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MISPERCEPTIONS ABOUT PERCEPTUAL BIAS

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ABSTRACT

Do people assimilate new information in an efficient and unbiased manner—that is, do they update prior beliefs in accordance with Bayes' rule? Or are they selective in the way that they gather and absorb new information? Although many classic studies in political science and psychology contend that people resist discordant information, more recent research has tended to call the selective perception hypothesis into question. We synthesize the literatures on biased assimilation and belief polarization using a formal model that encompasses both Bayesian and biased learning. The analysis reveals (*a*) the conditions under which these phenomena may be consistent with Bayesian learning, (*b*) the methodological inadequacy of certain research designs that fail to control for preferences or prior information, and (*c*) the limited support that exists for the more extreme variants of the selective perception hypothesis.

INTRODUCTION

Central to the study of democratic politics is the subject of how voters learn. Politics is an unending stream of events, and each day the public is presented with news about the economy, current policy concerns, scandal, and a welter of other information. Granted, much of what appears in the first section of the newspaper fails to attract the attention of the typical citizen (Neuman 1986; Patterson & McClure 1976). Granted, too, relatively few people possess detailed knowledge of political terminology or proper nouns, and many are grossly misinformed about the amounts that government spends on foreign aid or welfare (Delli Carpini & Keeter 1996). Nonetheless, the public does seem to update its perceptions in the wake of events. When unemployment rises, the public's assessment of economic conditions sours, and when economic opti-

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mism fades, the public's evaluation of presidential performance deteriorates (Tufte 1976). As expenditures on national defense change or as crime policies become more draconian, the public alters its desire to press government action further in these areas (Page & Shapiro 1992). Hunger for tax cuts seems to subside after tax rates fall (Sears & Citrin 1985). Learning seems to occur. The question is, what kind of learning?

Do people assimilate new information in an efficient and unbiased manner—that is, do they update their prior beliefs in accordance with Bayes' rule? Or are they selective in the way that they gather and absorb new information? A Bayesian public may be ignorant or inattentive, but it is not incapable of being persuaded by new information. If the economy's vital signs are widely reported to be deteriorating during a Democratic administration, Democratic and Republican voters with equivalent amounts of prior information will both tend to revise downward their assessment of the Democrats' economic stewardship. Democrats might greet the bad economic news with disappointment, but they nonetheless acknowledge its implications when evaluating political leaders.

For decades, leading scholars of electoral politics have argued that voter learning departs from this Bayesian characterization. One set of claims, which falls under the heading of selective perception, holds that citizens' interpretations of events are slanted toward their previously held convictions. Evidence for this phenomenon is drawn from a variety of sources. In Lord et al's classic experiment (1979), opponents of the death penalty were more likely to find fault with a study suggesting that it deters serious crime; death penalty supporters were similarly resistant to a study that drew the opposite conclusion. In fact, exposure to discordant evidence only made people more set in their ways. In a similar vein, several studies have found that viewers of presidential debates tend to think that their predebate favorite carried the day (Katz & Feldman 1962, Sigelman & Sigelman 1984). The economy is given more favorable marks by supporters of the incumbent president (Kinder & Mebane 1983), and people of different ideological stripe harbor different impressions about who is or is not a credible source of factual information (Sears 1969).

The most influential statement of the hypothesis that citizens with different political orientations form different impressions of the same set of facts concerns the distorting influences of partisan attachments. "Identification with a party," Campbell et al contend (1960:133), "raises a perceptual screen through which the individual tends to see what is favorable to his partisan orientation." Important recent work by Zaller (1992) extends this argument, proposing that, among the more politically aware segments of the public, "partisan resistance" causes voters to filter out information when it does not conform to their existing political predispositions. If this politically aware subset of the public is sufficiently large, a flurry of new information will generate a polarization of

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public opinion, since "people tend to accept what is congenial to their partisan values and to reject what is not" (Zaller 1992:241; see also 1992:144).[1]

In part, this characterization of partisan biases reflects the extensive research literatures in psychology concerning persuasion and the persistence of attitudes. Early work on selective perception emphasized the cognitive costs of holding inconsistent views (Festinger 1957). By this account, an individual is motivated by a desire to maintain harmony among his or her beliefs. Merrill & Lowenstein (1971:226–27) wrote,

> The sensible individual…will build up his own complex 'safety mechanism' for screening information; he will see less and less that does not agree with his dominant dispositions (selective exposure)...he uses propaganda to simply reinforce—not challenge—his basic attitudes and predispositions. If he did not do this, he would quickly fly into a million emotional pieces in the face of unverifiable and disharmonic information and opinion that surround him every day.

Later, psychologists such as Nisbett & Ross (1980) downplayed the role of consistency-seeking motivation and emphasized instead cognitive biases in the ways that self-styled "objective" observers interpret evidence. Currently, psychologists who argue on behalf of selective perception tend to cite both motivational and cognitive mechanisms (e.g. Pomerantz et al 1995).

Theories of biased learning in political science also draw upon a much deeper tradition of skepticism about human capacities for objectivity. Francis Bacon's view that "human understanding when it has once adopted an opinion (either as being received opinion or as being agreeable to itself) draws all things else to support and agree with it" (quoted in Lundgren & Prislin 1998:715) is echoed in Madison's [1937 (1787):56] observation, "No man is allowed to be a judge in his own cause because his interest would certainly bias his judgment." Stubbornness and self-interest cause people to hew to facts that confirm what they wish to believe. As a consequence, beliefs are not easily altered through reasoned, dispassionate discussion of evidence.

[1]A related form of biased learning is selective exposure, the tendency to expose oneself to evidence and viewpoints with which one is predisposed to agree. Supporters of Christian fundamentalism are more likely to tune in to church-sponsored cable news networks and less likely to read *Mother Jones*. Selectivity may be deliberate or incidental. Some liberals may make a conscious effort to avoid the blandishments of conservative radio commentators; others may find themselves in areas or social milieux where conservative views are simply absent from the airwaves or casual conversation. Like selective perception, selective exposure acts to reinforce existing beliefs. If conservative media are more likely to attract Republican viewers and more likely to present and emphasize information that is damaging to a Democratic administration, the net effect, according to this theory, will be to amplify the audience's negative assessments of the president. And if the converse process occurs among liberal media and Democratic audiences, the electorate as a whole becomes more polarized by the flow of information. Empirical studies summarized by Sears (1969), Sears & Whitney (1973), Chaffee & Miyo (1983), and Frey (1986) tend to offer little support to the notion that citizens avoid or seek political information depending on its anticipated content.

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Whatever its cognitive or motivational origins, selective perception implies that when the political fortunes wane for one party, its supporters nonetheless maintain their prior beliefs and evaluations; supporters of the other party, on the other hand, absorb the favorable news. This asymmetry widens the gap between the perceptions of Democrats and Republicans. As Berelson et al (1954:223) explain in their classic book *Voting,*

> The more intensely one holds a vote position, the more likely he is to see the political environment as favorable to himself, as conforming to his own beliefs. He is less likely to perceive uncongenial and contradictory events or points of view and hence presumably less likely to revise his own original position. In this manner, perception can play a major role in the spiraling effect of political reinforcement.

This "spiraling effect of political reinforcement" is the opposite of what a Bayesian model would predict about the trajectory of partisans' opinions over time. The Bayesian hypothesis holds that new information moves people with different partisan affinities (but similar levels of prior information) in the same direction and to approximately the same extent.

The purpose of this review essay is to situate the existing research on political learning within an analytic framework that encompasses both the Bayesian and biased learning perspectives.[2] In the first section, we explicate the Bayesian model. Next, we relax some of its assumptions in order to accommodate the hypothesis that people resist or ignore information that is at variance with their prior views or their partisan predispositions. Using these models to interpret the range of findings in political science and social psychology, we find that most of the studies purporting to demonstrate biased learning are either theoretically indeterminate or consistent with a Bayesian model. Moreover, although biased learning doubtless occurs, important aggregate time series, such as approval of the incumbent president, reveal little evidence of it. The phenomenon of biased learning in the form of selective perception has less empirical support than is often supposed. We conclude by discussing some of the conditions under which selective perception may shape political opinions and behavior.

MODELING VOTER LEARNING

With rare exceptions, scholars have advanced hypotheses about biased perception in informal terms. In this section, we attempt to translate the central propositions concerning biased learning into a mathematical form that permits

[2]For an earlier attempt to use Bayesian learning as an interpretive framework, see Ajzen & Fishbein (1975). The analytics of this essay, however, were found wanting (Fischhoff & Lichtenstein 1978). For discussion of non-Bayesian processes of perception, see Jervis (1976).

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clearer exposition while elucidating their empirical implications. One of the most important by-products of this exercise is to distinguish between very different empirical claims that are sometimes conflated in discussions of biased learning. Bayesian models do not preclude the possibility that Democrats and Republicans bring different prior beliefs to the evaluation of new evidence. Nor are they inconsistent with the observation that supporters of different parties sometimes apply different evaluative criteria when assessing the performance of public officials, policies, or institutions. (If Democrats care about equity and Republicans efficiency, they may form very different assessments of a privatization or deregulation initiative.) Nor does the Bayesian framework rule out the possibility that Democrats find evidence of a Democratic scandal less credible than do Republicans. The prediction that distinguishes Bayesian models from biased learning models has to do with whether Democrats and Republicans who possess equivalent levels of prior uncertainty and assign a given information source equal credibility ex ante are equally affected by the new information.

Model of Bayesian Learning

When we speak of learning, we have in mind the process by which people assimilate information so as to form new beliefs or reinforce old ones. Beliefs are defined as an individual's assessment of the likelihood that given factual statements are true. For example, individuals have beliefs about the likelihood that cigarettes cause cancer, that it will be sunny on Sunday, or that their legislator trades votes for campaign contributions. This section presents a simple mathematical model of learning to explain precisely what we mean by our contrast between the Bayesian learning ("unbiased learning") and selective perception ("biased learning") hypotheses, which posit different ways in which beliefs adjust to new information. It is important to distinguish beliefs, which measure a voter's assessments of objective characteristics of the political world, and preferences, which describe what the voter likes and dislikes. Quite often, the opinions that political scientists track over time are a mixture of beliefs and preferences. The question "Which political party is best able to manage economic affairs?" taps not only one's beliefs about the objective capabilities of the political parties but also the criteria one uses to judge which party is "best." Some voters may prefer economic stewardship that maintains low rates of unemployment; others may care only about low interest rates. For the moment, the model we present focuses on the dynamics of beliefs, but the distinction between beliefs and evaluations will become crucial later on as we consider empirical applications.

As an example of how beliefs change in response to new information, consider voter assessments of whether a politician is honest or corrupt. Before receiving new information, individuals start with some preconceptions. Suppose

an individual's prior beliefs can be represented by a normal distribution, with a mean value set to the individual's estimate of the politician's honesty and a variance capturing the uncertainty of this estimate. Let the variable θ stand for the politician's (unobserved) level of honesty. The voter's prior belief about the relative likelihood that the politician has various ethical standards is denoted by the probability distribution $\pi(\theta)$, which is distributed $N(\mu,\sigma_0^2)$.

Over time, a range of new information about the politician's ethics reaches the voter. The contents of this information are a function of both the truth and random sources of distortion. We model this new information by a second normally distributed random variable, with a mean equal to the truth about the politician and a variance that depends on the degree of uncertainty associated with the information. The new information is denoted x and is a draw from the probability distribution $N(\theta, \sigma^2_1)$. The variance, σ^2_1, captures how definitive the new information is. For example, if the new information is the result of a thorough and credible investigation, then the variance of this signal is very small, and the truth about the politician may be almost entirely revealed by the new evidence. Alternatively, if the new information is the number of rumors over a given period, this signal is only slightly informative, since it may be only weakly correlated with the truth about the politician.

Learning is how prior beliefs change in light of the new evidence. Using standard results from statistics, Bayes' rule implies that $\pi(\theta \mid x)$, the posterior distribution, is distributed $N(\mu(x), \rho)$, where

$$\mu(x)=\mu+(x-\mu)\frac{\sigma^2_0}{\sigma^2_0+\sigma^2_1}, \quad 1.$$

$$\rho=\frac{\sigma^2_0\,\sigma^2_1}{\sigma^2_0+\sigma^2_1}. \quad 2.$$

After observing x, the voter's best guess as to the legislator's level of honesty is $\mu(x)$. The degree to which the voter adjusts her beliefs in response to new information is a function of how much the new information deviates from her prior best guess, the precision of the new information, and the voter's confidence in her original guess. When additional new information arrives, the subject incorporates the information according to the same algorithm described in Equations 1 and 2, with the posterior mean and variance replacing the prior mean and variance in the formulas.

Model of Selective Perception

Over time, the voter observes a variety of pieces of new information, $\{x_1, x_2,...\}$, each with an associated variance, $\{\sigma^2_1, \sigma^2_2,...\}$. Let H_t denote the collection of new information available to the Bayesian learner at t, where t is an index of the number of pieces of new information observed. To formalize selective perception, we posit that partisans will minimize evidence that contra-

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dicts their partisan predispositions. To continue with the example of the honest or corrupt politician, suppose the politician in question is a Republican. Let higher values of x indicate higher levels of corruption, and let a value of $x = 0$ be a neutral reading. Then one interpretation of selective perception is that Republican partisans will look at $x > 0$ and see αx, where α is some number less than 1 ($x > 0$ is evidence of some corruption and so is one way to characterize "bad news" for a Republican partisan).

How does this bias in learning affect the updating of the prior beliefs? Using Equations 1 and 2, we can see that in the case of Bayesian learning, the mean value of the posterior beliefs given the history H_t is

$$\mu(H_t) = \rho(H_t)\left[\frac{x_0}{\sigma^2_0} + \sum_{i=1}^{t}\left(\frac{x_i}{\sigma_i^2}\right)\right], \qquad 3.$$

where $\rho(H_t)$ is the variance of the posterior distribution. To take into account the possibility of partisan perceptual bias, we rewrite this expression as

$$\mu(H_t) = \rho(H_t)\left[\frac{x_0}{\sigma^2_0} + \alpha\sum_{i=1}^{n}\left(\frac{x_i}{\sigma^2_i}\right) + \sum_{i=m+1}^{t}\left(\frac{x_i}{\sigma^2_i}\right)\right],$$

where the voter's information is grouped into the n cases where $x < 0$ and the $t–n$ cases where $x > 0$. In the interpretation of selective perception depicted in Equation 3a, partisans minimize the bad news in any report by viewing the evidence as less odious than it really is. One interpretation of this type of bias is "selective attention," in which the voter systematically fails to attend to the negative portions of the information. Another interpretation is "selective exposure," in which voters avoid television, radio, or newspaper accounts of untoward news (Sears & Whitney 1973) and so observe a version of reality in which much of the bad news is already filtered out. Indeed, the beauty of this formal treatment is that both forms of selectivity—selective exposure and perception—can be modeled within a common analytic framework.

EMPIRICAL ASSESSMENTS

Biased Assimilation

Lord et al (1979) used the term biased assimilation to describe the process by which an individual's prior beliefs determine whether he or she finds new information convincing. The claim that an individual's attachments and interests give rise to a tendentious interpretation of evidence has been borne out in decades of social-psychological research (Festinger 1957). Hastorf & Cantril (1954) found that when reviewing films of a rough football game between Dartmouth and Princeton, students from the two schools had disparate assessments of the number and severity of infractions committed by each team. Lord et al (1979) found that subjects who favored capital punishment were more

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likely to endorse a particular methodology if the study that used it found evidence for the deterrent effect of the death penalty; the same methodology was regarded as inferior when it generated the opposite conclusion. This finding was replicated by Houston & Fazio (1989), who found it particularly pronounced among subjects whose attitudes toward the death penalty were cognitively "accessible." In yet another death penalty study, Schuette & Fazio (1995) found a high correlation between preexisting attitudes and evaluations of the presented research results, except among those subjects who were told that the accuracy of their scientific evaluations would be judged against that of a "blue ribbon panel" of experts.

Moving outside the purview of death penalty research, Miller et al (1993, Experiment 3) found that proponents of affirmative action rated essays favoring the policy as more persuasive than opposing essays; the converse was true for opponents of the policy. Kunda (1987) examined the perceived harmfulness of coffee consumption. Selecting coffee drinkers and nondrinkers with roughly equivalent prior opinions about the adverse effects of coffee, Kunda studied the consequences of reading scientific evidence purporting to show that coffee consumption does or does not produce adverse health effects in women. Women coffee drinkers were less convinced by evidence showing adverse consequences. Chen et al (1992) found that students who were threatened by the immediate institution of proficiency exams were less persuaded by advocates of those exams than were students who expected to be grandfathered in under the current system. Koehler (1993) found that both parapsychologists and critics of parapsychology gave lower ratings to studies that disagreed with their positions on extrasensory perception. This pattern was also confirmed by a controlled experiment in which preconceptions about fictitious scientific issues were induced before subjects rated the soundness of research that supported or contradicted these preconceptions (Koehler 1993).

Findings of this sort abound in public opinion research as well, particularly in studies examining perceptions of prejudice and discrimination. Such studies invariably find that members of dominant groups believe job and housing discrimination to be less commonplace than do members of minority groups (Kluegel & Smith 1986) and that racial groups perceive new events (such as incidents of police brutality, race riots, and trials of prominent minorities) in markedly different ways.[3] Similarly, hostility and stereotyping of homosexuals is strongly related to students' receptivity toward scientific evidence confirming or disconfirming these beliefs (Munro & Ditto 1997).

[3]One of the more famous studies of biased assimilation (Vidmar & Rokeach 1974) found that more prejudiced viewers of *All in the Family*, a television series designed to denigrate bigotry, were more likely to admire the bigoted main character, whereas less prejudiced viewers admired his liberal antagonist.

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Examples also abound in the world of partisan politics, as Democrats and Republicans often differ markedly in their perceptions of political and economic affairs. Early survey researchers noted in 1936 that 83% of Republicans felt that President Roosevelt's policies were leading the country down the road to dictatorship, a view shared by only 9% of Democrats (Key 1963:246). This theme figures prominently in the classic works *The American Voter* and *Elections and the Political Order* (Campbell et al 1960, 1966), which stress the role of partisanship as a filter of political information. Stokes (1966:127), for example, argues that "for most people the tie between party identification and voting behavior involves subtle processes of perceptual adjustment by which the individual assembles an image of current politics consistent with his partisan allegiance."

Although widespread consensus exists about the capacity of preexisting beliefs to structure the assimilation of new information, the implications for "biased" judgment remain unclear. In one sense, judgment may be said to be biased when observers with different preconceptions interpret the same piece of evidence in ways that conform to their initial views. This process of putting a favorable spin on a piece of news comports with Key's observation that Democrats and Republicans "discover virtues and strengths far beyond those actually possessed" by their party's leader (1961:244). On the other hand, one could argue that the process of evaluating new information in light of what is previously believed is consistent with rational information processing.

A Bayesian Interpretation of Biased Assimilation

The fact that individuals (*a*) tend to reject evidence that conflicts with their initial opinions and (*b*) tend to doubt the accuracy of studies that present unexpected findings is often interpreted as evidence of biased information processing. This reasoning is particularly common among those who study "motivated reasoning" and conclude, for example, that "[d]efensiveness, or a motivation to protect self-relevant attitudes, results in deeper and more favorable elaboration of arguments supporting those attitudes than arguments opposing them" (Lundgren & Prislin 1998:715). Although a slanted interpretation of evidence could indicate a departure from Bayesian learning, it is not inherently incompatible with Bayesian learning. This issue is treated formally below, but a simple example explains the basic point. Suppose that you are supervising an employee, and you have questions about the employee's competence. After reviewing the employee's work over the past year and speaking to a dozen of his co-workers, you conclude that the employee is not doing a good job. Just as you are about to call him into your office, you hear back from a final co-worker who says that, in his opinion, the employee is very capable. Although there is no reason a priori to consider this new report any less reliable than the dozen reports already given, it is hardly convincing evidence that the

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employee is in fact a good worker. It is far more likely that the new report is wrong and that the final co-worker either has poor evaluation skills (this co-worker's "study" has a methodological flaw) or has observed an uncharacteristic performance (the co-worker's "study" presents misleading findings due to "random error").

Before proceeding with a more formal analysis, we need to define what would lead an experimental subject to say that evidence was "weak" or "unconvincing." There are two conditions that might generate this response. First, the evidence could be methodologically suspect, even if what the evidence suggests is likely to be true. For example, a poorly designed study showing that smoking was linked to lung cancer might be deemed unconvincing. Second, evidence might be termed unconvincing if it supports a seemingly false conclusion. A witness who says that he saw someone commit a crime, when contradicted by 10 other witnesses who place the accused far from the crime scene, might be said to provide unconvincing testimony. Because many of the experiments that deal with learning provide subjects with evidence of equal methodological quality on both sides of the issue, we restrict our definition of "unconvincing" or "weak" evidence to mean evidence that supports a conclusion that is perceived to be false.

Returning to the example of an individual assessing the honesty of a politician, suppose a subject receives the information x^*. According to Equation 1, after considering x^*, the subject updates his beliefs in the direction of x^* and ends with a posterior distribution $N(\mu(x^*), \rho)$. One way to gauge the extent to which the subject deems x^* an accurate reflection of the truth about the politician is to ask how likely it is that, given the posterior distribution, an exhaustive further investigation would reveal that x^* is far from the truth. Consider the case where $x^* > \mu(x^*)$. Given the posterior distribution described by Equations 1 and 2, the probability that the politician's true level of corruption is equal to or greater than x^* is $1 - \Phi(z)$, where

$$z = \frac{x^* - \mu(x^*)}{\sqrt{(\sigma^2{}_0 + \sigma^2{}_1)}} \left(\sigma_1 / \sigma_0\right) = \frac{x^* - \mu(x^*)}{\sqrt{\left(1 + \frac{\sigma_0^2}{\sigma_1^2}\right)}}. \quad 4.$$

We say that x^* is too extreme to be convincing evidence if this probability is sufficiently low. Notice that the form of the z value is similar, though not identical, to the z value that would be used to test for a "difference of means" between two samples, where the prior and the new information are estimates of the means, with variances equal to $\sigma^2{}_0$ and $\sigma^2{}_1$, respectively.

Whenever z is large, new evidence can be regarded as unconvincing. Using Equation 4, we find that this occurs when the new evidence x^* is too different from our posterior beliefs. For any given degree of deviation from our posterior beliefs, x^* is more convincing when our prior beliefs are weak (i.e. $\sigma^2{}_0$ is

large) or when the new evidence is very accurate (i.e. σ^2_1 is small). It is important to note that all of this is perfectly consistent with, and in fact derived from, a model of Bayesian learning.

This demonstration shows that in the Bayesian model, even unconvincing evidence is used in forming beliefs. Observers update their beliefs in the direction of the unconvincing evidence. Therefore, although it is not inconsistent with Bayesian learning for observers to comment that contrary information is unconvincing, in the simple version of Bayesian learning, we do not expect critics of new information to be altogether unmoved by it. Nor do we expect them to pick out only those features of the new information that are congenial to their view and to become more convinced of their original viewpoint, a process that Lord et al (1979) describe as polarization. Except in unusual circumstances (described below), polarization is inconsistent with the Bayesian model.

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Polarization

More arresting than the hypothesis of biased assimilation is the notion that, when people with different prior attitudes encounter new information, the gap between their beliefs grows larger. When, for example, proponents and opponents of the death penalty were shown an identical set of mixed evidence, the apparent result was to "increase further the gap between their views" (Lord et al 1979:2105). Subjects in this experiment seemed to attend to findings congenial to their original point of view. Instead of bringing the two groups closer together (or at any rate, moving them in the same direction), the new evidence caused the groups to polarize further.

Before getting into the details of this and other studies, let us step back and reflect on the conditions under which such a pattern would be consistent with Bayesian processing. Using Equation 3, we see that beliefs change in a positive direction if $\mu(H_t) > x_0$, regardless of the exact value of one's prior beliefs. Equation 3 says that the posterior mean equals a weighted average of the prior and the observed values of x. Observations with a small variance are given greater weight. It is somewhat difficult to get a sense of the magnitude of $\mu(H_t)$ for the general case. However, when we assume that the variances associated with each piece of information are the same, Equation 3 simplifies to

$$\mu(H_t) = \frac{\rho(H_t)}{\sigma^2}\left[x_0 + \sum_{i=1}^{t}(x_i)\right],$$

where $\rho(H_t)$ is the variance of the posterior distribution after H_t. Since $\rho(H_t) = \sigma^2/t$, this can be written as

$$\mu(H_t) = \frac{\sum_{i=0}^{t}(x_i)}{t}.$$

Last, the change in beliefs in response to H_t is

$$\frac{t-1}{t}\left[\sum_{i=1}^{t}\frac{x_i}{t-1}-x_0\right]. \quad 5.$$

Equation 5 shows that, regardless of the value of the prior belief, the voter updates it in the direction of the new information If the average of the new information (i.e. $\frac{1}{t}\sum x_i$) is greater than the prior, the voter adjusts beliefs upward; if the average of the new information is less than the prior, the adjustment is in the opposite direction. That being the case, under what conditions might one expect to see a polarization of opinion in response to new information? There are two possibilities. First, voters may apply different evaluative criteria to the same set of evidence. Suppose that voters see two studies on capital punishment. One shows that capital punishment has a strong deterrent effect against murder, and the second shows that sometimes innocent people are executed. This new information may cause voters to draw different conclusions even if they started out with the same prior beliefs and updated these beliefs in accordance with Bayes' rule. A voter who is horrified by the possibility of errors may move away from supporting capital punishment, whereas a voter for whom reducing the murder rate is a priority will show increased support.

Second, voters might differ in their assessments of new information. As the model has shown, the amount of weight placed on any new information is inversely proportional to the variance associated with it. If voters attribute different variances to the same information, they will assign different weights to the same piece of news. This implies that if there is at least one component of the information pulling voters in each direction, voters' beliefs might move in opposite directions, depending on which component of the new information is considered more precise. This theoretical possibility might be relevant to the world of international relations, where perceptions of states' intentions are subject to markedly different interpretations (Jervis 1996, Kydd 1997). This concern, however, does not seem to apply to polarization in laboratory experiments. Even if voters ascribe different variances to each piece of new information, in the absence of selective perception there is no tendency to overweight positive or underweight negative information. Therefore, results should average out across voters (particularly since these experiments randomize the methodology associated with each fictitious study), leaving only a small subset of voters moving in the "wrong" direction.

How persuasive is the polarization hypothesis? Taken at face value, the Lord et al (1979) study indicates that, after reading conflicting research reports, supporters of the death penalty were more likely than opponents to characterize their views as more strongly pro–death-penalty than before reading the reports. The catch is that self-described opinion change is not quite the same thing as opinion change. Ordinarily, when we think of opinion change,

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we have in mind a before-and-after study in which beliefs are assessed at each point in time. As Miller et al (1993) point out, the Lord et al study does not measure opinions before and after presentation of evidence; instead, the authors rely entirely on the subjects' assessments of whether their views have become more pro– or anti–death-penalty. Tellingly, Miller et al find that when pretreatment and posttreatment opinions are measured directly, the polarization hypothesis receives no support [in contrast to the capital punishment study reported by Pomerantz et al (1995)]. Moreover, Miller et al (1993) asked subjects to write posttreatment essays about their views and compared the content of these essays to their prior attitudes and reported attitude change. Based on essays about capital punishment and affirmative action, Miller et al (1993:571) found "very minimal behavioral consequences to subjects' reports of attitude polarization."

Much the same pattern of findings emerges in Munro & Ditto's (1997) experiments on anti-homosexual stereotyping and exposure to scientific evidence confirming or disconfirming these stereotypes. Self-reported belief change across a pair of experiments comports with the polarization hypothesis; directly measured pre- and posttreatment beliefs reveal no evidence of polarization.

What about other studies in which opinion change is measured directly both before and after the introduction of new information? Such studies are not as abundant as one might suppose, given the number of decades that biased learning theories have been in currency. As Chaiken et al observe (1989:232),

> Surprisingly, the biasing effects of prior attitudes have received little attention by contemporary cognitively-oriented researchers, even though earlier persuasion researchers often accorded prior attitudes an important theoretical role.... Most contemporary studies do not even assess prior attitudes. In these "after-only" experiments, subjects' pre-experimental attitudes typically are assumed to be opposed to the message's advocacy. Moreover, when prior attitudes are assessed, they are rarely represented in the analytic design.

Indeed, evidence confirming the polarization hypothesis boils down to just two studies in addition to the Pomerantz et al (1995) capital punishment study mentioned above.

Using the "fibrocystic disease threat" experiment crafted by Kunda (1987), Liberman & Chaiken (1992) examined the reactions of female coffee drinkers and nondrinkers to scientific evidence purporting to show that coffee consumption does or does not produce adverse health effects in women. Drinkers and nondrinkers were selected for the study on the basis of their roughly equivalent prior beliefs about fibrocystic disease. After seeing a study that supported the fibrocystic disease theory, both coffee drinkers and nondrinkers adjusted their beliefs in the same direction. But although both groups became more convinced by the soundness of the claim that fibrocystic disease is a real

health threat to women, the nondrinkers moved farther in the direction of accepting the claims of the theory. Strangely, however, nondrinkers exposed instead to scientific evidence disputing the fibrocystic disease hypothesis also became more convinced of the disease's adverse health effects. In the second study (Batson 1975), 11 Christian believers and 8 nonbelievers accepted as factual a fictitious story of archeological evidence disproving the Bible's account of the Resurrection; the believers became somewhat more firm in their religious conviction, whereas the nonbelievers became more skeptical after reading this report. Batson reported this asymmetric pattern of belief change to be statistically significant, despite the small sample sizes involved.

Taken together, these findings do not go very far in establishing the case for polarization, particularly when combined with the countervailing evidence presented by Miller et al (1993) and Munro & Ditto (1997). Applicability to the realm of politics is dubious as well. The experiments that do purport to show polarization make no attempt to establish the external validity of laboratory findings. Subjects in these experiments were quizzed about their beliefs immediately after exposure to the new information. It is unclear whether the polarization effects would have persisted over a longer period of time, amid further reflection or discussion with others. The issue of external validity is troubling because, to our knowledge, no field studies of the sort described by Wilson et al (1992) have turned up evidence of polarization.[4] In light of this concern, we now briefly examine the most widely studied time series in the study of American politics, namely approval of the incumbent president, to see whether Democrats and Republicans respond differently to political and economic developments.

A BRIEF LOOK AT AGGREGATE PUBLIC OPINION

Presidential Approval

Theories of party identification have often emphasized the extent to which party attachments operate as perceptual filters, causing partisans to assign disproportionate weight to evidence favoring their party. Stokes (1966:127), for example, contends that the "capacity of party identification to color perceptions holds the key to understanding why the unfolding of new events, the emergence of new issues, the appearance of new political figures fails to produce wider swings of party fortune. To a remarkable extent these swings are damped by processes of selective perception." Public opinion moves

[4]Wilson et al (1992) randomly assigned more than 1000 adults to an experimental condition in which they watched a movie designed to sensitize viewers to the plight of rape victims. Although the authors expected to find males in the treatment group to be less receptive to this message than females, evidence of polarization proved not to be significant.

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sluggishly because supporters of the party disfavored by current events take no heed of unfavorable news or construe it as favorable.

Testing the claim that Democrats and Republicans weigh the same evidence differently requires a longitudinal research design. At any given point in time, those who identify with the Republican Party are much more likely than their Democratic counterparts to approve of a Republican president or disapprove of a Democratic one. These divergent evaluations do not in themselves make the case for biased perception because they may well reflect the different policy orientations of the two groups of partisans. A more telling assessment of perceptual bias tracks presidential approval over time. Are events interpreted differently by Democrats, Republicans, and Independents, such that approval rises among one partisan group while falling or remaining unchanged among others?

Edwards' (1990) compendium of presidential Gallup approval ratings classified by respondents' party provides a readily accessible means for answering this question. Edwards presents annual figures on the percentage of Democrats, Republicans, and Independents who approve of the way the president is handling his job for the period 1952–1988 (Figure 1). The trajectories of presidential approval track quite closely across the three partisan groups. Indeed, when we look at annual changes in approval (discarding, necessarily, the first year of each presidency), we find very high correlations between the ways in which the partisan groups update their assessments. Annual percentage-point changes in presidential approval among Democrats and Republicans correlate 0.77 (n = 29); this figure rises to 0.79 when changes are recalculated in terms of shifts in log-odds.

The correspondence across partisan groups can be assessed more rigorously by examining the extent to which change in partisans' opinions tracks change in the opinions of Independents. Independents provide a useful benchmark because they lack the motivation to slant news in a particular direction. To examine whether partisans adjust their evaluations in the same manner as Independents, we estimated a system of equations in which change in the log-odds of approval among Democrats or Republicans is regressed on change in the log-odds of approval among Independents, plus an interaction term (scored 1 or –1) that indicates whether Independents are moving in a direction that signals unfavorable news. (A pro-Republican shift, from the standpoint of Democratic partisans, occurs when Independents' approval of a Democratic president falls or their approval of a Republican president rises). Adding in random disturbance terms, we may write these equations as follows:

$$\Delta \text{ log-odds of approval among Republicans} = a + b\,(\Delta \text{ log-odds of approval among Independents}) + c\,(\text{indicator variable scored 1 if Independents' approval is changing in a pro-Republican direction and } -1 \text{ otherwise}) * (\Delta \text{ log-odds of approval among Independents}) + \mu,$$

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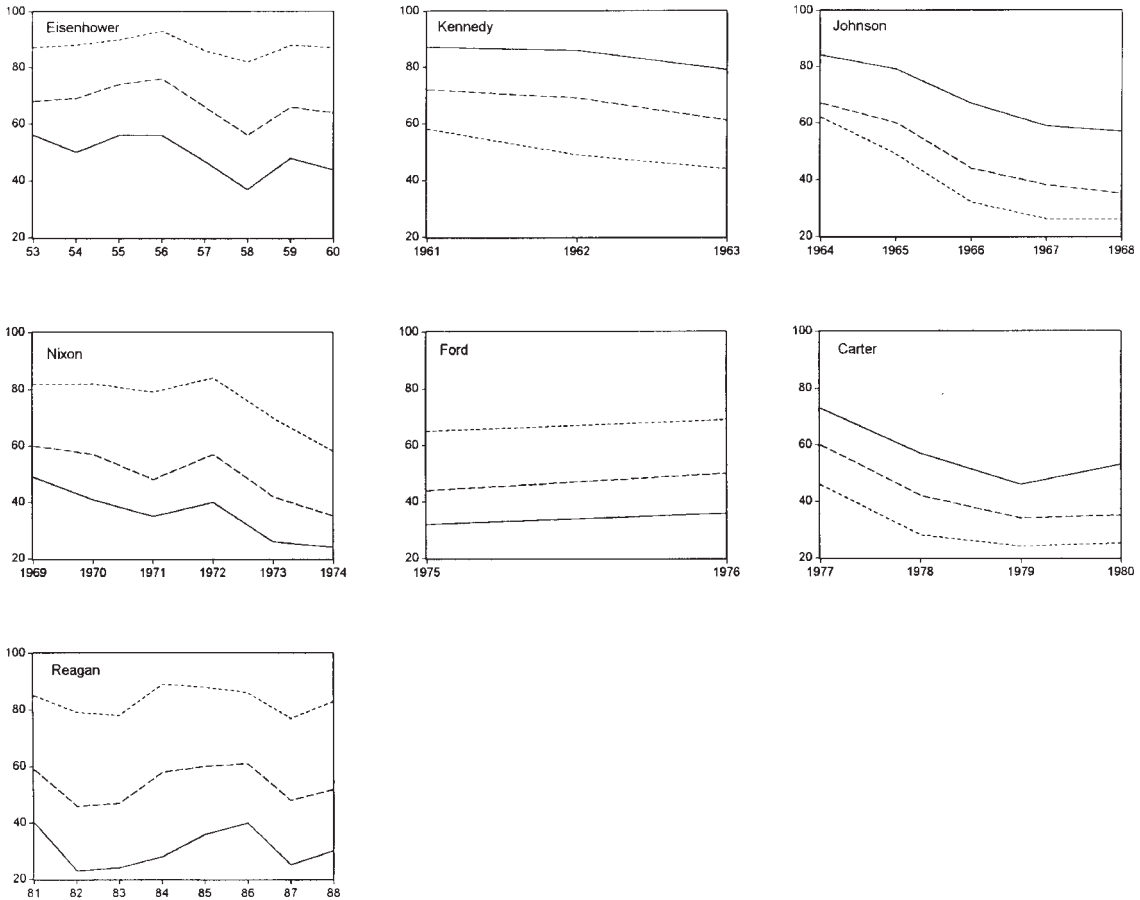

Figure 1 Presidential approval by party identification, 1953–1988 (Edwards 1990). Solid line, Democrats' approval; short-dashed line, Republicans' approval; long-dashed line, Independents' approval.

Table 1 Regression analysis of selective perception in presidential approval among partisans[1]

	Dependent Variable	
	Δlog-odds of approval: Democrats	Δlog-odds of approval: Republicans
Intercept	–0.016 (0.030)	0.014 (0.035)
Δ log-odds of approval: Independents	1.094 (0.133)	1.114 (0.111)
Δ log-odds of approval: Independents dummy scored 1 if change among Independents signals unfavorable news and 0 otherwise	–0.125 (0.163)	–0.006 (0.187)
Adjusted R^2	0.853	0.840

[1] $N = 29$ annually aggregated observations of presidential approval, deleting observations in which a president has just assumed office. Standard errors in parentheses.

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and

$$\Delta \text{ log-odds of approval among Democrats} = \alpha + \beta\,(\Delta \text{ log-odds of approval among Independents}) + \gamma\,(\text{indicator variable scored 1 if Independents' approval is changing in a pro-Democratic direction and } -1 \text{ otherwise}) * (\Delta \text{ log-odds of approval among Independents}) + \varepsilon.$$

Selective perception implies that the parameters c and γ will be negative—untoward information reduces the impact of the opinion change among Independents. Indeed, in its strongest formulation, selective perception implies that $b + c = 0$ and $\beta + \gamma = 0$; unfavorable information is ignored altogether. A Bayesian model, on the other hand, expects b and β to be 1 and c and γ to be zero.

Table 1 reports the results of these regressions. Both c and γ are found to be small, and neither is statistically distinguishable from zero. A Wald test of the coefficient restrictions associated with the Bayesian null hypothesis that $b = \beta = 1$ and $c = \gamma = 0$ produces a chi-square of 2.12, which is nonsignificant ($p = 0.71$). In sum, only the faintest traces of selective perception are evident from partisan trends in presidential approval. All three partisan groups move together—sometimes markedly—as party fortunes change. These data are inconsistent with the claim that partisanship "dampens" the effects of new information, as well as the broader thesis (Slovic & Lichtenstein 1971) that people update their beliefs in an overly conservative manner. Beliefs and evaluations do change, and they change to approximately the same degree among those with different political allegiances.

CONCLUSION

One of the most difficult aspects of studying biased learning is drawing appropriate links between theory and evidence. That previous scholarship has some-

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times lent support to the biased learning model suggests the inadequacy of tests that fail to track beliefs and evaluations over time. The mere fact that Democrats and Republicans each tend to declare their party's presidential nominee the more effective debater (Katz & Feldman 1962, Sigelman & Sigelman 1984) is not convincing evidence of selective perception because each group of partisans doubtless applies different ideological criteria when evaluating the candidates' ideas. Holding tastes constant is a critical component of an effective research design. If, in a college dormitory, half the students like Mexican cuisine and the other half do not, we would not cite mixed reviews of the lunch menu when tacos are served as evidence of perceptual bias. The issue of perceptual bias hinges on how evaluations change when the same dish is prepared by a gourmet chef.

By the same token, the fact that people with different preconceptions form different opinions about the same piece of evidence—so-called "biased assimilation"—is not inconsistent with Bayesian information processing. As Lord et al (1979:2107) acknowledge, it may be entirely rational for those with strong prior beliefs to downplay the value of new information. Making sense of the literature on biased learning requires a sharp distinction between studies that examine the credence subjects place in an argument and studies that examine how new evidence changes existing beliefs. Only the latter type offers a compelling test of whether learning departs from a Bayesian characterization.

Bayesian learning models are called into question by evidence of belief polarization because the Bayesian model predicts polarization only in very unusual circumstances. Although the Lord et al (1979) study has been cited with approval on hundreds of occasions, its central empirical claim is not well supported. Granted, subjects who evaluate mixed scientific evidence may report that their beliefs have grown more extreme, but direct assessments of change often fail to show evidence of polarization. Moving beyond the confines of laboratory experiments on undergraduates to public opinion surveys, we see surprisingly little indication that Democrats, Republicans, and Independents respond to current events differently. Presidential approval seems to rise and fall among all partisan groups to a similar extent. This finding accords with Gerber & Green's (1997) analysis of panel survey data, in which Democrats, Republicans, and Independents moved together in their evaluations of which party was best able to handle the nation's economy.[5] It accords also with Page

[5]Based on their survey analysis of economic perceptions, Peffley et al (1987:103) conclude that "people appear to be extremely conservative information processors, revising their beliefs to a much more limited degree than Bayes' theorem prescribes." Whether voters change their beliefs to a sufficient degree is difficult to establish empirically, since it requires precise measurements of prior beliefs and exposure to new information. Suffice it to say, "beliefs about party economic competence may change fairly appreciably over the course of two year's time" (Peffley et al 1987:105), a finding consistent with results presented by Gerber & Green (1997).

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& Shapiro's (1992) extensive evidence that the opinions of opposing ideological, social, and economic groups seldom polarize over time.

Such findings are more suggestive than definitive, and there may be important circumstances in which biased learning surfaces. Selective perception may be more apparent in people's immediate reactions to new information. The polarizing effects of information that have occasionally been observed in the laboratory may simply be too short-lived to manifest themselves in aggregate time series spanning months or years. Analyses that track evaluations over shorter time spans, when beliefs and the criteria by which to gauge the quality of incoming information are uncertain and unformed, may turn up more evidence of asymmetrical opinion change. Haight & Brod's (1977) analysis of opinion during political crises is suggestive of such short-run effects. It may also be that, in the cases we have studied, selective perception is restricted to a small portion of the electorate; although present, its effects escape detection. If motives arising from deep-seated ideological commitment engender selective perception, perhaps the United States, with its famously narrow band of ideological variation, is a limiting case.

As the study of voter learning moves forward, at least three lines of research and methodological innovation present themselves. The first is the study of more emotionally charged issues or ideologically committed individuals. As one tracks the beliefs of rival groups in a political or ethnic conflict, do perceptions converge as new evidence comes to light, or do these groups react in an asymmetric fashion to new information? Relatedly, in what ways do social processes—discussion, opinion leadership, and other processes that are generally overlooked in laboratory studies of belief change—contribute to or mitigate polarization (see Liu & Latane 1998)?

Second, a thorough empirical analysis of Bayesian learning (and departures therefrom) requires greater attention to the measurement of prior beliefs. Not only is it important to have reliable information about the location of these beliefs, it is also important to gauge the uncertainty with which they are held. The term selective perception, coined in political science by Berelson et al (1954), originally described the fact that voters' perceptions of candidate stances were colored by their own policy preferences: "In almost every instance, respondents perceive their candidate's stand on the issues as similar to their own and the opponent's stand as dissimilar—whatever their own position" (1954:220). Although Democrats and Republicans have broadly similar impressions of where the candidates stand, "Overlaying the base of objective observation is the distortion effect—distortion in harmony with political predispositions" (1954:220). Without disputing the existence of this phenomenon, which has been observed by other scholars (Markus 1982), we would argue that this sort of "projection" is much as the Bayesian model would expect among those who lack information. As the focus shifts from prior beliefs to learning, it is telling

that Berelson et al themselves demonstrate a powerful relationship between respondents' exposure to campaign information and the accuracy with which they describe the candidates' platforms (1954:228; see also Sears 1969 on the inverse relationship between the clarity of a stimulus and the degree of perceptual distortion).[6] Very few studies take seriously interpersonal variation in uncertainty.

Finally, and perhaps most importantly, students of voter learning must devote greater attention to the measurement and conceptualization of beliefs. To date, researchers have been content to take verbal expressions of beliefs at face value. People are assumed to believe the survey response option that they select. The question arises, however, whether such responses actually constitute the premises on which people would be prepared to act. Consider, for example, respondents' retrospective appraisals of economic conditions in the 1980 and 1992 National Election Studies. In 1980, Democrats were more likely than Republicans to claim that the economy had improved over the preceding 12 months; in 1992, Republicans were more likely to do so than Democrats. Leaving aside the issue of whether Democrats and Republicans might have been applying different economic criteria when evaluating the nation's well-being, there remains the possibility that these statements reflect something other than genuine convictions about the state of the economy. If the Democrats really felt more sanguine about the economy in 1980, did these beliefs manifest themselves in terms of consumption or investment? Did Republicans' consumption decline and Democrats' surge between 1992 and 1993, when the Democrats regained control of the presidency? In the study of beliefs as elsewhere, seeing is believing.

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[6]Berelson et al summarize (1954:229), "It seems that communication exposure clarifies perception probably more than any other factor...[T]he more reading and listening people do on campaign matters, the more likely they are to come to recognize the positions the candidates take on major issues. It is as though the weight of the media is sufficient to 'impose' a certain amount of correct perception, regardless of the barrier presented by the voter's party preference."

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