Visual Political Knowledge: A Different Road to Competence?

Markus Prior Princeton University

Even though visual images and television are ubiquitous in politics, surveys rarely use visuals to assess what people know about politics. I measure visual political knowledge in a series of experiments that ask otherwise identical questions using either relevant visual elements or words only. These experiments were embedded in two representative surveys of U.S. residents conducted in 2003 and 2008. Adding a visual to an otherwise identical knowledge question causes, on average, a small but significant increase in correct answers. Treatment effects are larger for a subset of the population: women, older people, the less educated, and people with a visual cognitive style all perform disproportionately better on visual knowledge questions. Validation shows that visual knowledge is as indicative of civic competence as verbal knowledge. Hence, traditional verbal-only questions miss a significant amount of political knowledge. Several population segments previously deemed ill-informed in fact store some political information visually.

> "I can see his face and his balding head, but I can't remember his name. The name just doesn't come to me."
>
> "I can see his face but I can't remember his name, bad with names, real bad."
>
> — Respondents 10640 and 15223 asked to name George W. Bush's Supreme Court nominee Samuel Alito (phone survey conducted by Indiana University's Center for Survey Research for Time-sharing Experiments for the Social Sciences on November 4 and 9, 2005)

Visuals are everywhere in American politics.[1] Every day, more people watch television news than read a newspaper or listen to news on the radio. One content analysis estimated that a typical TV news story contains almost 70 different visual images per 1,000 words. Even after accounting for the brevity of stories on television, this translates into an average of 24 images in a two-and-a-half-minute story (Neuman, Just, and Crigler 1992). Graber (1990) found that about a third of all visuals in a typical newscast add new information to a story. Recent presidential candidates were seen more often in network news programs than they were heard speaking (Bucy and Grabe 2007).

Yet, when political scientists measure what people know about politics, they hardly ever ask about visuals. Existing studies of political knowledge levels and distributions are based on all verbal knowledge questions[2] (e.g., Bennett 1995; Converse 1964; Delli Carpini and Keeter 1996; Gilens 2001). Many of these analyses find substantial knowledge differences by gender, race, and socioeconomic status. In the most comprehensive study to date, Delli Carpini and Keeter conclude that "groups of citizens vary in knowledge in ways that mirror their standings in the social, political, and economic world, calling into question the fundamental democratic principle of equality among citizens" (1996, 271). These inequalities are persistent, leading the authors to fear "the institutionalization of economic and social inequities—a kind of political caste system" (155).

There is reason to believe, however, that some of these inequalities are reflections not of genuine knowledge differences, but of partial survey questions.

[1]An online appendix with supplementary material for this article is available at http://dx.doi.org/10.1017/S0022381613001096. Data and supporting materials necessary to reproduce the numerical results will be made available at www.princeton.edu/~mprior.

[2]By "traditional verbal" or "verbal-only" questions I mean questions read by the respondent (in mail or Internet interviews) or to the respondent (in face-to-face or phone interviews.)

The Journal of Politics, Vol. 76, No. 1, January 2014, Pp. 41–57 doi:10.1017/S0022381613001096
© Southern Political Science Association, 2013
ISSN 0022-3816

People with less formal education and lower functional literacy may depend more on visuals in processing and storing political information. Research reviewed below indicates that women are better than men at recognizing faces. According to theories of mental representation and information processing, some people prefer to learn and think visually, whereas others favor a verbal cognitive style—leading psychologists to distinguish ''visualizers'' and ''verbalizers'' (e.g., Paivio 1971, 1986; Richardson 1977). When visualizers, women, and less educated people answer verbal knowledge questions, they may be handicapped by an instrument that does not fit their cognitive style and abilities. To penalize them for this handicap undermines political knowledge measurement and confounds who is knowledgeable and why. Might Delli Carpini and Keeter have reached their conclusion about persistent gender and socioeconomic inequality in part because they never asked about what people *see* on television or in photographs? Does the ''lower caste'' in their analogy simply take a different path to political competence, one that relies more on visual representations of politics?

Graber's (1988, 1990, 2001) research suggests that omitting visuals may bias measures of political knowledge. Using mostly focus groups and experiments, she shows that viewers recall visual themes presented in TV news at least as easily as verbal themes. But ''even though people would score well on such questions because they remember visual information better than verbal data, they are seldom asked about the content and meaning of pictures seen on television'' (2001, 52).

This study translates one element of Graber's broader claim into an experimental research design. Keeping the question topic and its wording the same, do people perform better when they can also draw on visual representations of the question referent? Research in cognitive psychology (see below) suggests that they should because visual representations offer an additional pathway between the question topic and the conceptual representation of it they have in memory. Respondent 10640, quoted in the opening epigraph, cannot remember Samuel Alito's name but knows him nonetheless (i.e., has a visual representation of Alito). Knowledge measures that do not tap visual representations may thus underestimate what some people know about politics because they insist on one particular link to information stored in memory.

This article reports the results of two experimental studies, including the first nationally representative survey to measure visual political knowledge. In the first study, conducted in 2003, one-half of the respondents answered a series of knowledge questions with visual elements. The other half received identical questions, except that words replaced the visuals. The second study (in 2008) used a within-subjects design, so all respondents answered visual and verbal-only questions. The two experiments are analyzed to determine if visual political knowledge is sufficiently different from traditional verbal knowledge so that all-verbal measures produce misleading conclusions about sources and structure of what people know. Both types of measures are validated against independent measures of civic competence to establish that visual knowledge, like verbal knowledge (Delli Carpini and Keeter 1996), is associated with other normatively desirable characteristics.

In order to demonstrate that modality matters, it is essential to hold constant the content of the question. Substituting photos of individuals for their names meets this criterion and has external validity as close-ups are by far the most common visuals in news stories (Graber 1990). Moreover, most experimental research using visual stimuli has focused on faces (e.g., Lang, Potter, and Bolls 1999; Rosenberg, Kahn, and Tran 1991; Sullivan and Masters 1988). The hypotheses proposed here also apply to visual questions without direct verbal equivalents, such as questions about symbols, nonverbal behaviors, and news footage. But those questions are not suitable for establishing modality differences as they cannot hold constant the question content. Despite this constraint, knowledge items in this study cover a variety of domains, including all branches of government, the Federal Reserve, party affiliation, the 2004 presidential primaries, roll calls of 2008 primary candidates, and foreign leaders.

Theory and Hypotheses

Survey-based studies on the measurement of political knowledge and research on its causes and consequences has traditionally employed verbal measures of knowledge (e.g., Delli Carpini and Keeter 1996; Luskin 1990; Mondak 2001). If some people store correct information about the object of the question in visual form or retrieve it more effectively after a visual cue, verbal knowledge questions may underestimate how much people know. Models of memory distinguish visual, conceptual, and phonological representations (see Schacter 2002, 62–68). In devising questions about persons in the public domain—one of the most common type of question (Delli Carpini and Keeter 1996)—political scientists aim to test if respondents hold specific conceptual representations

of politically consequential persons, such as their responsibilities, ideological leanings, or biographical attributes. People may relate the person and an attribute of the person (conceptual representation) without recognizing the persons' name (phonological representation) because "most models of name retrieval hold that activation of phonological representations occurs only after activation of conceptual and visual representation" (Schacter 2002, 65). In other words, you do not need to know the name to know about the person.

According to Paivio's (1971, 1986) dual-coding theory, knowledge can be represented visually or verbally as "any given stimulus can be encoded using one of two symbolic systems: the verbal system which is essentially linear and most suitable for dealing with language and abstract, sequential relationships; and the imaginal system, which specializes in dealing with nonverbal and concrete parallel relationships" (Fogarty and Burton 1996, 87). Processing visual information appears to happen automatically and require fewer resources than verbal information. When visual and verbal stimuli compete for scare mental capacity—as when the video and audio tracks of TV news offer nonredundant information—visual information is more likely to be encoded and stored in memory (Grimes 1991; Lang, Potter, and Bolls 1999). Even for content that is presented both verbally and visually, comprehension, encoding, and later retrieval of the visual information may be easier (Lang 1995).

Research in cognitive psychology thus suggests that survey respondents may have visually encoded and stored some information relevant to the question they are asked verbally. Hence, respondents may answer a verbal knowledge question incorrectly not because they do not know the answer, but because their knowledge is available to them only in visual form. They may, like the two TESS respondents in the epigraph to this article, remember the face of a Supreme Court nominee but not his name. Models of human memory thus generate the first hypothesis:

> *H1*: Adding a relevant visual element to a verbal-only knowledge question increases the probability of a correct answer.

H1 does not further define the "relevant visual element." In this study, I test a more specific version of Hypothesis 1—that adding the photo of a person invoked by name will increase the chance of a correct answer to a knowledge question about the person. Adding the photo allows respondents to draw on either of two memory links between the person and the attribute the question asks about: the name-attribute or the photo-attribute link. The null hypothesis rests on several possibilities: people who do not recognize the name may rarely recognize the visual. The visual may not activate a link to the attribute. The visual element may convey misleading considerations or activate irrelevant information that impede the association between person and attribute.

When the photo instead replaces the name, respondents must draw on one memory link at the expense of another. For respondents with a stronger photo-attribute link, knowledge should be lower when the question includes only the name. The reverse should be true for respondents with a stronger name-attribute link. Theory does not predict whether knowledge scores should be higher, lower, or the same in the visual-only condition than in the verbal-only condition. It depends on the relative prevalence of links between visual and verbal representations of the person and the attribute tested in the question.

In addressing Delli Carpini and Keeter's (1996) concern about inequality, variation in modality effects across individuals is more critical than variation across knowledge questions. According to dual-coding theory (Paivio 1971, 1986), people differ in their propensity to rely on verbal and imaginal systems. Purely verbal measures of political knowledge should thus disadvantage some people disproportionately. Following Paivio's stipulation that people's preferences for information processing influence which symbolic system they use, researchers have developed measures to distinguish people who like to learn and think verbally from people who prefer visual information (Kirby, Moore, and Schofield 1988; Plass et al. 1998; Richardson 1977). This individual difference should explain relative performance on visual and verbal knowledge questions:

> *H2*: Adding or substituting a visual element in a verbal knowledge question improves performance of people with a visual cognitive style compared to people with a verbal cognitive style.

Other groups of people might also be handicapped by verbal-only questions and should disproportionately benefit from adding or substituting relevant visual elements. According to Graber, "skill in processing verbal information, particularly when it is printed and deals with complex matters, often requires formal schooling. Audiovisual information transmission, therefore, can potentially reach much larger audiences, starting at a much younger age" (1996, 86). Hence, a visual knowledge question may be easier to answer for less educated respondents than a verbal question because they are more likely to have processed and

stored the relevant information visually. According to the UN Human Development Report 2002, 21% of Americans between the age of 16 and 65 are functionally illiterate. Although even the visual-question format used in this study contained words, it may reduce the disadvantage for these respondents. More generally, education increases familiarity and experience with verbal test questions. Visuals might reduce test-taking effects and encourage less educated respondents to consider the question.

H3: Formal education is more strongly related to verbal political knowledge than to visual political knowledge.

Women are generally better than men at recognizing faces (Lewin and Herlitz 2002; Rehnman and Herlitz 2008), so they might benefit disproportionately from visual questions because they hold more visual information in memory.

H4: Compared to men, women perform relatively better on visual political-knowledge tests than on verbal tests.

"Name blocking," failure to retrieve a person's name from memory despite remembering the person and attributes of the person, becomes more common with age (Cohen 1990; Cohen and Faulkner 1986; Schacter 2002, 62). Name blocking is particularly common for names of famous people and occurs even in mid-age (Burke et al. 1991).

H5: Older people perform relatively better on visual political-knowledge tests than on verbal tests.

Hypotheses 2–5 emphasize potential differences in storage and retrieval of different modal representations of knowledge. Relative exposure to visual or verbal representations of the same person may also vary across individuals. People who get a lot of their information from visual media may be more likely to form a connection between conceptual and visual representations of a person.

H6: Television news viewers do better on visual knowledge questions than on verbal questions.

Data and Experimental Design

In each of two surveys, respondents answered a set of knowledge questions that randomly varied whether the questions contained visual elements. In the visual-only condition, questions asked about individuals shown by photographs. In the verbal-only condition, questions were identical except that they referred to individuals by name rather than picture. Study 2 also includes a visual-and-verbal condition which used both name and picture.

Study 1 used a between-subjects design to test the difference between verbal-only (name) and visual-only (photo) identification of individuals. Respondents were assigned to one of the two conditions for the entire knowledge battery. Study 2 used a within-subject design to compare three mode conditions: verbal only (name), visual only (photo), and verbal and visual (name and photo). Knowledge questions were divided into three blocks, and respondents were randomly assigned to a different condition for each block. Randomization was balanced so that no respondent would be assigned to a condition for more than one block. Block sequence was randomized to control for order effects. Question order within each block was fixed. This design is a (orthogonal) Latin square design (Jones and Kenward 2005, 154–56) with six possible treatment sequences and the same expected number of observations in each sequence. The main advantages of a within-subject design are greater statistical power and the ability to hold constant stable respondent characteristics.

All knowledge questions were multiple choice. The survey design followed Mondak's (2001) recommendation to discourage "Don't Know" responses by not giving respondents an explicit "Don't Know" option. Each response is recoded into a binary variable with 1 indicating choice of the correct answer and 0 for incorrect answers and screens left blank.

Both sets of experiments were embedded in representative opinion surveys, so the results can be generalized to the U.S. population. Knowledge Networks, which conducted both surveys, interviews national probability samples of the U.S. population over the Internet by providing a large panel, selected through Random Digit Dialing, with WebTV units and free Internet connections in exchange for taking surveys. Study 1 was conducted in April 2003 ($N = 1{,}650$, completion rate 71%). Study 2 was conducted in March and April 2008 ($N = 778$, completion rate 57%).

The two studies combined draw on 30 different knowledge questions to avoid undue influence of idiosyncratic items. Questions use several designs to capture different mappings between conceptual and visual/phonological representations of political information. The "Which office . . . " design asked respondents to name the office or position held by an individual identified by name, a photograph, or both. One question in this format asked respondents about Nicolas Sarkozy's job. In the visual-only condition, respondents saw a photo of Sarkozy and were asked "What position is currently held by the person shown in this picture?" In the verbal-only condition, the question was "What position is currently

held by Nicolas Sarkozy?" In the verbal-and-visual condition, included only in Study 2, respondents received the same question but also saw Sarkozy's photo. The response options for the question were the same in all conditions (and presented in random order). Figure 1 illustrates the experimental design with screenshots for each condition.

In a second question design, the "Who is . . . " design, respondents were asked which politician holds a particular office. The response options for those in the verbal-only condition consisted of the names of four figures of public interest. Respondents in the visual condition chose between the photographs of the same four individuals. The verbal-and-visual condition presented both names and photos. To avoid asking only about politicians' jobs, a third design tests knowledge of more political elements of conceptual representation. Respondents were asked to indicate the party of several politicians, how Democratic candidates for the 2008 presidential nomination had voted on the 2002 Senate authorization of military action in Iraq, whether or not several politicians had announced their candidacy for the 2004 Democratic nomination, and which politicians out of a set of four were most conservative and most liberal. Appendix Table A1 lists all questions and describes steps taken to minimize the possibility that respondents would look up answers.

Method

Unconditional and conditional treatment effects are estimated using a repeated-measures framework that nests knowledge questions within respondents. Each respondent $i = 1, \ldots, n$ answers knowledge questions $j = 1, \ldots, k_i$. The probability of answering correctly, $P(y_{ij} = 1)$, is a function of the treatment for question j. One treatment, available in both studies, is the presence of a visual element, VIS_{ij}. Only Study 2 uses a second treatment, BTH_{ij}, the addition of the photo(s) to the verbal-question format. Questions-specific effects u_j capture variation in baseline difficulty. Study 2 varied the order of the treatments, so period effects $u_{p(j)}$ can be estimated. (In Study 1, question order was constant.) With $F(z)$ indicating the logit function $1/(1+\exp(-z))$, the resulting model is

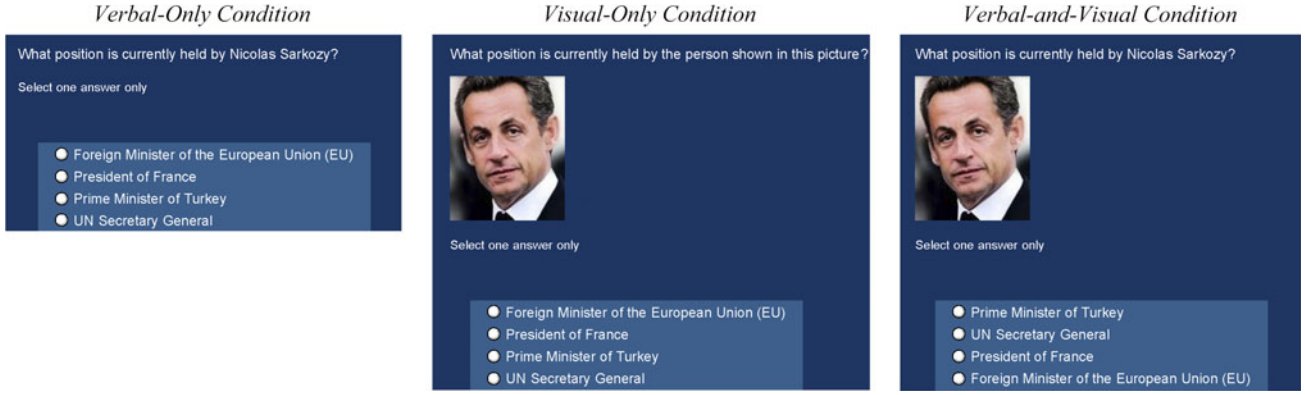
$$P(y_{ij} = 1 | VIS_{ij}, BTH_{ij}, u_j, u_{p(j)}) = F(\alpha + VIS_{ij}\beta_1 + BTH_{ij}\beta_2 + u_j + u_{p(j)}). \quad (1)$$

Respondents who answer one knowledge question correctly are more likely to answer a second question correctly as well. Hence, observations from the same respondent are not independent. To break up this serial correlation, Equation (1) is modified to include separate intercepts for each respondent. These respondent effects capture unobserved differences between respondents in the underlying propensity to answer knowledge questions correctly. Conditional on this respondent effect (and the observed independent variables), observations can be treated as independent.

$$P(y_{ij} = 1 | \alpha_i, VIS_{ij}, BTH_{ij}, u_j, u_{p(j)}) = F(\alpha_i + VIS_{ij}\beta_1 + BTH_{ij}\beta_2 + u_j + u_{p(j)}), \quad (2)$$

Hypothesis 2 to Hypothesis 6 relate treatment effects to respondent characteristics. To estimate treatment effects in population subgroups, treatment indicators are interacted with control variables $\mathbf{x}_i$.

FIGURE 1 "Which Office . . . " Design, Example (Study 2)



Note: This figure shows screenshots for the three different experimental conditions in Study 2 for one political knowledge question in the "Which office…" design. For a list of all questions, see Appendix Table A1 in the supporting information.

$$P(y_{ij} = 1|\alpha_i, VIS_{ij}, BTH_{ij}, \mathbf{x}_i, u_j, u_{p(j)}) = F(\alpha_i + (VIS_{ij}\beta_1 + BTH_{ij}\beta_2)\mathbf{x}_i + u_j + u_{p(j)}). \quad (3)$$

For random-effects logit models to provide consistent estimates of Equation (3), it is necessary to assume that α_i is unrelated to the other independent variables in the model. Following convention, α_i is assumed to be normally distributed with mean zero (e.g., Frees 2004, 329–32). It is possible to estimate Equation (3) without this random-effects assumption. After conditioning on $\sum_j y_{ij}$ (i.e., the number of correct responses across all questions), the distribution of $\mathbf{y}_i$ no longer depends on α_i. Unlike full maximum-likelihood estimation, this conditional MLE (called conditional logistic regression or fixed-effects logit) provides consistent estimates of $\boldsymbol{\beta}$ (Baltagi 2008, 237–40; Frees 2004, 335–39).

In Study 2, Equations (2) and (3) can be estimated by either a conditional logistic regression or random-effects logit because treatment varies within respondents. Main effects of between-subject covariates $\mathbf{x}_i$ drop out in the conditional MLE, but the interaction effects between treatment and respondent-level characteristics will be estimated. If the random-effects assumption is correct, random-effects logit provides more efficient estimates. In Study 1, each respondent receives exactly one treatment, so treatment is a between-subject covariate and conditional MLE is impossible.

In within-subjects experiments, carry-over effects occur if the impact of the previous treatment still influences respondents when they answer questions under the next treatment. For example, visual elements may encourage some people to answer the question ,and this encouragement may spill over to the verbal questions in the next block in Study 2. Carry-over can be detected because some subjects were randomly assigned to verbal questions in their first block, which by design cannot be affected by carry-over effects.

To identify visualizers and test if they do systematically better on visual knowledge items (H2), I use questions developed in psychology to measure respondents' cognitive style (Kirby, Moore, and Schofield 1988; Mayer and Massa 2003; Richardson 1977). They operationalize Paivio's (1971, 1986) concept of preference for verbal and visual (imaginal) processing. For each respondent, it provides "a single score representing a point on a continuum ranging from verbally oriented to visually oriented processing" (Childers, Houston, and Heckler 1985, 131). In both studies, the measure has a mean of .48 and a standard deviation of .13, with high values indicating a more visual style (see appendix for details.)

Hypothesis 3 to Hypothesis 5 require standard measures of education, gender, and age. To assess the modality of respondents' preferred news for a test of Hypothesis 6, respondents are asked from which media they "typically get most of [their] news." The four response options were print media, radio, television (including "online news clips"), and "other sources." The analysis uses an indicator for respondents who selected television (63% in Study 1, 56% in Study 2). Models also control for income, political interest, perceived duty to be informed,[3] and strength of partisanship. Following previous work on political sophistication (Bennett 1995; Luskin 1990; Neuman, Just, and Crigler 1992), analyses include a measure of cognitive skills. The measure, adopted from the General Social Survey, consists of 10 items (eight in Study 2) that ask respondents to select synonyms for different words (see Verba, Schlozman, and Brady 1995, 561–62). Vocabulary tests are sometimes interpreted as indicative of general cognitive abilities.

Results

Across the 18 knowledge questions in Study 2, adding visuals increases the percentage of correct responses by 2.3 points on average. Instead of averaging between-subject effects across questions, Equation (2) can generate within-subject estimates of the photo effect. Conditional logistic regression yields a logit coefficient of .117 (s.e. = .051). Using the random-effects (RE) logit estimator, which is a weighted average of between- and within-subject effects, this coefficient is almost identical at .117 (.050). Holding item and period fixed effects at their sample proportions and subject fixed effects at zero, this amounts to an increased probability of answering correctly of .029 in the visual-and-verbal condition. Tests for carry-over effects are negative: indicators for treatment in the previous block are jointly insignificant regardless of estimator or definition of carry-over by block or screen.

Substituting names with photos tests the difference between the phonological-conceptual and the visual-conceptual link. The average (between-subject)

[3] "Duty to be informed" is measured as agreement with two items: "It is my duty as a citizen to follow the news," and "Everyone should know about the important political issues of the day."

effect of replacing names with photos is a decline of .7 percentage points. (The median decline is a 1-point drop.) The within-subject effect, using conditional logistic regression to estimate equation 2, is −.098 (.051). The equivalent RE estimate is −.095 (.050) for Study 2 and −.097 (.088) for Study 1. This difference is only significant (at $p = .060$) in Study 2 (which is more efficient due to the within-subject design, even though it has less than half as many respondents.) The effect amounts to a drop in probability of .024.

The main purpose of this analysis is to understand variation across individuals. There are strong theoretical reasons to expect that some people are disproportionately affected by measuring political knowledge using exclusively verbal questions, so averaging hides important individual differences. If some people do particularly well on verbal questions, while others do better on visual ones, using only verbal questions would systematically discriminate against the visually inclined. The following analysis relates the probability of answering a question correctly to a set of predictors and tests if question modality conditions the impact of these predictors (see Equation 3).

Table 1 presents RE estimates of Equation (3) for both studies. The top part reports the main effects of each predictor. The within-subject design of Study 2 also makes it possible to estimate conditional logit models. Conditional logit does not yield estimates of a predictor's main effect, only of the extent to which a predictor works differently as a function of the experimental treatment.

The main effects, which represent the predictor's impact in the verbal-only condition, confirm past research, virtually all of which is based on traditional verbal measures (e.g., Delli Carpini and Keeter 1996; Gilens 2001; Luskin 1990). People who report following government often, party identifiers, and, at least in Study 1, those who perceived it to be their duty to be informed are all more likely to respond correctly. Men, older people, and wealthier individuals do better. The strongest nonpolitical factor is the vocabulary test, confirming the results by Neuman, Just, and Crigler (1992, 137). Even after accounting for vocabulary skills, education still matters. College-educated respondents are more likely to answer correctly.

Two findings in Table 1 add new insights to the literature on political knowledge, however. First, visual cognitive style has a clearly negative effect on the probability of answering questions correctly in the verbal-only conditions of both studies. No previous research on political knowledge has documented this negative association. The probability of a correct answer by a respondent who is one standard deviation above the mean on cognitive style (i.e., a visualizer) is between .043 (Study 2) and .083 (Study 1) lower than the same probability of an otherwise identical respondent who is a standard deviation below the mean.[4] Of the same magnitude as the probability difference between a strong partisan and a partisan leaner (.057), the impact of cognitive style is sizable. Notably, it emerges after variation in cognitive skills and formal education has been accounted for.

Second, conventional wisdom does not apply in the same way to visual knowledge. The impact of standard predictors of knowledge varies in predictable ways with question modality. The middle part of Table 1 shows estimates of interactions between predictors and the visual-only treatment. Significant coefficients indicate that a predictor's impact of political knowledge was different in the visual-only condition than in the verbal condition. The bottom section of Table 1 presents estimates of the difference between the visual-only and the visual-and-verbal conditions, which is available only in Study 2. Significant coefficients here mean that a predictor's impact differs statistically depending on whether or not the photos were accompanied by names.[5]

Studies 1 and 2 offer consistent support for Hypothesis 2: visualizers do relatively better on knowledge questions that include photos. The magnitude of the statistically significant interactions between visual treatment and cognitive style in both studies indicates that visualizers' handicap disappears when knowledge questions contain a photo: visualizers perform just as well as verbalizers. Comparing the impact of cognitive style in the visual-only condition to its impact in the visual-and-verbal condition in Study 2 indicates that the variable operates in about the same way in both conditions. The contrast is substantively small and statistically insignificant (see bottom section of Table 1). Two independent studies thus demonstrate that visual knowledge does not suffer from the discriminatory effect of cognitive style that is evident for traditional measures of political knowledge.

Figure 2 plots the treatment effects on the impact of different independent variables. It illustrates the difference cognitive style makes in the different

[4]Predicted probabilities are generated while holding continuous variables at their sample means, education at "some college," age at "45–59," and all other indicator variables at their base levels.

[5]Treatments are coded into two indicator variables, one for conditions with photos (visual-only and visual-and-verbal), one for conditions with photos and names (visual-and-verbal).

TABLE 1 Covariates of Political Knowledge, by Modality

	Study 2 Conditional Logit	Study 2 Random-Effects Logit	Study 1 Random-Effects Logit
Female		-.29 (.09)**	-.69 (.11)***
Black		-.14 (.17)	-.35 (.20)*
Hispanic		-.02 (.17)	-.28 (.26)
Other nonwhite		.12 (.20)	.09 (.29
Age (baseline: 18–29)			
30–44		.21 (.17)	-.19 (.22)
45–59		.39 (.18)**	.001 (.22)
60+		.64 (.19)**	.23 (.22)
Income (0–17, mean deviation)		.02 (.01)	.08 (.01)***
Education (baseline: less than high school)			
High-school degree		-.04 (.14)	.14 (.20)
Some college		.02 (.14)	.02 (.22)
College degree		.21 (.16)	.58 (.22)**
Vocabulary Test (0-1, mean deviation)		.94 (.23)***	2.12 (.29)***
Visual Cognitive style		-.66 (.36)*	-1.29 (.41)**
Follows Government (baseline: "now and then" or less)			
"some of the time"		.16 (.12)	.36 (.14)**
"most of the time"		.80 (.14)***	.77 (.16)***
Duty to be informed (0–1, mean deviation)		.08 (.24)	.72 (.24)***
Most news from TV		-.06 (.09)	.15 (.11)
Strength of party ID (0–3)		.11 (.04)**	.10 (.05)**
Election panel		.04 (.10)	n/a
Visual-Only Condition	-.75 (.39)*	-.72 (.37)*	-.94 (.53)*
× Female	**.19 (.12)***	**.15 (.11)***	**.50 (.15)*****
× Black	.04 (.19)	.01 (.20)	.16 (.28)
× Hispanic	.44 (.23)**	.34 (.20)*	-.29 (.36)
× Other nonwhite	-.06 (.27)	-.14 (.23)	-.11 (.42)
× Age 30–44	.29 (.18)*	.30 (.17)**	.32 (.33)
× Age 45–59	.30 (.18)*	.33 (.17)**	.29 (.32)
× Age 60+	.23 (.20)	.24 (.18)*	.34 (.33)
× Income	.002 (.02)	.004 (.01)	-.04 (.02)**
× High-school degree	**-.33 (.20)****	**-.33 (.20)***	**-.42 (.28)***
× Some college	-.49 (.21)**	-.51 (.21)**	-.09 (.31)
× College degree	**-.31 (.23)***	**-.32 (.22)***	**-.46 (.31)***
× Vocabulary test	.11 (.31)	.07 (.26)	-.36 (.40)
× Visual cognitive style	**.72 (.47)***	**.79 (.43)****	**1.01 (.60)****
× Follows government "most of the time"	-.33 (.18)**	-.27 (.17)*	-.22 (.23)
× Follows government "some of the time"	-.21 (.15)*	-.22 (.14)*	-.25 (.20)
× Most news from TV	.22 (12)*	.19 (.11)**	-.13 (.16)
× Duty to be informed	.34 (.32)	.36 (.28)	.29 (.33)
× Strength of party ID	.01 (.05)	-.004 (.05)	.12 (.07)*
× Election panel	.16 (.12)*	.11 (.11)	n/a
Both Conditions (vs. Visual Only)	.17 (.41)	.12 (.37)	
× Female	-002 (.12)	-.01 (.11)	
× Black	-.27 (.23)	-.25 (.20)	
× Hispanic	-.18 (.24)	-.13 (.21)	
× Other non-white	-.32 (.28)	-.31 (.23)*	
× Age 30–44	-.24 (.18)*	-.22 (.17)	
× Age 45–59	.08 (.18)	.08 (.17)	
× Age 60+	.02 (.20)	.05 (.18)	

TABLE 1 (Continued)

	Study 2 Conditional Logit	Study 2 Random-Effects Logit	Study 1 Random-Effects Logit
× Income	-.0003 (.02)	-.002 (.01)	
× High-school degree	.27 (.21)	.30 (.20)*	
× Some college	.40 (.22)**	.45 (.21)**	
× College degree	.12 (.24)	.18 (.22)	
× Vocabulary test	-.36 (.29)	-.41 (.26)*	
× Visual cognitive style	-.22 (.48)	-.27 (.42)	
× Follows government "most of the time"	.37 (.19)*	.33 (.17)**	
× Follows government "some of the time"	.38 (.16)**	.37 (.14)***	
× Most news from TV	-.33 (.12)***	-.31 (.11)***	
× Duty to be informed	-.06 (.30)	-.05 (.28)	
× Strength of party ID	-.0003 (.05)	.002 (.05)	
× Election panel	-.06 (.12)	-.03 (.11)	
Log Likelihood [1]	-5,770	-7,564	-10,037
Sigma u		.67 (.03)	1.24 (.04)
rho		.12 (.01)	.32 (.01)
Number of respondents	726	726	1,575
Number of responses	12,870	13,068	18,900

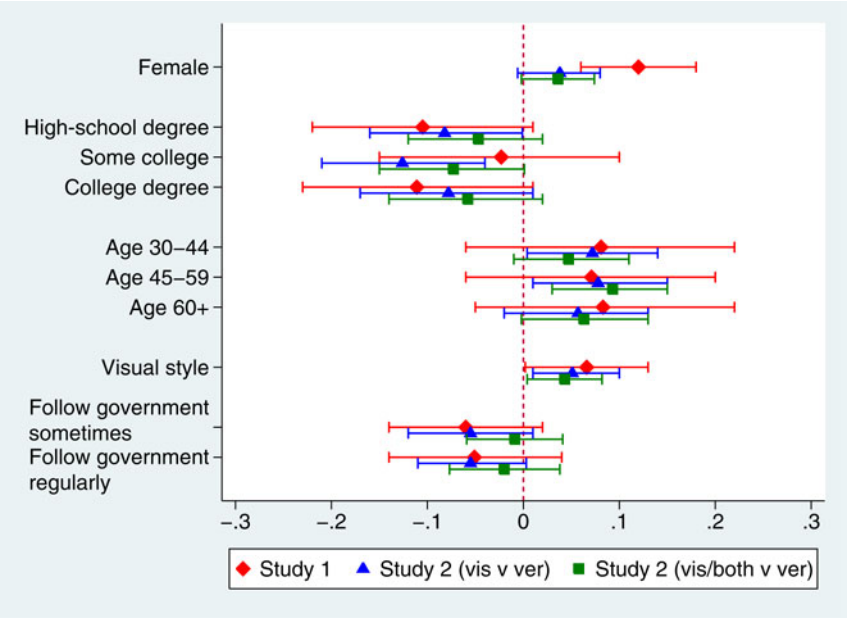
Note: Cell entries show logit coefficients with standard errors in parentheses. Models also include fixed effects for knowledge question and position of the question within the knowledge battery (Study 2 only). Fixed-effects conditional logistic regression estimates provide robust standard errors (clustered at the respondent level.) Standard errors for random-effects logistic regression estimates are based on the observed information matrix of the log likelihood. Bolded rows indicate conditional treatment effects that are consistently significant in both studies.
[1]Pseudolikelihood for conditional logit model.
*$p < .10$, **$p < .05$, ***$p < .01$ (two-tailed tests for main effects, one-tailed for interaction effects)

conditions. The plot shows the difference in the impact of cognitive style when a photo is present in the question compared to the impact of cognitive style for a verbal-only question. This difference is calculated by subtracting the change in predicted probability of answering correctly associated with a two standard-deviation change in cognitive style under the verbal-only treatment from the probability change that the same cognitive style difference makes under the visual treatments. (Figure 2, in other words, essentially plots differences-in-differences for probabilities.) The diamond shows the difference in the effect of cognitive style between the verbal-only and the visual-only condition for Study 1. The triangle shows the same quantity for Study 2. The square, finally, pools the visual-only and visual-and-verbal conditions in Study 2, showing differences in the impact of cognitive style between the verbal-only condition and the two visual conditions. All three estimates are very similar, and their 90% confidence intervals do not include zero. Relative to verbalizers (one standard deviation below average cognitive style), visualizers (one standard deviation above average) increase their probability of answering correctly by .07 in Study 1 and .05 in Study 2 when the question contains a visual.

In most previous research, education is strongly related to political knowledge, and the most comprehensive study concludes that "education is the single strongest predictor of political knowledge" (Delli Carpini and Keeter 1996, 271). According to Hypothesis 3, derived prominently from Graber's (1990, 1996) work, education matters less for visual knowledge because comprehending, processing, and retrieving visual information depends less on the verbal skills learned and rehearsed through formal education. Together, the two studies provide support for Hypothesis 3. The performance advantage for college graduates on verbal knowledge is essentially leveled in the visual conditions.[6]

[6]Vocabulary skills, which correlate with an ordinal measure of education at .44, reduce the main effect of education. In Study 2, the main effect for College Degree rises from .21 to .81 without vocabulary skills in the model and from .02 to .52 for Some College. The treatment × education interaction does not depend on the inclusion of vocabulary skills in the model. Without it, the interaction of Visual-only and College Degree has a coefficient of −.31 (.22) in the RE model. Results are not consistent between Studies 1 and 2 for respondents with some college. Both studies find that visuals help respondents without even a high school degree do relatively better than high school graduates, but this effect disappears again when photos and names are both included in Study 2.

FIGURE 2 Political Knowledge, by Question and Experimental Condition



Note: This graph is based on Model 3, as estimated in Table 1. It shows the treatment effects on the impact of different independent variables. Estimates are the difference between the predicted probability of answering correctly associated with a change in respective independent variable under the verbal-only treatment and the probability change that the same change makes under the visual treatments. (For visual cognitive style, the change is two standard deviations.) The diamond shows this difference between the verbal-only and the visual-only condition for Study 1. The triangle shows the same quantity for Study 2. The square represents the pooled effects of the visual-only and visual-and-verbal conditions in Study 2, showing the difference in the impact of the independent variable between the verbal-only condition and both visual conditions. The graph plots 90% confidence intervals around these estimated differences.

Both studies show that women benefit more than men from the inclusion of visuals, supporting Hypothesis 4. According to most previous studies of this subject and again on the verbal-only questions in Studies 1 and 2, women know less about politics than men. On visual knowledge, this gender gap declines by between half and two-thirds. This is true for both the visual-only and the visual-and-verbal condition in Study 2. Averaging the two studies, the probability of a correct answer is .08 higher for women relative to men when the question includes visuals. In light of a long line of research documenting a substantial gender gap on political knowledge, the considerable decline in this gap on visual political knowledge is remarkable. It questions whether gender differences on verbal knowledge really "reflect a genuine difference in the taste for politics" (Verba, Burns, and Schlozman 1997, 1070) and exist because "politics is still very much a man's world" (Gidengil et al. 2006, 246). Results of the two studies presented here are more consistent with the conclusion that women store political information visually and are hurt by knowledge questions that do not test this reservoir of knowledge. (Women are no more likely than men to be "visualizers," so cognitive style cannot explain their stronger performance in the visual conditions.)

The age differences in both studies are remarkably consistent (see Figure 2) but statistically significant only in Study 2 due to its greater power. In both studies, respondents over 44 do disproportionately better on visual knowledge questions. (Respondents between 30 and 44 do relatively better in the visual-only condition, but not in the visual-and-verbal condition.) Age is already positively related to political knowledge in the verbal-only condition and becomes more pronounced in the visual conditions. These results support Hypothesis 5. Although they are generally consistent with research in cognitive psychology showing that older people have more difficulty accessing memory representations of names, this is not a direct demonstration of name blocking because verbal-only questions required recognition, but not recall of names.

The final hypothesis (H6)—people who typically get their news from television do better on visual knowledge—is supported only in Study 2 and only for the visual-only condition. The latter result fits the theory. If television news strengthens the connection between visual and conceptual object representations, those who rely on TV should do better specifically when the photo-attribute link is the only available link to answer the question correctly (as in the visual-only condition). When photo and name are both shown, the photo-attribute link is no longer the only available link, so TV news viewers no longer have a disproportionate advantage. In Study 1, however, respondents who indicated television as their typical news source did no better or worse than others, regardless of the question format. Overall, evidence on Hypothesis 6 is inconclusive.

One other difference, this one not predicted theoretically, emerges consistently. As expected, politically interested respondents do better on the verbal knowledge test. Their advantage is significantly attenuated in the visual-only conditions in both studies, but not in the visual-and-verbal condition in Study 2 (see difference between triangle and square in Figure 2.) These results imply that more interested people draw disproportionately on the name-attribute link. When that link is not available, their knowledge advantage over the less interested declines. It is restored when the name-attribute link is available again in the visual-and-verbal condition.

The main theoretical focus of this study is Delli Carpini and Keeter's (1996) concern about deep-rooted socioeconomic reasons for inequality in political knowledge. Smaller gender and education differences in visual knowledge suggest that part of the reason is instead related to measurement strategies that do not match the memory and processing predispositions of seemingly disadvantaged groups. Weakened impact of cognitive style on visual knowledge supports the same conclusion. Other results add suggestive evidence. Income is strongly related to verbal knowledge in Study 1, but the substitution of visuals reduces this effect by half. (In Study 2, the effect of income is only marginally significant and does not vary with treatment.) Cognitive ability (as measured by the vocabulary test) is closely related to formal education, but it may have an independent effect in the same direction as education. In Study 2, the impact of cognitive ability is significantly lower in the visual-and-verbal condition (but not in the visual-only condition). In Study 1, the same result just misses statistical significance. Although the findings for income and cognitive skills are not as consistent across the two studies, they point to the same interpretation as the consistent findings for gender, education, and cognitive style: some of the seemingly status- or resource-related inequality in political knowledge is in fact a consequence of a skewed measurement approach.

In all, empirical evidence supports four of five hypothesized differences in predictors of visual and verbal knowledge. The gender gap is smaller on visual knowledge, whereas the age gap increases. When knowledge questions include visuals, less educated people and people with a visual cognitive style do better than the literature and the verbal-only condition suggest. Each one of these effects is substantively modest, amounting to probability differences of .05 to .10. Yet, for some groups of individuals, the cumulative differences add up to large effects. A college-educated man under 30 with verbal cognitive style (1 standard deviation below the mean) is almost 60% more likely to answer a verbal knowledge question correctly than a 60-year old woman without a high-school degree and visual cognitive style (.60 predicted probability versus .38). When the question includes visuals, the performance gap between the two essentially disappears (.46 versus .47 for visual only, .50 versus .45 for visual and verbal.)

Validating Visual Knowledge

It is noteworthy that some segments of the population are more politically knowledgeable on visual questions than traditional verbal knowledge tests indicate because political knowledge is often considered a democratic good. More knowledgeable people are more likely to think consistently about politics, participate, and vote in accordance with their issue stances (e.g., Delli Carpini and Keeter 1996; Neuman 1986; Verba, Schlozman, and Brady 1995). Yet, empirical studies demonstrating a link between political knowledge and civic competence are based on verbal knowledge measures. This section examines if visual political knowledge, too, is associated with normatively desirable outcomes.

Following Converse (1964), consistency between different political attitudes is often considered a sign of civic competence. Mondak (2001, 233) argues that stronger associations between ideological self-placement and evaluations of politicians or political groups indicate greater political sophistication. If this assumption is correct, more valid knowledge scales should produce "sharper knowledge × ideology interactions" in a model predicting evaluations. Delli Carpini and Keeter examine "instrumentally rational partisanship" (1996, 252), the extent to which people's positions on

different political issues are systematically related to their party identification. If a respondent holds conservative positions on most or all political issues, she should, according to current political logic, identify with the Republican Party and describe herself as a conservative.

Mindful of Kuklinski and Quirk's (2002) critique that a tight fit between different political attitudes or between attitudes and partisanship is not a necessary condition for competence, I aim to stay close to Converse's notion of "objectively logical constraint" (1964, 209). For example, Converse maintains, "One cannot [logically] believe that government expenditures should be increased, that government revenues should be decreased, and that a more favorable balance of the budget should be achieved all at the same time" (1964, 209). In the following analysis, the first validation criterion is the strength of the association between respondents' level of disagreement with the statement that "The 2001 tax cuts for people with incomes over $200,000 should be renewed when they expire in 2011" and their support for redistributive economic policies, as measured by two standard ANES items (see appendix.) By this criterion, it is a mark of political competence to either oppose tax cuts and support more government services or to support tax cuts and oppose more services. (Admittedly, this constraint is short of "objectively logical" because it omits the budget constraint and a precise time horizon. It is the closest to logical available in my data.)

To examine if visual knowledge is as good a predictor of logical constraint as verbal knowledge, I estimate the following model predicting support for redistribution, REDIST_i:

$$\begin{aligned}\text{REDIST}_i = {} & \alpha_0 + \alpha_1 \text{TAX}_i + \alpha_2 \text{KN}_i \\ & + \alpha_3 \text{TAX}_i \times \text{KN}_i + \beta_1 \text{VIS}_i \\ & + \beta_2 \text{VIS}_i \times \text{KN}_i + \beta_3 \text{VIS}_i \times \text{TAX}_i \\ & + \beta_4 \text{VIS}_i \times \text{TAX}_i \times \text{KN}_i + \gamma_1 \text{BTH}_i \\ & + \gamma_2 \text{BTH}_i \times \text{KN}_i + \gamma_3 \text{BTH}_i \times \text{TAX}_i \\ & + \gamma_4 \text{BTH}_i \times \text{TAX}_i \times \text{KN}_i. \qquad (4)\end{aligned}$$

This model estimates the relationship between the dependent variable and tax-cut opposition, TAX_i, and does so conditional on respondent's political knowledge, KN_i. Three-way interactions with the randomly assigned modality of the knowledge questions are added to test if the interaction between knowledge and tax-cut opposition is as strong when knowledge is measured visually. The critical coefficients in this model are thus β_4 (visual-only condition) and γ_4 (visual-and-verbal condition). Estimates of less than zero would indicate that visual knowledge is not as good a predictor of attitude constraint as verbal knowledge (which is estimated by α_3.) Significantly positive estimates would indicate an even stronger link with this measure of political competence. Small and statistically insignificant estimates of β_4 and γ_4, finally, would demonstrate that visual knowledge is as strongly related to competence as verbal knowledge.

In Study 2, each respondent answered three blocks of knowledge questions, one each in the three experimental conditions (verbal only, visual only, visual and verbal). To compare the same questions asked in different modalities, I estimate Equation (4) three times, once for each knowledge block, as three separate between-subjects comparisons. The first block comprises the "Who is . . . " design (4 questions), the second block the "Which office . . . " design (4 questions), and the third block the Political Attributes and Ideology designs (10 questions). In each block, KN_i, is the fraction of correctly answered questions.

Validation results are in Table 2. For all three blocks, estimates of α_3 are positive and at least marginally significant, indicating that respondents who score high on verbal knowledge have more constrained attitudes on redistribution and taxes than respondents with low verbal scores. None of the estimates of β_4 or γ_4 (bolded in Table 2) are negative and significant. The null hypothesis that visual knowledge predicts attitudinal constraint equally well—and is thus an equally valid measure of political competence—cannot be rejected. In fact, the largest absolute value of β_4 or γ_4 is positive and marginally significant ($p = .14$): If anything, knowledge in the visual-and-verbal condition in Block 1 may be a better measure of political competence than knowledge measured either in the traditional verbal way or by replacing names with photos.

To illustrate these results, Figure 3 plots the predicted relationship between tax-cut opposition and redistribution attitudes for all blocks and experimental conditions at two levels of knowledge. "High knowledge" is the maximum block score. "Low knowledge" represents one-quarter of questions correct, which is the expected value for respondents guessing randomly. Analysis and presentation directly follow Mondak (2001, 234–36). The critical quantity is the treatment effect on the difference between the "high knowledge" and "low knowledge" slopes. The marginally higher validity of knowledge in the visual-and-verbal condition in Block 1 is evident: slopes are

TABLE 2 Validating Political Knowledge

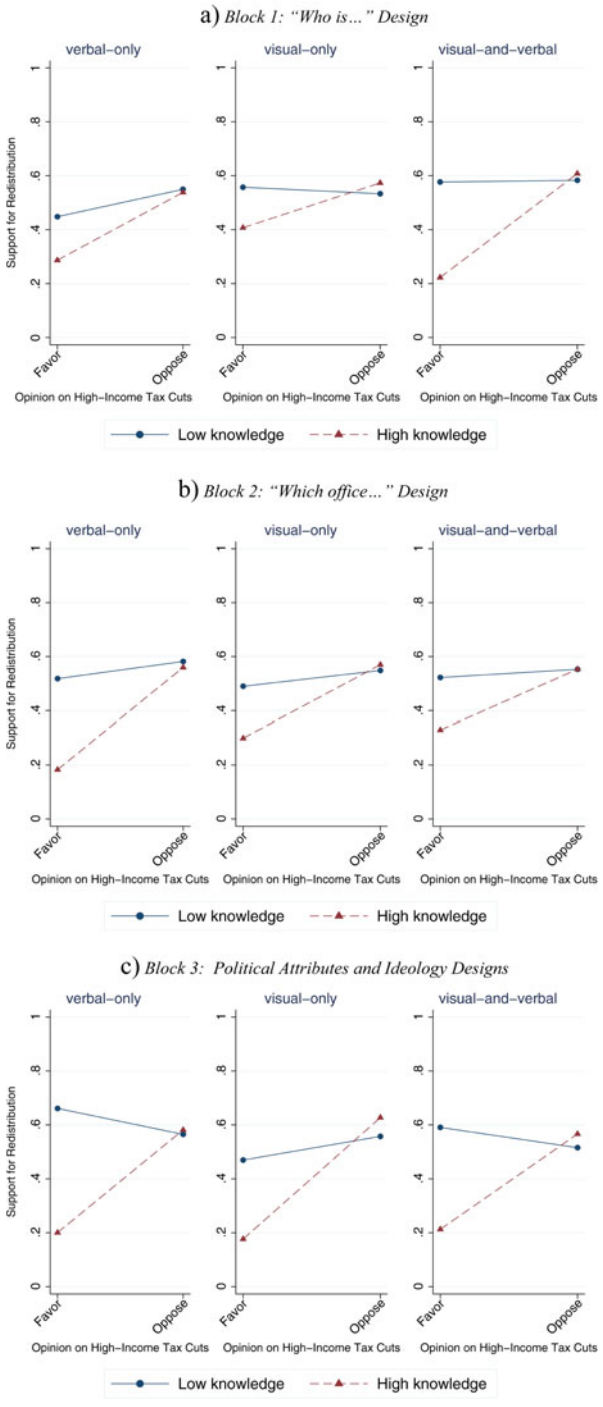
	"Who is . . ." Design *Block 1*	"Which office . . ." Design *Block 2*	Political Attributes and Ideology Designs *Block 3*
Opposition to renewing Bush tax cut for incomes over $200,000	.05	-.04	-.30
	(.10)	(.09)	(.11)***
Political knowledge	-.22	-.45	-.66
	(.11)**	(.10)***	(.12)***
Political knowledge × Tax-cut opposition	.20	.42	.68
	(.15)	(.14)***	(.17)***
Visual-only condition	.11	-.08	-.26
	(.09)	(.09)	(.11)*
Tax-cut opposition × Visual-only condition	-.14	.03	.23
	(.13)	(.13)	(.16)
Political knowledge × Visual-only condition	.01	.19	.24
	(.14)	(.15)	(.18)
Political knowledge × Tax-cut opposition × Visual-only condition	**.05**	**-.13**	**-.16**
	(.20)	**(.22)**	**(.26)**
Visual-and-verbal condition	.19	-.04	-.11
	(.09)**	(.08)	(.11)
Tax-cut opposition × Visual-and-verbal condition	-.17	.01	.04
	(.14)	(.12)	(.16)
Political knowledge × Visual-and-verbal condition	-.26	.19	.12
	(.14)*	(.14)	(.18)
Political knowledge × Tax-cut opposition × Visual-and-verbal condition	**.31**	**-.16**	**-.07**
	(.21)	**(.20)**	**(.26)**
Intercept	.51	.63	.86
	(.07)***	(.06)	(.07)***
R^2	.10	.09	.12
Number of respondents	717	717	717

Note: The dependent variable measures support for redistributive economic policy on a 12-point scale using two items. The first asks respondents to indicate on a 7-point scale if they are closer to the position that "the government should provide fewer services even in areas such as health and education in order to reduce spending" or that "it is important for the government to provide many more services even if it means an increase in spending." On the second item, respondents place themselves between "Some people [who] feel the government in Washington should see to it that every person has a job and a good standard of living." and "Others [who] think the government should just let each person get ahead on their own."
Estimates are Ordinary Least Squares (OLS) coefficient with standard errors in parentheses.
*$p < .10$ **$p < .05$ ***$p < .01$ (two-tailed)

more different in the right-most graph in the first row than in the other graphs in the same row (i.e., $\gamma_4 > 0$). In Block 3, knowledge in the visual-only condition appears to distinguish less well between different levels of attitude constraint, but the treatment effect is not statistically significant. Moreover, this condition also produces the steepest slope for high knowledge, and it is the relative difference between slopes that matters for validation. In all, validation against attitude constraint indicates that visual knowledge captures political competence about as well as verbal knowledge. Other validation analyses confirm this conclusion (see appendix.)

In sum, several different validation analyses suggest that visual political knowledge is just as good a measure of civic competence as verbal knowledge. Visual knowledge thus offers a second path to competence. People who do well on visual but not on verbal knowledge exhibit just as much political sophistication as those with verbal knowledge, but a lack of visual knowledge. Both sets of people show greater political understanding than those who know little about politics regardless of modality. Visual knowledge is a different path associated with the same outcome; it cannot be dismissed as politically inconsequential or inferior to verbal knowledge.

FIGURE 3 **Political Knowledge, by Question and Experimental Condition**



Note: This graph is based on the regression models in Table 2 and shows the predicted values for the relationship between tax-cut opposition and redistribution attitudes at different levels of political knowledge as measured in each of the three experimental conditions. Panels (a) through (c) plot predicted values separately for each block of knowledge questions for all experimental conditions. "High knowledge" is the maximum block score. "Low knowledge" represents one-quarter of questions correct, which is the expected value for respondents guessing randomly.

Conclusion

Visual political knowledge is different from verbal political knowledge and represents a previously unmeasured element of political involvement. This study has shown that adding visuals to otherwise identical all-verbal knowledge questions significantly increases correct responses. This finding strongly suggests that some people with substantive knowledge of political figures respond incorrectly to knowledge questions about them just because they lack a phonological representation of the person (the politician's name). Allowed to draw on a visual representation (the politician's face), they are able to report accurate conceptual knowledge about the politician. Theoretically, it is difficult to argue that this kind of visual-conceptual link is less important than the phonological-conceptual link tested by traditional all-verbal questions. Empirically, visual knowledge reflects civic competence as well as verbal political knowledge, according to several validations. Using only verbal questions to measure political knowledge underestimates how much people know about politics.

For the population as a whole, this measurement bias is small. Adding visual elements to a verbal knowledge question increased the probability of a correct answer by .03. For some segments of the population, the bias is considerably larger, however. As political scientists have shown over and over again, when knowledge is measured using words alone, the less educated do worse than the more educated, and women do worse than men. People with a visual cognitive style also score lower on verbal knowledge than people with a verbal style. All of these individual differences are significantly attenuated or disappear entirely for visual political knowledge.

Comparison of visual and verbal political knowledge reveals what could be called "mode publics"—groups of people whose political knowledge in one mode of communication exceeds their knowledge in another mode, much like Converse's (1964) "issue publics" are more likely to know about some political issues than others. The treatment effects conditional on cognitive style add to the face validity of visual knowledge. Why, after accounting for motivation (political interest, duty to be informed, strength of partisanship) and ability (formal education, cognitive skills, as measured by vocabulary scores), should visual cognitive style still be associated with lower verbal political knowledge? It is difficult to explain why people for whom "A picture is worth a thousand words" (to quote one cognitive-style item) know

inherently less about politics, even when they are equally interested, educated, and verbally proficient. More likely, they are short-changed by measurement instruments that do not reflect their most comfortable cognitive style.

An important finding of this study is thus that verbal-only knowledge questions disproportionately bias measurement against particular groups, introducing systematic measurement error. Researchers who want to measure political knowledge should thus use a mix of verbal and visual questions to avoid distorting their conclusions about level and, more importantly, correlates of political knowledge. Including visual elements makes knowledge tests more comprehensive and fairer to different mode publics.

This study adds to a growing list of reasons why measurement problems exaggerate the lack of political knowledge in the U.S. public. Multiple-choice questions that provide a "Don't Know" option understate knowledge because some respondents who know the correct answer lack confidence and respond "Don't Know" (Barabas 2002; Mondak 2000). Failing to credit partial knowledge in answers to open-ended questions deflates knowledge levels (Gibson and Caldeira 2009; Mondak 2000). Lack of motivation rather than lack of knowledge explains some incorrect answers (Prior and Lupia 2008). Individually, each of these measurement problems understates political knowledge only modestly. Cumulatively, the impact is substantial. The present study adds a previously unrecognized measurement problem to the list: Privileging phonological over visual memory, verbal-only knowledge questions understate what people know and do so disproportionately for some subgroups. And since all experimental conditions in this study already account for some of the other measurement problems by discouraging "Don't Know" responses and using close-ended questions, the modality differences shown here represent a unique, independent reason why traditional knowledge measures understate how much Americans know.

Learning about politics from photos and moving images is not new. What is new is the convenience with which visuals can be included in survey instruments that use computer displays. This study is the first to take advantage of this technological innovation in a general population experiment to advance our understanding of political knowledge. Two independent survey experiments consistently demonstrate that many people have stores of visual political knowledge that used to go undetected in survey research. This finding provides scholars with a solid justification to invest more resources in the study of visual learning and information processing, including a comparison of recall (open-ended) and recognition (multiple-choice) and an extension to domains in which direct verbal and visual equivalents do not exist.

A limitation of this study is that it cannot clearly specify the respective contributions of learning, memory, and interview effects. People may differ in how often they encounter and how efficiently they process visual and verbal information about politics (learning effects). Or they may differ in how easily they can retrieve visual and verbal information they were exposed to (memory effects). Or, respondents may approach a survey question with visuals differently than a fully verbal question (interview effects). Each effect could explain why many independent variables affect knowledge scores differently for visual than for verbal questions. Educated respondents may have an advantage on verbal questions because they process (learning effect) and store (memory effect) more verbal political information or because verbal questions are easier after years of educational tests (interview effect). By controlling for vocabulary skills and preferred news source, this study tried to distinguish these possibilities, but a clearer understanding requires more work. Similarly, women might do better on visual- than verbal knowledge questions because their apparent advantage at recognizing faces (Lewin and Herlitz 2002; Rehnman and Herlitz 2008) means that they process and store visual representations of politicians more easily (learning or memory effect) or because it encourages them to consider questions more carefully that include visuals (interview effect).

Despite the need for more research on underlying cognitive processes, this study provides evidence that Delli Carpini and Keeter's fear of "a political caste system" (1996, 151), where past injustices and present socioeconomic inequalities lead to deep knowledge differences, is exaggerated. Although Delli Carpini and Keeter took care to base their conclusion on a comprehensive set of knowledge questions, they did not consider measures of visual knowledge. Consistent with psychological research on memory and information processing, several of the inequalities that Delli Carpini and Keeter found are much attenuated for visual knowledge. Many people, to be sure, still perform quite poorly on visual knowledge questions, and considerable inequality remains. But some segments of the population, women and the less educated among them, may use visual knowledge as a road to political competence—a road that researchers had previously overlooked.

Acknowledgments

This project was supported by David Brady, the Center for the Study of Democratic Politics at Princeton, and Knowledge Networks. Thanks to Jason Barabas, John Bullock, Paul Goren, and Scott Althaus and the Citizen Competence Group at UIUC for their extensive feedback. Gaurav Sood, Aram Hur, and Steven Snell provided research assistance on this project.

References

Baltagi, Badi. 2008. *Econometric Analysis of Panel Data*. 4th ed. Chichester, UK: John Wiley.

Barabas, Jason. 2002. ''Another Look at the Measurement of Political Knowledge.'' *Political Analysis* 10 (2): 1–14.

Bennett, Stephen Earl. 1995. ''Americans' Knowledge of Ideology, 1980–1992.'' *American Politics Quarterly* 23 (3): 259–78.

Bucy, Eric P., and Maria E. Grabe. 2007. ''Taking Television Seriously: A Sound and Image Bite Analysis of Presidential Campaign Coverage, 1992–2004.'' *Journal of Communication* 57 (4): 652–75.

Burke, Deborah, Donald G. MacKay, Joanna Worthley, and Elizabeth Wade. 1991. ''On the Tip of the Tongue: What Causes Word Finding Failures in Young and Older Adults?'' *Journal of Memory and Language* 30: 542–79.

Childers, Terry L., Michael J. Houston, and Susan E. Heckler. 1985. ''Visual Versus Verbal Information Processing.'' *Journal of Consumer Research* 12 (3): 125–34.

Cohen, Gillian. 1990. ''Recognition and Retrieval of Proper Names: Age Differences in the Fan Effect.'' *European Journal of Cognitive Psychology* 2 (3): 193–204.

Cohen, Gillian, and Dorothy Faulkner. 1986. ''Memory for Proper Names: Age Differences in Retrieval.'' *British Journal of Developmental Psychology* 4 (2): 187–97.

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

Delli Carpini, Michael X., and Scott Keeter. 1996. *What Americans Know About Politics and Why It Matters*. New Haven, CT: Yale University Press.

Fogarty, Gerard J., and Lorelle J. Burton. 1996. ''A Comparison of Measures of Preferred Processing Style: Method or Trait Variance?'' *Journal of Mental Imagery* 20: 87–112.

Frees, Edward W. 2004. *Longitudinal and Panel Data: Analysis and Applications in the Social Sciences*. Cambridge: Cambridge University Press.

Gibson, James L., and Gregory A. Caldeira. 2009. ''Knowing the Supreme Court? A Reconsideration of Public Ignorance of the High Court.'' *Journal of Politics* 71 (2): 429–41.

Gidengil, Elisabeth, Elizabeth Goodyear-Grant, Neil Nevitte, and Andre Blais. 2006. ''Gender, Knowledge and Social Capital.'' In *Gender and Social Capital*, eds. Brenda O'Neill and Elisabeth Gidengil. New York: Routledge, 241–72.

Gilens, Martin. 2001. ''Political Ignorance and Collective Policy Preferences.'' *American Political Science Review* 95 (2): 379–96.

Graber, Doris A. 1988. *Processing the News: How People Tame the Information Tide*. 2nd ed. New York: Longman.

Graber, Doris A. 1990. ''Seeing Is Remembering: How Visuals Contribute to Learning from Television News.'' *Journal of Communication* 40 (3): 134–55.

Graber, Doris A. 1996. ''Say It with Pictures.'' *Annals of the American Academy of Political and Social Science* 546: 85–96.

Graber, Doris A. 2001. *Processing Politics: Learning from Television in the Internet Age*. Chicago: University of Chicago Press.

Grimes, Thomas. 1991. ''Mild Auditory-Visual Dissonance in Television News May Exceed Viewer Attentional Capacity.'' *Human Communication Research* 18 (2): 268–98.

Jones, Byron, and Michael G. Kenward. 2005. *Design and Analysis of Cross-over Trials*. 2nd ed. Boca Raton, FL: Chapman & Hall.

Kirby, John R., Phillip J. Moore, and Neville J. Schofield. 1988. ''Verbal and Visual Learning Styles.'' *Contemporary Educational Psychology* 13: 169–84.

Kuklinski, James H., and Paul J. Quirk. 2002. ''Conceptual Foundations of Citizen Competence.'' *Political Behavior* 23 (3): 285–311.

Lang, Annie. 1995. ''Defining Audio/Video Redundancy from a Limited-Capacity Information Processing Perspective.'' *Communication Research* 22 (1): 86–115.

Lang, Annie, Robert F. Potter, and Paul D. Bolls. 1999. ''Something for Nothing: Is Visual Encoding Automatic?'' *Media Psychology* 1: 145–63.

Lewin, Catharina, and Agneta Herlitz. 2002. ''Sex Differences in Face Recognition: Women's Faces Make the Difference.'' *Brain and Cognition* 50: 121–28.

Luskin, Robert C. 1990. ''Explaining Political Sophistication.'' *Political Behavior* 12 (4): 331–61.

Mayer, Richard E., and Laura J. Massa. 2003. ''Three Facets of Visual and Verbal Learners: Cognitive Ability, Cognitive Style, and Learning Preference.'' *Journal of Educational Psychology* 95 (4): 833–46.

Mondak, Jeffery J. 2000. ''Reconsidering the Measurement of Political Knowledge.'' *Political Analysis* 8 (1): 57–82.

Mondak, Jeffery J. 2001. ''Developing Valid Knowledge Scales.'' *American Journal of Political Science* 45 (1): 224–38.

Neuman, W. Russell. 1986. *The Paradox of Mass Politics: Knowledge and Opinion in the American Electorate*. Cambridge MA: Harvard University Press.

Neuman, W. Russell, Marion R. Just, and Ann N. Crigler. 1992. *Common Knowledge: News and the Construction of Political Meaning*. Chicago: University of Chicago Press.

Paivio, Allen. 1971. *Imagery and Verbal Processes*. New York: Holt, Rinehart, and Winston.

Paivio, Allen. 1986. *Mental Representations: A Dual Coding Approach*. New York: Oxford University Press.

Plass, Jan L., Dorothy M. Chun, Richard E. Mayer, and Detlev Leutner. 1998. ''Supporting Visual and Verbal Learning Preferences in a Second-Language Multimedia Learning Environment.'' *Journal of Educational Psychology* 90 (1): 25–36.

Prior, Markus, and Arthur Lupia. 2008. ''Money, Time, and Political Knowledge: Distinguishing Quick Recall and Political Learning Skills.'' *American Journal of Political Science* 52 (1): 168–82.

Rehnman, Jenny, and Agneta Herlitz. 2008. ''Women Remember More Faces Than Men Do.'' *Acta psychologica* 124 (3): 344–55.

Richardson, Alan. 1977. "Verbalizer-Visualizer: A Cognitive Style Dimension." *Journal of Mental Imagery* 1: 109–26.

Rosenberg, Shawn W., Shulamit Kahn, and Thuy Tran. 1991. "Creating a Political Image: Shaping Appearance and Manipulating the Vote." *Political Behavior* 13: 345–67.

Schacter, Daniel L. 2002. *The Seven Sins of Memory*. Boston: Houghton Mifflin.

Sullivan, Denis G., and Roger D. Masters. 1988. "'Happy Warriors': Leaders' Facial Displays, Viewers' Emotions, and Political Support." *American Journal of Political Science* 32: 345–68.

Verba, Sidney, Nancy Burns, and Kay Lehman Schlozman. 1997. "Knowing and Caring About Politics: Gender and Political Engagement." *Journal of Politics* 59 (4): 1051–72.

Verba, Sidney, Kay Lehman Schlozman, and Henry E. Brady. 1995. *Voice and Equality: Civic Voluntarism in American Politics*. Cambridge, MA: Harvard University Press.

Markus Prior is an Associate Professor of Politics and Public Affairs at the Woodrow Wilson School, Princeton University, Princeton, NJ, 08544.