I. Introduction: the Role of Information in Choice

In lecture 3 we discussed cases in which rational ignorance might produce fiscal illusion and thereby lead the median voter to prefer policies that were thought to maximize his or her utility, but actually did not. Lecture 7 more fully explores that possibility. Rather than simply assert that everyone knows their true interests and behaves accordingly, we'll think a bit about the role that information and theory play in an individual's efforts to understand his or her interests and to act in a manner that advances them. The framework developed applies to all manner of choices, not simply those of voters.

To begin with, think about what it means to be a member of a species. It means that one has certain genetically transmitted characteristics. In the case of humans, this includes two arms, two hands, two legs, two feet, two kidneys, two eyes, two ears, one braine, one nose, one mouth, and so on. Humans cannot fly unassisted, nor can they swim unless taught to do so. Their sense organs—eyes, ears, nose, tongue, skin—take in various forms of data that our brains make sense of. Much of this is automatic—which is to say part of our nature—but much else is learned. The part that is automatic can be regarded as a product of evolution and minor genetic variation within the species. Some folks grow taller than others, see better than others, some hear better than others, and so forth. There is enough in common that we can regard all humans to be part of the same species in spite of those differences. We'll ignore the differences for the most part in this lecture, not because these minor variations are unimportant, but because they are not essential for our analysis of the role of information in choice. We'll simply treat everyone as having the same genetic endowment—although we know these vary to some extent and often in important ways.

Using computers as an analogy, our genetic nature is our hardware. It is, however, not simply inert but includes a series of "programs" that tend to process our sensory information in particular ways and to predispose us to take some actions in response to particular circumstances—albeit ones that were important in the millennia before written language and settled communities emerged. These dispositions are not all

encompassing—they do not "tell us what to do" in every circumstance—but imply that what we see and hear and our instinctive reactions to those sights and sounds were vary useful to humankind in the period in which the species was devoted to hunting and gathering. They are realistic and optimal in that sense for genetic forebears. However, not all those dispositions are equally useful for settled agricultural societies, industrial ones, or in post-industrial ones that we seem to be headed toward.

Fortunately, we are not entirely determined by our genetic predispositions. If we were, we'd still be nomadic hunter foragers. In addition to our physical attributes and our dispositions (our "firmware"), we have the ability to internalize new rules—our "software." We are not the only species that can do so—even rats can master a maze, a horse can be taught to trot, a dog to roll over and play dead, and so on. But humans can devise and internalize far more elaborate rules than other species—and because of that they could and did create a far more elaborate language for sharing rules and other ideas with one another. These languages were "local" in times gone past, but were extremely useful because solutions to the problems of life for humans could worked out across generations rather than one life at a time. Many—but not all—of the rules taught to children today were also taught to their parents, and theirs, and theirs and so on for dozens if not hundreds of generations.

Of course, human language—as sophisticated as it is relative to others in the animal kingdom—is still imperfect. Thus, every individual has to be actively engaged in interpreting what is transmitted to them through language. This implies that we are neither entirely genetically or socially created—because each person may interpret the lessons learned from other in their own unique—albeit human—manner. We are to some extent "self-programed" at the margin. We have some more or less "hard wired rules," many of which we can over-ride—as for example persons can voluntarily starve to death, forgo procreation, charge a machine gun, engage in painful activities, and so on. We have a good deal of "software" that we've learned from others, that we can similarly over-ride—we can learn to speak and write better English than we learned at home, change religions, alter out diets, move to another part of the world and learn a

new language, and so on. At the margin, as I said, we are all self-programed rather than entirely genetically or socially predetermined. We are all human all partly products of our family and culture, but not entirely so. Cave men could not build helicopters, computers, nor universities. People from your homes and home communities have chosen entirely different lives than you have, and so on. Even twins raised in the same families do many things a bit differently from each other.

There are two rather obvious explanations for these differences—although they may be obvious to you only after I remind you of a few things that you already know. First, we all have the capacity to refine rules that we've been taught and invent entirely new rules—rules that have never been used before. Some of the latter rules will be so grand that others will learn them, as with Newton's theory of gravity or Adam Smith's theory of the invisible hand. Others will remain our own private idiosyncrasies and die with us. Second, we all experience the world in somewhat different ways—we see different things, hear different stories, read different book, travel to different places, and interpret each in some what different ways—partially because how we interpret things (data) today depends in part on ideas, conclusions, and rules of thumb (operating hypotheses) that we've absorbed or worked out previously.

Notice the role that "information" broadly interpreted plays in this process. In the earliest days of humanity, most of our information was collected as "raw data," as our own direct sense information, that we would individually make sense of one way or another, probably using our "hard wired" instinctive informational processing system. As language emerged—and it might well have emerged early one—and became better able to convey subtle meanings from one person to another, more and more of our information was "pre processed," by other minds. Thus, even in the days before written languages emerged, much of what humanity has used as information was "preprocessed" by others. Someone sees something of interest and points at it. Someone tells a story that can be used to shed light on the way people behave in particular circumstances or particular kinds of people (often kings or heroes) behave in general. Someone shows another how to light a fire, find a particular plant or animal, and use it for food or

clothing. Our data tends to be become more and more "preprocessed" as language and society becomes more complex. (Indeed, one reason why many of us enjoy hiking is arguably because it places us back in a setting where our "old fashioned" direct sense information is most important.)

Preprocessed information is obviously important for what we know about economic and politics. Even if we undertake our own econometrics, the data are numbers collected by others and the software used for statistical analysis created by others. Much of our information is not raw data, but information and information processing systems developed partly by others. Most of what we know about production and pricing is in this form—unless we have attempted to found our own firm or grew up in a family where other family members did so or managed one. Most of what we learn about politics is also in this form—unless we have attempted to be elected to a government office or grew up in a family where other family members did so. Nonetheless, we all must interpret the preprocessed information that we acquire. This course is an effort to help you more fully interpret the information that you already have about politics and economics by providing you with "preprocessed" theories about how political and economic systems interact. It also attempts to provide "pre processed" information that is thought to be relevant for demonstrating the explanatory and predictive power of those theories.

In some cases, the information we have is "unbiased" in the sense that it is simply an effort to assemble and deliver facts to users of that information. We expect, for example, government data to be of this sort with respect to GNP, unemployment, prices, health statistics and so on. Other information is clearly biased because the persons providing it have political or personal agendas of their own—which is, of course, sometimes true of government officials as well. The information provided by such persons is very likely to be assembled and delivered in a way that they expect to advance their interests as they understand them. Within institutional settings that reward honesty, that may simply require the production of unbiased information. Within other settings, biased information is to be expected.

Our preprocessed information affects our choices in a number of ways. Economics implies that price information affects expectations and thereby the choices of consumers and firms and also of potential input providers. Preprocessed information about candidates—who are for the most part strangers to us except for what we see and hear on the news—also affects our assessment about them as people—honest or not, competent or not, aligned with our interests or not—and their espoused policies, which may in turn affect both our voting behavior (I'll vote for X rather than Y because he/she seems honest, his/her interests and espoused policies are better aligned with mine, and seems more competent) and our private investment behavior (electric cars, etc, are being subsidized, so perhaps they are worth a look given their lower than cost prices; defense spending is likely to rise so why not pick up a some defense stocks, etc.).

Information in this "preprocessed or pre-packaged" sense plays similar roles in most choices that we make. As long as we can filter out the biases (both intentional and unintentional) in the information that we obtain—both that that we obtain with little or not effort and that we obtain after seeking it out and studying it—our choices can be said to be "informed" and likely to advance our own interests, as we understand them.

On the other hand, filtering for bias is difficult to do perfectly, unless one already knows the truth; thus we all occasionally get fooled by information that we have, partly because of information that is never provided to us. Informational uncertainty is a fact of life in environments in which others can benefit from manipulating informational flows in circumstances in which we are ignorant about much that would be useful to know.[1]

II. Information and the Demand for Public Policy

We now shift back to public economics from human science, anthropology,

[1] For a sophisticated book-length discussion of how the mind works, I suggest Pinker (2002) *The Blank Slate: the Modern Denial of Human Nature*. Pinker's book is written from a determinist perspective, but draws on an enormous pool of information and presents it in a nuanced subtle manner. For a longer treatment of my perspective on this chapter see (Congleton 2019 [Homo Constituitionalus], Congleton 2019 forthcoming [Behavioral Economics and the Virginia School]). For more on "artifactual man," see Buchanan (1978) or Aristotle's *Ethics* (340 bc).

psychology, and philosophy. For positive public economics, what matters is that new information can change voter demands and that both natural and rational ignorance imply that voters can be manipulated. Partly because of the latter, but also because of the former, we are also interested in the extent and variation in the extent of the pivotal voter's bias.

As true of most work in economics and public choice, we assume that voters are forward looking and take steps to advance their interests. They take the best steps in their private lives to advance their interests—at least insofar as they understand their interests and relevant possibilities—and similarly in their roles as voters. In most theoretical work, it is assumed that voters fully understand both their interests and the steps that may be taken to advance their interests. However, those assumptions are widely recognized to be a simplifying assumptions. In most cases, individuals do not fully know their interests or the best means of advancing them. Instead, they know a bit about their long-term interests in safety, health, and material comforts and have some imprecise ideas about how to advance those interests in the circumstances in which they find themselves.

This knowledge problem is greater with respect to public policy than in private life, as noted by Downs (1960), because the issues are generally more complex and the incentives to be well informed are weaker. A consumer controls exactly what goes into his or her shopping cart but has far less control over the portfolio of policies implemented by his/her government or who will hold elected office. That smaller influence on results weakens incentives to be well informed, although it does not eliminate all interest in policy-relevant information.

Some policy information is personally important (Congleton 2001); so, both general and specific information about candidates and policies is collected and analyzed. Not all details are equally important to all people, however, and so the specific knowledge collected varies substantially among individual voters.

In most public choice and rational politics models, the interests to be advanced are taken as given and treated as abstract demands for pure public goods or externality-reducing regulations. However, when ignorance is acknowledged, this implies that changes in

information about policy alternatives or consequences affects each voter's policy preferences and voting behavior.

For example, managing risks associated with ignorance and nondeterminism is an important part of life and new information about risks can induce significant changes in behavior. Thus, as voters become convinced that some risks are greater (or less) than they formerly believed, their demands for public services and regulations tend to change. Voters favor a variety of insurance-like services from government because the latter can reduce their effective risks from (i) others in their community, (ii) diseases that are costly to treat, and (iii) economic shocks that reduce their income and wealth.

New information about such risks may induce changes both in voters' most preferred policies, political parties, and candidates. The best strategies for managing risks are rarely obvious. These strategies tend to evolve with experience and with indirect experiences provided by stories from friends and family, theories learned at school and through reading, and mass media accounts of the news of the day. One may change one's diet, for example, after learning a new theory about which foods are best for one's health and longevity, without changing one's job or moving to a new apartment or house. One may voter for stronger environmental regulations when new information suggests that risks are greater than previously thought, or for weaker regulations when new information suggests that risks are smaller than previously believed. With respect to votes among candidates or political parties, voters with stable understanding of their short- and long-term interests may cast their votes for the same party for decades at a time and for the same sorts of candidates within such parties.

New information or events may induce individuals to reconsider their policy and/or candidate preferences. For example, a regulatory failure such as those associated with the 2011 Fukushima nuclear plant crisis triggered jointly by a tsunami, poor design, and regulatory errors may create a new demand for both new forms of crisis management and better regulation of nuclear facilities. This in turn tends to encourage innovation by government officials to satisfy that demand, as has been the case in Japan.2 Similar information-driven shifts—albeit less dramatic and sudden—in voter assessments about

governmental policies with respect to health insurance and environmental regulation have taken place during the past half century as concerns about health and environmental risks have gradually increased and our ability to moderate them has improved. Tolerance for national debt—whether wisely or not—has also evidently increased during the past half century, although this may reflect complacency rather than new information.

Survey evidence suggests that most voters are aware of only the broad outlines of most public policies. A typical voter's demand for services is general rather than specific, and his/her policy preferences in the short run tend to favor "more" or "less" of relatively broad categories of expenditures already in place, such as health care, tax-financed retirement benefits, environmental regulation, and national defense, rather than detailed policy demands for specific programs in such areas.

However, there are exceptions. A subset of voters may have particular concerns about health risks, for example, and may have clear preferences for expanded coverage of particular medical treatments. Similarly, a subset of voters whose wealth or income is directly affected by relatively narrow provisions of the tax code or details of regulation may have clear, detailed preferences with respect to tax and regulatory policies on those issues (but not the entire body of tax or regulatory law).

Only subsets of voters that are aware of the details of most policies, and only those voters will vote with particular policy details in mind. The demands of such narrowly informed voters tend to influence the details of public policy, because they are the only voters whose votes are affected by such details. Other voters will tend to be entirely unaware of such details.

From this perspective (and that of ordinary economics), policy stability tends to reflect the stability in voter information and thus preferences over policies. In normal times, changes in both general and particular interests occur only at the margin as a voter's information, tastes, and circumstances change; so considerable stability exists with respect to their perceived interests. It is partly for this reason that rational choice models of politics often assume that voter interests are completely stable. This stability, together with some of the micro institutions of legislatures, tends to imply stable paths for public policies and

taxation.

The result of political competition in this case where voters vary in the extent of their knowledge about public policies is an equilibrium similar in spirit to the one characterized in Down's pathbreaking paper and book. **However, in this case, the median of the group of all persons casting votes determines the broad outlines of policies, but the median of informed subgroups of voters determine the details**.

The latter implies that many of the details of public policy will reflect relatively narrow interests rather than general interests. (Such informed persons are often members of organized Olsonian [1965] interest groups, who are informed about the details of policies by publications by their group's organization. We'll take up interest groups next week)

The details of policy are based on a more thorough understanding of the issues than implied by public surveys of voter knowledge, but the details of most policies reflect the interests of relatively small groups of especially interested voters. This effect is reinforced by the "Condorcet Jury Effect" discussed in the next sub section of these notes.

III. The Condorcet Jury Theorem and the Median Voter

There is considerable survey evidence that voters know very little about government policies and the backgrounds of elected governmental officials. However, there is also considerable evidence that democratic governance works quite well, if not perfectly. This is a great puzzle, upon which this paper attempts to shed a bit of light. Clearly, if democratic outcomes were based entirely on the limited information available to a "typical voter," even the best democratic government imaginable would adopt policies that are far from perfect, because voters know so little about public policy. Yet the experience of the past century suggests that majoritarian polities create attractive rather than repulsive societies. The citizens of the longest-standing democracies have the highest incomes and longevity on Earth. Emigrants from around the world seek them out, often at great cost and personal risk. How is this possible when the typical voter knows so little about public policy?

This section of the lecture explores one of the more plausible explanations and it is one that rests on the median voter theorem but is not obviously associated with "middle of the road" opinions. Instead, it has to do with the statistical properties of medians. It turns

out that median estimators are more robust estimators of central tendencies than are averages, because they are less affected by outliers. This has implications both for what might be called the median policy expectations of voters and with therefore with respect to the median voter's assessment of the relative merits of policies and candidates.

The great bulk of the literature on the "jury theorem" focus on "true-false," "guilty-not-guilty," and similar "0-1" assessments of a person or policy. The models begin with the assumption that the only difference among voters are their estimates of the 0-1 variable of interest and evaluate the likelihood that a collective choice—such as a jury's assessment of the guilt or innocence of an accused person—tends to be correct or not. Given the 0-1 choices assumed by most of the literature, the probability distribution of outcomes can be characterized as a Bernoulli or Binomial distribution. The main interest of the Jury theorem literature is the voting rule that is most likely to generate accurate results, which is a somewhat different measure than the one focused on in most analyses of the properties of that distribution. [2]

The mean of the Bernoulli distribution is usually reported as the number or fraction of results that are of a particular value—say 1. If p is the probability of a 1 and (1-P) is the probability of a 0, then the average and median number of 1's is pN, where N is the number of trials. If the (expected) median number of 1's is greater than half of N and N is interpreted as the number of voters in a jury or electorate, then the median voter will cast his or her vote for "1." Notice that this occurs whenever $p > 0.5$. Thus if the median voter is more likely to be "right" or "accurate" than not (e.g. p of being right is greater than 0.5) then the median voter will be very likely to get the right answer. More likely he or she is to be correct, the more likely the median Bernoulli voter is to get it right. Of course many other voters get it right as well, but many also get it wrong ((1-p)N).

Of course if the voters are less than 50% likely to get it right, the median voter will almost definitely get it wrong rather than right, in which case the Condorcet Jury Theorem will not help us explain why democratic polities have done so well for the past two centuries.

[2] For relatively early contemporary contributions to this literature see, for example, Nitzan and Paroush (1982), and Grofman et al (1983). For a recent overview see McCannon (2015) or McCannon and Walker (2016).

There are some limitations to this approach. First, it assumes that voters vote randomly, which is to say unpredictably—possibly because of differences in their information. In this respect voting might be considered similar to random walk theory of stock markets used in finance and some parts of macro economics. However, in the case of voters, there are also predictable (average) correlations between gender, race, education, income, socio-economic status, etc. and propensities to vote for particular parties in the United States. So, information is probably not the only difference among voters. How differences in information affect voter expectations is left as a "black box." It is left unmodelled. Moreover, the binomial stochastic voting model does not help much when there are more than two alternatives as there often are in democracies.

Congleton (2007) takes up both limitations of the mainstream jury theorem literature. In that paper, I imagine voters trying to estimate the quality of candidates for office Voters are assumed to know the "quality of candidate function," which is assumed to be a linear function of two characteristics, one observable and one not observable. Their task is to parameterize that function—which I call a yard stick—and use it to assess the quality of two candidates running for office. In the first half of the paper, I demonstrate that if voters have just a little bit of complete information, the median estimate of candidate quality is very accurate—at least as accurate as it can be given the existence of relevant unobservable characteristics. Various Monte Carlo simulations are run to examine the effects of the size of the electorate and importance of the unobservable outcomes on electoral outcomes. Since they are simulations, I know which candidate is most qualified.[3]

[3] Each voter is assumed to know the quality and observable quality characteristic (experience education etc) of the incumbent (from news accounts) and that of one other "reference" candidate, who vary among voters. This might be someone from history or some one that they know and can use as a metric. Given these two observations, they estimate a quality of candidate function and use that function to rank challengers over or above incumbents. The reference candidates are modelled as random draws whose quality is generated by the true yard stick function and random draws of the observable and unobservable characteristics. These vary among voters. The incumbent is the same for all voters and his/her quality is also generated from the true yard stick function given random draws from the observable and unobservable characteristic distributions, which are assumed to be uniform in nature.

Table 1 presents average and median estimates of challenger quality for five series of simulated elections with different sized electorates. Note that the results are not much affected by the size of the electorate, although as statistical theory predicts the standard error of the median estimate falls somewhat as the size of the electorate increases. Errors are mainly caused by variation in the unobserved characteristic of the challenger, rather than information failures of the median voter. Even with very limited information, median estimates tend to converge quickly to the true underlying functional form of the yardstick function.

However, even given that accurately parameterized candidate quality function, voters cannot precisely judge candidate quality because of the unobservable determinants of candidate quality such as trustworthiness or sound judgement. So, the average value of that characteristic rather than its actual value is used. When candidates are "close" in quality, but for the unobserved characteristic of the challenger, mistakes are occasionally made in about 13% of the elections.

Table 1: Electoral Outcomes as Estimates of Candidate Quality

Electorate Size	Average Challenger Quality in Sample	Median Estimated Challenger Quality	St. Error of Median Est. Candidate Quality	Number of Electoral Mistakes
11	-4.114	-4.068	2.68	13
101	-3.808	-3.975	2.77	14
501	-3.884	-3.827	2.63	14
1001	-3.964	-3.979	2.34	13
2001	-4.071	-4.093	2.31	10

A hundred elections are simulated for each community of voters. The incumbents, reference candidates, and challengers change in each election. The average challenger quality, however, is -4.0.

The use of Monte Carlo simulations also allows the effects of various forms of ignorance (natural and rational) to be assessed. Three types of ignorance and voting are analyzed. (i) Voters that remain ignorant of the observable characteristics of challengers will vote for the incumbent if he/she is believed to be of above average quality (based on the voter's "reference" candidate. (ii) Voters who make no effort to take account of the unobserved characteristics of candidates vote based on their observed characteristics

and so will vote for the better of the two candidates based on this characteristic alone. (iii) Voters who remain ignorant about both relevant characteristics and so vote at random for reasons having nothing to with candidate quality. As you might suspect, these rationally ignorant voters are far more mistake prone even in elections in which the Jury theorem helps to reduce errors.

Table 2 shows both the effects of different types of ignorance and of the importance (variance) of the distribution of the unobservable characteristic on median voter errors. The first column are the "slightly informed" voters of the previous tables, the rest are various forms of rationally ignorant voters, the last column is the number of mistakes made by the entire electorate. Note that in the upper electorate, the jury theorem here makes the slightly informed voters pivotal in many elections and so reduces the effects of voter ignorance on electoral outcome. The lower electorate has fewer of the slightly informed voters and so they are less likely to be pivotal with the result that more mistakes occur.

Table 2
Electoral Mistakes by Median Voters
in Populations of Slightly Informed and Rationally Ignorant Voters
Simulations: 100 elections, with 202 Slightly Informed Voters and 101 of Each Type of Rationally Ignorant Voter

Range of *u*	Slightly Informed Group	Rationally Ignorant of β	Rationally Ignorant of α	Completely Uninformed Group	Overall Electoral Mistakes
+/- 0.1	0	22	42	51	0
+/- 1.0	7	20	41	51	6
+/- 2.0	12	23	38	50	11
+/- 4.0	21	31	36	52	25
Simulations: 100 elections, with 151 Slightly Informed Voters, and 151 of Each Type of Rationally Ignorant Voter					
+/- 0.1	0	26	45	51	29
+/- 1.0	5	29	40	50	27
+/- 2.0	19	33	41	50	33
+/- 4.0	21	34	42	47	38

Overall these results imply that the results of elections tend to be better informed than any single voter tends to be, and that majority rule itself operates like a median estimator in cases in which voters differ mainly in their information and estimates. When voters have different true interests, these results can be thought of as characterizing voters with approximately median characteristics and to demonstrate that the policies chosen are very likely to advance their interests even when relatively few have even a bit of general knowledge about the candidates and/or issues at stake. Interpreted in this way, this provides at least a partial explanation of the relative success of democracies for the past two hundred years. Many voters may have biased ill-informed beliefs about policies but the median voter tends to have ones that are less biased because this is partly what makes him or her the median of the distribution of voter ideal points. In such cases, moderate voters get more or less what they hope to get, namely policies that advance their true interests.

(Another might be that most Western voters have been various types of "liberals" for most of that period and so had reasonably well-grounded ideas about the kinds of policies and candidates that would advance their interests. We'll return to that possibility towards the end of the course.)