and that these strategies could be utilized in our experiments. If so, the negative effect of age on the probability of voting correctly could disappear or even reverse in a more fully specified analysis. We would find this logic much more likely to apply to correct voting in actual elections, however, where it would be hard to imagine that prior experience with voting would not prove valuable. We must predict that older voters in real elections, like the voter's in Lau and Redlawsk's experiments, will rely on *less* information in making their vote decisions (Marsiske and Margrett 2006). But we also expect to find that older voters rely on *different* information in making their vote decisions compared to younger voters. In particular, older voters might be more likely to rely on political heuristics such as party or liberal-conservative identifications, for example, high-information cues that are typically easily available and easy to process and remember and may well compensate for the absence of more detailed and specific information about the candidates.

Study 1: Were Lau and Redlawsk's (2006) Age-Related Findings Artifactual?

The biggest difference between how people accessed information in Lau and Redlawsk's experiments—on a computer, using dynamic process tracing—and how they usually access information in an actual election, is the use of a computer. There are several reasons to think that older people might have a harder time using the computer program than younger people.

1. First, a reasonable amount of manual dexterity is required to access the information scrolling down the computer screen. Such fine motor coordination becomes more difficult with age.[5]
2. Second, at the time the Lau and Redlawsk studies began in the mid-1990s, older people would generally have had much less experience with computers than younger people. These studies began just as computers were becoming pervasive in the workplace, but a goodly number of subjects were already retired (25%), and another subset were homemakers. It is reasonable to believe that many of these two groups of subjects would have had relatively little prior experience using computers.
3. Finally there is the possibility of interest here, that mental capacity for many cognitive tasks shrinks as people age, particularly among the elderly, and that this affects information processing, memory, and decision making.

These three explanations have very different implications for how we should think about Lau and Redlawsk's (2006) findings.

The first explanation suggests that any observed age effects would indeed be artifactual, a product of the experimental procedure itself (i.e., the political "campaign" being presented on a computer), and thus we would not expect to observe them in an actual election, with information available about candidates in newspapers, magazines, and the nightly news on television. If experimental artifacts completely explain these age effects, they have no political consequences.

The second explanation would also suggest that any observed effects are artifactual, although in this case we might expect them to disappear if someone ran a similar experiment a decade from now, by

[5]Informal impressions gathered from the experimenters confirmed this possibility. Subjects in their 80s seemed to have a lot more difficulty getting the "hang" of accessing the scrolling information on the computer, such that they required noticeably more practice during the practice session before they felt ready to start the experiment. Further evidence comes from a study where subjects were asked at the end of the experiment to go through a list of everything they had looked at during the primary election campaign and report in their own words why they had selected each particular item. Some of these items were accessed "by mistake" (about 5–6%, overall). The correlation between age and number of such mistakes was $r = .30$, suggesting even more directly that older people had more trouble using the mouse to access the information they desired.

which time most retired people would have a good deal of experience with computers. Again, however, there would be no political consequences of Lau and Redlawsk's findings.

Only the third explanation of declining cognitive ability with age would suggest that there are age-related information processing effects (as opposed to computer-using effects) that might also be observed in actual elections.

We care about the answer to this question because one of the artificial aspects of these experiments was the way most of the information had to be obtained during these mock election campaigns. It takes neither manual dexterity nor computer experience to learn about the candidates running in a real presidential election, and if we can attribute some or all of the observed age effects to either of these two causes, we could "explain them away" as artifacts of the experimental setting that have no analog in real campaigns. On the other hand, if declining cognitive ability is the most likely explanation for the observed age effects, then we have learned something important about voters that could very well apply in actual elections.

We therefore looked throughout our dataset for additional variables that could shed light on one or another of the possible explanations for the observed age effects. We found three, the first two based on a measure of employment status. We considered people who were retired or were housewives as unlikely to have much computer experience. This "singles out" a little under half of the subject population, a figure that would certainly seem too high today. But remember these experiments began over a decade ago, when computers were not as pervasive in the home then as they are now, and the recruitment guidelines excluded people younger than 18 and college students—the group who became computer literate soonest. These are undoubtedly noisy measures, but it was the best we could do to try to capture this "computer experience" concept since we did not think to directly measure this concept.

The third variable is designed to approximate the manual dexterity needed to move the computer mouse to the onscreen button that had to be clicked to read information. Because no direct measure exists for this, we constructed one by considering that the total time any given subject takes to read a particular piece of information and then click on the button to return to the scrolling labels (on the main screen) is composed of two parts. First is the time it takes to actually read the information, which varies of course based on the number of words and the individual's own reading ability. The second part is the time it took physically to move the mouse and click the button. The trick is to decompose these two parts so we have a separate measure of dexterity.

To do this we regressed the time each subject spent looking at every item he or she accessed on the number of words in that item. These regressions were conducted "within-subject—that is, a separate regression was estimated for every individual, with each case comprised of the "looking time" and word length of each item accessed by that person. The regressions produce an estimate of reading time per word for each voter; but they also produce a *constant* which is added in the estimation process to every individual item, no matter how many words the item contains. This constant represents (in an admittedly noisy way) the amount of time it took a subject to click the "return to campaign" button after they had finished reading whatever information was included in the item they had chosen. This time should be roughly the same (i.e., constant) for every item selected by a given voter. But it will differ *across* voters, and we can therefore use this measure as an estimate of manual dexterity.

We included age-squared along with age in all of our analyses. If cognitive declines begin in early adulthood and proceed more or less continuously thereafter, as Salthouse (1985, 1991 2005) and others would argue, then age will have a significant negative effect. Schaie (2005) maintains that many cognitive processes show very little decline up to the mid-70s, but then begin declining rapidly after that. If so, age-squared will be significant and negative, while any distinct linear effects of age could be reduced or even disappear. Adding a quadratic term to the equation will allow us to detect such nonlinear effects of age.

Results

We examined three measures of cognitive processing as dependent variables: the total number of items subjects accessed across both election campaigns, the total number of memories they reported about the two candidates from the general election campaign, and the total number of memories about those two candidates that were judged to be accurate. The first variable is simply a good way to summarize the various content of search and depth of search measures analyzed by Lau and Redlawsk (2006)—and is the most likely to be affected by experimental artifacts—while the last two variables are key measures of memory. In addition to age, age-squared, and the

three crucial "artifactual" predictors described above, our analyses included education, income, gender, political sophistication, ideology, and strength of party identification as controls. We also include the number of items accessed during the general election (which is part of the dependent variable in the first analysis) as a predictor in the two analyses of memory, to control for the fact that the more information that is examined, the more there is to remember.

The results of these regressions are reported in Table 1. Beginning with the equation for total items accessed, we see that age continues to have a significant negative effect in the analysis. The equation estimates that a 70-year-old voter would access 27 fewer items across the two election campaigns compared to a 20-year-old voter. This effect is illustrated in Figure 3, and it accounts for almost half of the total 55-item difference in information accessed between the oldest and youngest voters. Age squared, on the other hand, is trivial; there is no evidence that the decline in the number of items accessed accelerates with advanced age.

None of the control variable had a significant effect in the analysis. But one of our three variables designed to tap possible experimental artifacts is poor manual dexterity. This variable is measured in seconds, and it suggests that every extra second it took a voter (on average) to return to the campaign and thus have the opportunity to look at something else costs that voter almost eight fewer items selected during the two campaigns.[6] Neither measure of lack of computer experience is statistically significant, but they are both larger than their standard errors and together would predict a decline of about 13 items accessed. Thus poorer (or at least slower) manual dexterity and a lack of computer experience explains a good deal—but by no means all—of the effect of age on discretionary information access.

As can be seen in the two memory analyses reported in Table 1, a lack of experience with computers and poor manual dexterity have nothing to do with memory. This is actually good, because there is no reason why they should have any effect on memory. But controlling on all of the other variables in the equations we estimate very significant and substantively meaningful linear effects of age, with no hint of any acceleration at very advanced ages as would have been indicated by significant quadratic terms. Instead, we are still estimating a gradual but steady decline in memory of about one-eleventh of a memory (and one-tenth of an accurate memory) per year. Figure 4 shows this result graphically. It is a little bit slower of a decline than suggested in our original estimates (Lau and Redlawsk 2006), which must be due to the inclusion of the total number of items accessed during the general election as a predictor in the equation. But still we are talking about a decline of four-and-a-half total memories, and five accurate memories, over a 50-year span. When the mean number of total memories about the two candidates across all voters is 16, and the mean number of memories that could be coded as accurate is six, these effects are huge.

It appears then that the age effects observed in Lau and Redlawsk's experiments are not just—or even mostly—artifacts of having to use a computer to learn about the candidates in the mock presidential-election campaign. Even controlling for their lesser experience with computers and their slower reaction times, older voters in these experiments accessed significantly fewer items about the candidates and remembered significantly less of the information they did consider. We find this evidence sufficiently intriguing to see if we could find age effects in survey data about real presidential elections.

Study 2: Do Age Effects Generalize to Actual Elections?

Any significant age effects on how voters process political information, how they go about making their vote decisions, and how likely they are to vote correctly, have important social consequences because as we have already seen, the voting age population is growing rapidly older. We should seek additional evidence about actual elections from more representative samples before we even contemplate thinking about the social implications of these findings. We therefore turned to the American National Election Studies (ANES) surveys to see what measures we could create that were at all comparable to Lau and Redlawsk's experimental data. We came up with four possible measures that could bear on the quality

[6]We took the natural logarithm of the Poor Manual Dexterity variable to reduce the effects of outliers, as is standard practice with latency measures. Translating this coefficient back to seconds yields a coefficient of −8.05. The magnitude of the coefficient strikes us as about right. The mean number of items accessed across the two campaigns—the dependent variable in this analysis—was 122. Losing one additional second returning to the campaign for each of those items would total just over two minutes, or about 6% of the total length of the two campaigns. The predicted decline of eight items selected is 8% of the mean.

TABLE 1 Explaining the Age Effect on Amount of Information Search and Memory, Experimental Data

	Total Items Accessed B	Total Memory B	Accurate Memory B
Constant	127.78***	6.24***	−1.15
	(6.06)	(2.55)	(2.51)
Education (years)	−.32	4.95***	3.13**
	(6.14)	(1.14)	(1.26)
Income	2.55	.13	1.65
	(4.19)	(.77)	(.88)
Female	−.96	.75	.46
	(2.79)	(.52)	(.56)
Political Sophistication	−4.60	6.84***	4.35*
	(9.30)	(1.71)	(1.88)
Ideology (Conservative)	1.59	.27	−.19
	(6.04)	(1.11)	(1.25)
Strength of Party ID	−1.65	.60	−.18
	(4.01)	(.74)	(.81)
# Items Accessed, General		.03***	.04***
		(.01)	(.01)
Age (years)	−.54***	−.09***	−.10***
	(.12)	(.02)	(.02)
Age-Squared	−.002	−.001	−.000
	(.006)	(.001)	(.001)
Retired	−6.61	−.05	−.12
	(5.73)	(1.06)	(1.14)
Homemaker	−6.71	1.25	1.74
	(4.23)	(.78)	(.91)
Poor Manual Dexterity	−82.88***	1.29	1.76
	(4.51)	(1.09)	(1.18)
Adjust R^2	.59	.236	.310
N	492	488	282

*$p < .05$, **$p < .01$, ***$p < .001$

Note: Table entries are regression coefficients, with standard errors in parentheses. All control variables have been transformed to have a one-point range. The Poor Manual Dexterity variable is logged.

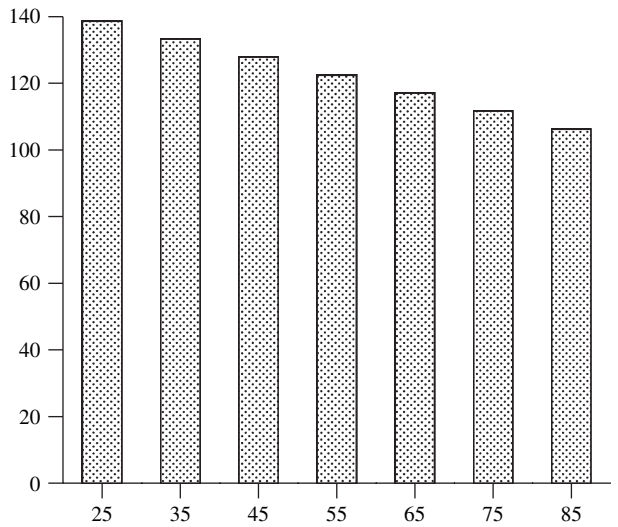
of the information processing or choice processes employed by older voters.

First and most straightforwardly, we looked at political knowledge. Having a store of political knowledge makes understanding new political information so much easier. As Delli Carpini and Keeter (1996) argue, political knowledge provides a context in which new information can be interpreted. Understanding is quicker and more easily integrated with prior knowledge. The rich get richer, both in terms of money and in terms of knowledge. We looked in the ANES surveys for questions of a factual nature that could be scored as correct or incorrect. In each survey between 1980 and 2004, we created a simple additive scale of the number of correct answers. This scale ranged from a low of 0 (for someone who could not answer any of the questions correctly—and every survey included some such respondents) to a high of between 17 and 23, depending on the number of questions available. We rescaled these measures to have a similar 0–20 range in each survey. Because this knowledge measure largely involves crystallized knowledge that can accumulate with experience, we would expect a positive effect of age on knowledge, although one that could begin declining at very advanced ages.

The next variable we considered was the number of reasons respondents could give about what they liked and disliked about the two major parties, and the two major party candidates, from the preelection survey each year. The answers to these questions are often treated as ''memories'' about the parties and candidates.[7] Up to five responses to each question are

[7]These questions provide an affectively biased measure of memory, as the questions direct respondents to report positive and then negative reasons (see McGraw, Fischle, and Stenner 2000). Politics is about affect, however, and it is not at all clear how this would bias total amount of memory.

FIGURE 3 Corrected Effect of Age on Total Information Search



Note: Figure combines data from both the primary and general election campaigns of Lau and Redlawsk's (2006) studies, and controls for the effects of the other predictors in Table 1, including lack of computer experience and slower manual dexterity.

recorded, and we created simple additive scales of party and candidate memory by adding up the number of reasons respondents report. The resulting measure ranges from 0 to 20 for both party and candidate memory. Again, these measures involve crystallized knowledge—particularly memories about the two parties, which have existed throughout all respondents' lifetimes—and thus we would predict a positive effect of age on memory. This effect should be noticeably weaker for memories about the candidates, who generally would have been on the political scene for a much briefer period of time than the parties, and thus older voters would have had less time accumulating knowledge about them.

Third, we considered the number and type of considerations that go into the vote choice of younger and older voters—by which we mean the *direction* of the vote. To simplify matters, we throw out all voters for third-party candidates and consider only the choice between the Democrat and the Republican. We base our analysis loosely on the model presented by Miller and Shanks (1996). The first stage is comprised of six background variables, including age, education, income gender, race, and frequency of church attendance. The second stage brings in two long-standing political predispositions that have great heuristic value, party identification and liberal-conservative identification. The third stage includes six issue-based considerations that were available in every survey (including most relevantly for older Americans, preferences for government-provided national health insurance[8]), personal financial well-being,[9] and perceptions of the performance of the national economy over the past year. The fourth stage involves evaluations of the incumbent president's job performance,[10] while the final stage includes four variables tapping perceptions of the candidates' personalities.[11] We tested the complete model twice, once for all respondents and once with a series of interaction terms between age and all of the attitudinal variables subsequent to it in the vote model. If older citizens make their vote decisions differently than younger citizens, many of these interaction terms will prove to be significant. Because of the decreasing capacity of working memory, we expect older voters to utilize *fewer* criteria in making their vote decision, particularly criteria based on rather isolated, hard-to-obtain information, but instead to rely more strongly on highly efficient heuristic-based cues such as party and liberal-conservative identifications.

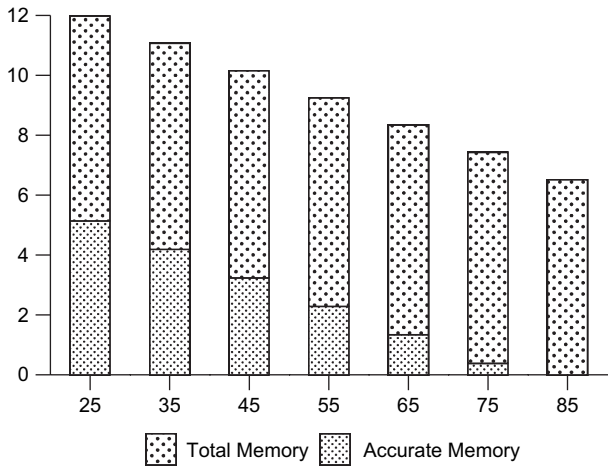
[8]We utilized Rabinowitz and MacDonald's (1989) directional method for determining issue preferences, employing respondent's own reported issue positions, and experts' judgments about where the candidates' stood on the issues (the mean judgments of respondents with at least a college degree) as an objective measure of where the candidates actually stand. We initially targeted the ANES surveys from 1980 on because 1980 was the first year that the crucial candidate trait items were asked. The question about national health insurance was not asked in 1980, however, although it was asked in every survey from 1984 on. Because we wanted to include a policy question that should be of particular relevance to older voters, analysis of the vote choice is limited to the six presidential elections from 1984 through 2004. Every other analysis of the ANES surveys includes data from 1980.

[9]All of the political variables were coded such that a high value should be associated with a Republican vote. For the personal financial well-being question, this meant coding the variable such that perceptions of being "better off" than a year ago was scored high with a Republican incumbent and scored low in years with a Democrat incumbent.

[10]In two of the elections the incumbent President could not run for reelection, but in both of those cases the sitting Vice President was his party's choice for the election, and we felt justified in assuming that in those cases the retrospective job performance question referred to both the President's and the Vice President's job performance.

[11]The Ability factor was measured by perceptions of the degree to which each candidate was "intelligent" and "knowledgeable." The Leadership factor was measured by questions about how "inspiring" and "strong" each candidate was. Compassion was measured by questions about "caring about people like you" and being "in touch." Integrity was measured by questions about how "honest" and "moral" each candidate was. We made summary scales for each of these trait factors for each candidate and then subtracted the score for the Democrat from the score for the Republican.

FIGURE 4 Corrected Effect of Age on Memory



Note: Data come from Lau and Redlawsk's (2006) studies, and control for the effects of the other predictors in Table 1, including lack of computer experience and slower manual dexterity.

Finally we turn to correct voting itself. In the experimental data older voters searched for less information (probably because it took them longer to process what they have), and remembered less of what they had examined. Quite logically, this could be expected to translate into less accurate voting decisions. But most older people learn to compensate in different ways for their declining cognitive abilities (Freund and Baltes 1998), and they may have learned though experience how to make high-quality vote decisions with relatively less information.

A "correct vote," according to Lau and Redlawsk (1997), is one in which the voter chooses the candidate she would have chosen given full information about all of the candidates competing in the election. All subjects in their experiments had to make that decision well before they had anything approaching full information. Calculation of the correct vote in a real election is somewhat complicated, since assumptions must be made about what information voters *have* about each candidate, but Lau and Redlawsk (1997) provide a procedure for doing this that seems to have a great deal of construct validity (see their Appendix A; Lau, Andersen, and Redlawsk (in press) have recently extended their analysis of ANES data through the 2004 election). We follow those guidelines here, which involve comparing the voter's own position on issues, group preferences, and party affiliation and comparing them to an objective measure of where each candidate actually "stands" on each attribute of judgment (which are not all policy stands). The "distance" can then be calculated between each candidate and the voter. If the voter chooses the closest candidate, she is said to have "voted correctly."

While Lau and Redlawsk (2006) reported strong negative effects of age on correct voting in a primary election, they found no significant age effects on correct voting in the general election campaigns of their experiments. But this was a unique situation that could have minimized any positive effects of accumulated experience with voting. Assuming older voters do indeed rely more heavily on heuristic (top down) processing than more cognitively difficult bottom up processing (Fiske 1986) in real elections, they may have "figured out" how to fulfill their citizen duties efficiently and actually vote correctly at higher rates than younger voters, particularly in a general election where party affiliation is probably the most important difference between the two major candidates. On the other hand, Lau and Redlawsk (2001) report no straightforward relationship between heuristic use and correct voting and clearly show how overreliance on political heuristics can in some situations lead to incorrect decisions. So the effect of age on correct voting, even in general elections, remains an open question.

Results

We have predicted that age will have a positive effect on political knowledge, party memories, and candidate memories, because these scales all reflect the type of information that can accumulate with greater experience. We include a quadratic term, age squared, in all analyses, to determine if the effect of age ever reverses at very advanced ages. We must of course also control on education in this analysis, because it too should have a strong positive effect on different forms of political knowledge.[12] Hence we regressed each of the first three dependent variables on age, age-squared, years of education, and as additional controls family income, gender, and race. All three dependent variables range from 0 to 20. Female and nonwhite are dummy variables; we have recoded education and income to have similar one-point

[12]It is particularly important to control for education because age and education are negatively correlated in any general population sample: older people tend to have less education. If we find any decline in political knowledge with age, we must be sure this is not attributable to lower levels of education at older ages. All analyses of ANES data also included dummy variables for election year. This controls, in an atheoretical but statistically efficient manner, for any election year-related clustering of the error terms (Steenbergen and Jones 2003).

ranges, but age and age-squared have been left in their original metric to ease interpretation.

The results are shown in Table 2. With a very large sample size, virtually every coefficient is statistically significant. Education has the largest effect in these analyses. A full "dose" of education—20 years—translates into 14 correct answers on the political knowledge scale, seven memories about the parties, and eight memories of the candidates running for president. But age is the next most important predictor, and its impact is quite substantial. A reasonably full does of age—60 years of adulthood, from age 18 to 78—translates into six correct answers, four memories about the parties, and over 2.6 memories about the candidates. We expected age to have a stronger effect on party memories than candidate memories, as the two major parties have been around for the respondents' entire lives, and the older respondents would thus have more to remember about the parties than the presidential candidates, who typically have been on the political scene for shorter periods of time. This is exactly what we observe. In every case, however, the quadratic term is also significant and negative, suggesting that political knowledge and memories continue to accumulate with age but the rate of accumulation slows down, reaching a peak at rather advanced age (69 for political knowledge, 67 for party memories, 81 for candidate memories) and then slowly reversing. Figure 5 illustrates the predicted effects.

As predicted then, voters tend to accumulate political knowledge with age and experience, a trend that slows down but does not actually peak until retirement age or even later. But does that greater knowledge lead older citizens to make their vote decisions in more sophisticated ways, where by "sophisticated" we mean by taking more of their political preferences into account? To answer this question we specified a logistic regression where the choice of the Republican over the Democratic candidate was regressed on six background characteristics (including age) and 15 different political attitudes, including two long-term political predispositions, several economic perceptions, retrospective evaluations of the president's job performance, perceptions of the two candidates on four different trait dimensions, and closeness to the candidates on six different political issues. This equation does a great job explaining the vote choice, correctly predicting almost 93% of the actual vote decisions with a pseudo R^2 (Nagelkerke) of .84. All of the political attitudes have their predicting sign and all but two—personal financial well-being (which is rarely significant in a vote equation: see Kinder, Adams, and Gronke 1989, or Kinder and Kiewiet 1979) and attitudes toward government supported health insurance.

But our question is whether younger and older voters make their decisions in significantly different manners. To address this question, we recoded age to range between 0 and 1 and then interacted age with each of the 15 political attitudes. The results of this equation are reported in Table 3. The first two columns present the main effect of each of the six background variables and the marginal effect of the political attitudes among 18-year-old voters—those

TABLE 2 Effect of Age on Political Knowledge and Memory, ANES Surveys

	Political Knowledge	*Party Memories*	*Candidate Memories*
Age	.100 (.008)	.063 (.006)	.043 (.006)
Age-Squared	−.001 (.000)	−.001 (.000)	−.000 (.000)
Education	14.17 (.28)	7.27 (.23)	7.95 (.23)
Income	2.49 (.18)	1.03 (.15)	1.14 (.15)
Female	−1.71 (.07)	−.87 (.06)	−.40 (.06)
Nonwhite	−1.38 (.10)	−.12* (.08)	−.73 (.08)
Constant	6.28 (.14)	2.12 (.12)	4.31 (.12)
Adjusted R^2	.38	.17	.17

*$p > .14$

Note: Data come from the 1980, 1984, 1988, 1992, 1996, 2000, and 2004 ANES surveys. All control variables have a one-point range, but Age and Age-squared have been left in their original metric. All predictors are significant, $p < .001$, except when noted by an asterisk. All analyses also include dummy variables representing the different election years. N = 11,523.

FIGURE 5 Effect of Age on Political Knowledge and Party and Candidate Memories ANES 1980 - 2004 Data

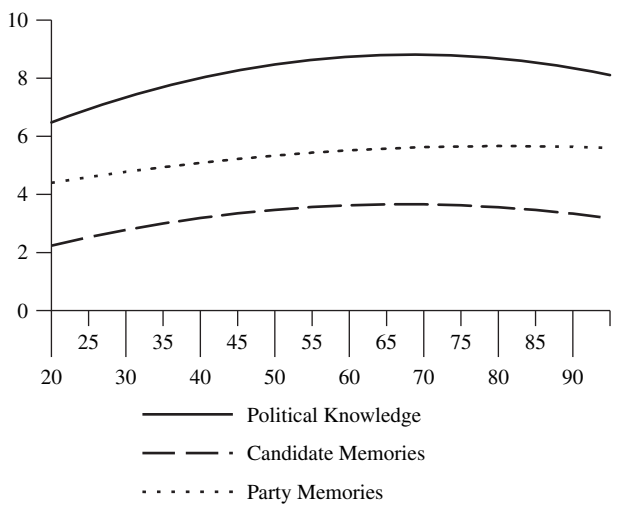


TABLE 3 Predictors of Republican Vote Choice by Age 1984 - 2004 ANES Surveys

	B	S.E.	B	S.E.
Age	−.538	(.369)		
Education	.839*	(.435)		
Income	.279	(.262)		
Female	113	(.108)		
Nonwhite	−.978***	(.168)		
Church Attendance	.438**	(.163)		
	Marginal Effect Among 18 Year Olds		*Change in Effect Among Very Old Voters*	
Party Identification	2.520***	(.378)	1.460@	(.877)
Liberalism-Conservatism	1.268*	(.570)	.273	(1.426)
Personal Financial Well-Being	625	(.433)	−1.636	(1.117)
Evaluations of National Economy	.295	(.473)	.306	(1.127)
Presidential Job Approval	1.856***	(.320)	.717	(.743)
Candidates Knowledgeable	.333	(.830)	.059	(1.046)
Candidates Compassionate	5.744***	(.777)	−4.415*	(1.190)
Candidates Strong Leaders	4.217***	(.740)	−1.420	(1.769)
Candidates Moral	1.557*	(.761)	2.973	(1.841)
Government Guaranteed Jobs	.775	(.520)	.732	(1.241)
Government Health Insurance	−.409	(.407)	1.236	(.969)
Government Aid to Minorities	1.460**	(.620)	−2.477@	(1.452)
Equal Role for Women	1.010	(.780)	−.980	(1.720)
Abortion	.294	(.265)	−.086	(.626)
Defense Spending	1.226*	(.605)	−1.496	(1.491)
Constant	.668***	(.196)		
Nagelkerke R^2	.846			
Correctly Classified	92.6%			
Model X^2 (df)	6781.8 (41)			
Significance	$p < .000$			

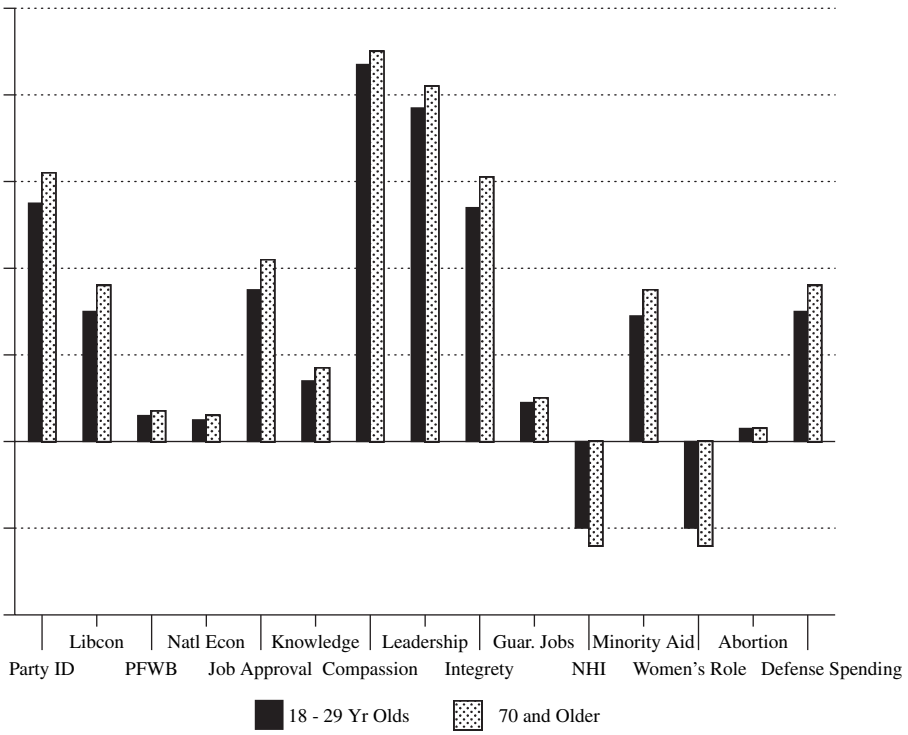
@$p < .10$, *$p < .05$, **$p < .01$, ***$p < .001$

Note: ANES data come from the 1984 thru 2004 U.S. presidential elections. The analysis also includes dummy variables representing the different election years. N = 6778.

coded 0 on the age variable. The last two columns report the predicted *change* in the effect of each political attitude on the log odds of a Republican vote among very old (96) voters. This analysis provides no clear evidence that older citizens make their vote decisions any differently than younger citizens, as the omnibus test for the addition of the 15 interaction terms fails to reach conventional levels of significance ($\chi^2(15) = 21.05$, $p < .14$). Only three of the interaction terms even approach statistical significance, but the specific effects are interesting. Older voters care significantly less than younger voters about how compassionate the competing candidates appear to be and also care much less about closeness to the candidates on the issue of government aid to minorities. But as predicted, older voters rely significantly more on their party identifications in making their vote choices—a long-term political orientation of unusual heuristic value.

To make these age differences (or the lack there of) easier to visualize, we have run separate vote choice analyses for the youngest (age 18–29) and oldest (age 70 and older) voters—a little under 1000 respondents in each case. This is another way to look for an interaction between age and the components of the vote decision, one that does not impose the assumption of linear changes across a life time and thus can test the robustness of our original findings. Figure 6 displays the predicted change of probability of a full "dose" of each of the political attitudes in these two samples, holding every other variable at their mode or midpoint. These probabilities reflect how *responsive* the different samples are to large changes in political attitudes. As can be seen in the figure, there are very

FIGURE 6 Explanatory Power of Different Categories of Predictors of the Vote Choice by Voter Age, 1984 - 2004 ANES Data



Note: Figure represents the predicted effect of a full "dose" of each explanatory variable in the two different samples, holding every other variable at its median or mode.

few differences in these predicted probabilities, and they all track each other almost perfectly. The largest difference is for the responsiveness of party identification, which is about 7% stronger for the oldest compared to the youngest voters. The overall model fits the data slightly better among the older voters than the younger. Thus there simply is no evidence in these ANES surveys that older voters make their vote decisions in fundamentally different ways than younger voters.

But are the *quality* of those vote decisions just as high for older voters? Given what the literature says about the shrinking capacity of working memory, we might expect older voters to have a more difficult time combining all of these different considerations into a vote choice that most closely reflects their own preferences. On the other hand, the greater accumulated wisdom of older voters could more than compensate for any shrinking capacity of working memory, so that the *net* effect of increasing age on the quality of voter decision making could be nil, at least until the last stages of life when declines in cognitive functioning may accelerate. This suggests we may need to model a polynomial age function with two different turning points (and thus linear, quadratic, and cubic terms). Following the guidelines of Lau, Andersen, and Redlawsk (in press), we regress the measure of correct voting on age, age squared, and age cubed; education, income, gender, race, frequency of church attendance; liberal-conservative identification, strength of party identification, and a dummy variable representing election years with significant third-party candidates (1980, 1992, and 1996), when there are more prominent alternatives on the ballot and the choice should be harder to make.[13] We expect the linear effect of age to be negative (representing the steadily shrinking capacity of working memory), the quadratic effect to be positive (representing the countervailing forces of accumulating political knowledge with experience), and the cubic effect of age to be negative (representing accelerated cognitive declines in the last stages of life).

We thought long and hard about whether to also include the various measures of political knowledge—which as we have already seen, are a function of age—in the equation. If the effects of age on correct voting are primarily mediated by the effects of age on

[13]Again, analyses also included dummy variables for election year to control for hierarchical clustering of error terms.

political knowledge and memory, then including knowledge as a predictor could mask the effects of age. As it turns out this does *not* happen, as the predicted effect of age is very similar whether or not we include the different indicators of political knowledge/memory as predictors. Table 4 therefore reports the results of the most fully specified equation which, in addition to the variables mentioned above, includes the three different indicators of political knowledge and memory.

Most of the control variables in this equation about which we had strong theoretical expectations—strength of party identification, political knowledge, party memories, and the number of prominent candidates on the ballot—all have their predicted sign and are highly statistically significant. Candidate memories and education both have positive coefficients but are not reliably different from zero, although they both become statistically significant if the other measures of political knowledge are removed from the equation. The results of these control variables give us confidence that the correct voting dependent variable really is tapping the quality of voter decision making that is of theoretical interest. But we are most concerned with the effects of age on correct voting, and as can be seen in Table 4, age follows exactly its predicted functional form.[14] The total effect of age on the probability of a correct vote is shown by the solid line in Figure 7, where as usual all of the other variables are held at their median or mode.[15] The curve starts with just over a 63% chance of a correct vote among 18-year-olds in a two-candidate race, drops ever so slightly to age 25 when the countervailing forces of greater experience begin reversing the trend to a peak of just under a 65% chance of a correct vote at age 51, after which time the curve reverses again, so that by age 64 it has fallen below the starting point of 63%, and by age 70 has finally fallen below a 60% chance of a correct vote. This describes over 50 years of small changes in the probability of a correct vote that probably have few practical consequences. But around age 70 the declines begin accelerating rapidly such that the probability of a correct vote by age 81 falls below the 50% chance level in a two-candidate race. These results comport quite nicely with what is known about cognitive aging in general.

Table 4 Age and Correct Voting, 1980 - 2004 ANES Surveys

	B	S.E.
Education	.152	(.254)
Income	−.081	(.138)
Female	.108	(.059)
Nonwhite	.621***	(.096)
Frequency of Church Attendance	.052	(.081)
Strength of Party ID	1.549***	(.092)
Conservative ID	−.163	(.133)
Number of Candidates	−1.523***	(.130)
Political Knowledge	1.875***	(.168)
Party Memories	.587**	(.205)
Candidate Memories	.066	(.199)
Age	−3.384**	(1.228)
Age-Squared	7.729*	(3.247)
Age-Cubed	−5.209*	(2.494)
Constant	.977***	(.175)
Correctly Classified	75.6%	
Nagelkerke Pseudo R^2	.19	
Model X^2 (df)	1030.17 (19)	
Significance	$p < .000$	

*$p < .05$, **$p < .01$, ***$p < .001$
Note: ANES data come from the 1980 through 2004 U.S. presidential elections. The analysis also includes dummy variables representing the different election years. N = 7662.

Discussion

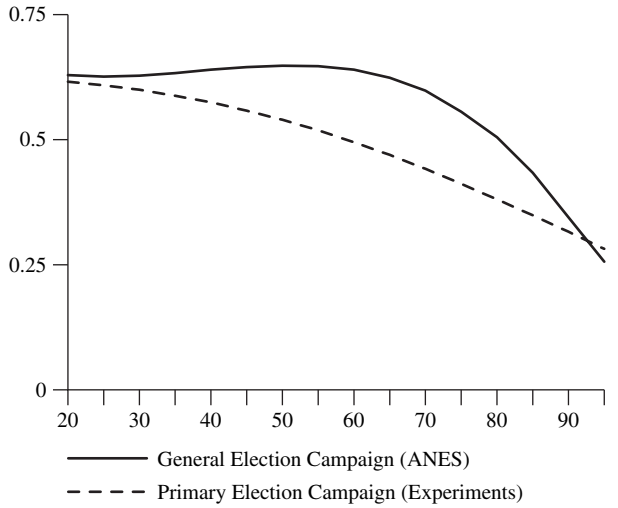
We have now explored the effects of age on information processing in some detail. We found that part of the effect Lau and Redlawsk (2006) observed in their experiments was the result of experimental artifacts: political campaigns were presented on computers, and older people were generally less familiar with computers and had somewhat slower manual dexterity which was required to access information from the dynamic information board. These artifactual effects will not generalize to real election campaigns.

But experimental artifacts accounted for only *part* of the age effects—and then only for variables such as information search which directly depended

[14]To ease interpretation all predictors in this table, including age, have been recoded to have a one-point range.

[15]We also include in Figure 7 the analysis of age effects on correct voting in the dynamic process tracing experiment primary election as a point of comparison. The data are drawn from Lau and Redlawsk (2006, Table 10.2, 216). Age effects in the primary appear to be nearly linear, perhaps because a key heuristic—party identification—is useless in choosing among candidates in a primary election. Heuristics certainly require some knowledge to allow them to work well (Lau and Redlawsk 2001), and in a general election the availability of partisanship as a cue may offset some aging effects if older voters are better able to use that heuristic.

FIGURE 7 Age Effects on Probability of a Correct Vote in U.S. Presidential Elections, 1980 - 2004



Note: General election campaign estimates based on analysis of 1980 through 2004 ANES surveys. Primary election campaign estimates come from experiments conducted by Lau and Redlawsk (2006).

on quick mouse clicks. These artifactual explanations played no role in understanding age effects on memory, for example, and those effects were quite large, monotonically decreasing from age 20 through at least age 85. Any way we look at it, memory for new players on the political stage and for specific episodes or events—the type of stimuli provided by Lau and Redlawsk's experiments—begins declining in young adulthood and continues more or less unabated until the end of life.

When we turned from experimental data about mock campaigns to survey data from recent U.S. presidential elections, the stimuli change and so do the effects of age. Available measures of knowledge and memory concerned objects (the workings of American government, the Democratic and Republican parties, major candidates long on the political scene) about which knowledge should accumulate with greater experience. In such instances (or with measures such as these), the greater accumulated wisdom from aging more than compensates for any declines in cognitive functioning until relatively late in life—in our estimates, the late 60s at the earliest.

Somewhat surprisingly, we found little evidence that older voters make their vote decisions in a presidential election any differently than younger voters. This may be due to the fact that we examined voter decisionmaking under very favorable conditions, when there are only two alternatives who differ along at least a few highly salient criteria, and more information is available about the alternatives than anyone can process. It may also be the case that most people make their vote decisions in the manner described by Lodge, Steenbergen, and Brau (1995)—by forming or revising overall impressions of candidates "online" when information about them is encountered, but forgetting the details upon which those impressions were based and thus minimizing cognitive demands. We hypothesize that more dramatic age differences would be observed for more difficult electoral choices, such as in primary elections or general elections for offices lower than the presidency, where typically the candidates are less well known and far less information about them is readily available. But for now, we have no data to test this hypothesis.

The most important dependent variable for political scientists considered here is correct voting, as it gets at the very heart of democratic representation. Citizens in a democracy have few ways to influence their government, and most people do little besides voting. But if people cannot even determine which candidate best represents their preferences, they loose even the very blunt instrument of trying to elect leaders who share their own values. We find significant age-related declines in correct voting in the later years of life *despite* our inability to find many differences in how younger and older people make their vote decisions—that is, in how much information they try to bring to bear on the decision. The inference that we draw from these seemingly contradictory findings is that older voters do not integrate all of the information they have about the alternatives under consideration as successfully as younger voters. Lodge, Steenbergen, and Brau's (1995) online decision making cannot help here, because correct voting requires specific candidate *comparisons* on particular issues or dimensions of interest, and they typically require memory.

Figure 7 displays our best estimates of the relationship between age and voting correctly in two-candidate primary and general elections. Although the curves begin and end at about the same place, the trajectory of the two curves is quite different, as the effect of age is seen much sooner in primary elections. This makes some sense, as correctly linking one's own preferences to candidates is much more difficult in a primary election than a general election because party affiliation does not discriminate between candidates in the former. We would expect any age-related effects to be magnified with more difficult decisions.

On the other hand, the consequences of voting incorrectly are probably less in a primary election where all candidates generally share certain basic beliefs and values with the voter, than in a general election where this may not be the case.

If we build on estimates of the proportion of the electorate that is 65 or older from Figure 1, holding everything else constant, the proportion of the entire electorate voting correctly in primary elections is projected to decrease by more than 4% over the course of the twenty-first century *due solely to the aging of the population*. For general elections, the figure is about 2%. Of course any consequences of this drop in correct voting should fall most heavily on older voters, whose preferences are less likely to be represented.

We would hope that our data also prove of interest to researchers in the field of cognitive aging. The two curves in Figure 7 represent the two major competing views as to when cognitive declines typically occur. Salthouse (1985, 1991, 2004) argues that declines begin almost immediately in young adults and proceed more or less continuously until the end of life. Although there is a slight bend in the curve for correct voting in primary elections, the relationship is largely linear. The data on episodic memory and cognitively difficult information gathering follow similar patterns. In contrast, Schaie (2005) believes that for most tasks of consequence for everyday living, there are no real declines before age 60, but by the mid-70s very real and important declines have typically occurred. That would pretty much describe the estimated curve for the probability of correct voting in general election campaigns, and our data on semantic memory and political knowledge that can accumulate with experience. Hence we have some support for both of these viewpoints, and the different patterns are theoretically consistent with a much larger body of work.

We close this essay with a final point that goes a bit beyond our data, but only a small bit. We have documented some very real and politically consequential declines in political cognition, at least in the later years of life. The consequences of poor decision making by the mass public are moderated by the fact that these are mass decisions, only indirectly translated into government action. But how about decisions made by people in government themselves? Elected office is an accomplishment rarely achieved before age 40, and the higher the office usually the older the age of the office holder. Surely the average elected official will be much older than the average citizen. Three of our 43 presidents were 65 or older when they first took office, and 13 had reached that age before they left office. Forty-nine of the 100 senators in the newly elected 110th Congress will be 65 or older by the conclusion of the term; 27 will be 70 or older; 11 will be 75 or older. This is a lot of older people making some pretty important decisions. Are we suggesting that older people are incompetent decision makers? No, of course not, but declines in cognitive capacity can make any job (including that of college professor) that much more difficult to do successfully. The greatest impact of age on political cognition may not be where we have looked, among the mass public, but among political leaders who are often making much more difficult, and more consequential, decisions. We need much more research on the cognitive shortcuts and heuristics that allow older decision makers to continue to do their jobs despite any decrease in cognitive efficiency.

Acknowledgments

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