

Positive Changes in Political Science

*The Legacy of Richard D. McKelvey's
Most Influential Writings*

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THE UNIVERSITY OF MICHIGAN PRESS

Ann Arbor

Information in Elections

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1. Introduction

In the scientific study of elections, there is a growing emphasis on the role of information. Of particular importance are the conditions under which certain kinds of informational asymmetries affect voter strategies, candidate strategies, and electoral outcomes. For claims about such effects to apply generally, interactions between voters and candidates must share an underlying logic. To the extent that political information is sought and produced by goal-oriented actors, this logic will include attention to the role of incentives. We can, for example, expect that actors who can influence others through the selective provision of information may have an incentive to exercise their influence in the service of only their own interests. At the same time, if those who are subject to such influence recognize these incentives, then they are likely to have an incentive to be selective about who and what to believe.

Game theory provides a means for understanding the logic of information transmission and reception in circumstances where at least some actors have an incentive to be at least partially strategic in their conveyance or acceptance of information. In such circumstances, game theory can clarify how clearly stated premises about voter, candidate, and contextual attributes relate to clearly stated conclusions about communicative and behavioral outcomes. It can help us understand the conditions under which certain kinds of information, such as polls and endorsements, affect voter and candidate strategies. Such understanding, in turn, can clarify the credibility and applicability of many election related claims, including those made elsewhere in the scientific literature.

One of the first attempts to employ game theory to this end is McKelvey and Ordeshook's 1985 paper, "Elections with Limited Information: A Fulfilled

Expectations Model Using Contemporaneous Poll and Endorsement Data as Information Sources" (Chapter 15 of this book). In the next section, we sketch the context and substance of this paper. Subsequent sections address some developments in the theory of electoral competition under uncertainty, paying particular attention to the extent to which electoral competition promotes information aggregation across individuals (section 3) and to the conditions under which commonly available kinds of political endorsements affect voter beliefs and behavior (section 4). A final section points to some open issues for future research.

2. Some Context and the Paper

When McKelvey and Ordeshook began working on their paper, there was precious little interaction between formal modelers and other political scientists who were interested in information and elections. On the empirical side, there existed a large literature documenting a considerable lack of information among voters (for instance, Berelson, Lazarsfeld, and McPhee, 1954; Almond and Verba, 1963; Converse, 1975). Conclusions from these studies tended to reflect variations on a theme. Relative to the sorts of elections one might expect under full information and universal participation, an uninformed electorate was presumed to induce low-powered incentives for voter turnout, to create inefficiencies in legislative decision-making, and to attenuate electoral control of political agents. Moreover, an asymmetrically informed electorate was characterized as promoting unequal turnout among more and less informed voters, as well as partisan bias and manipulability of policy choice. At the same time, there was a much smaller (formal) theoretical literature in political science that began to address related issues. For example, Downs (1957) suggested problems involved with the "rationally ignorant voter," while Stokes (1963) criticized the standard spatial model of the day for its informational assumptions. Later, the depth of theoretical inquiry increased. Early probabilistic voting models were being developed to reflect candidate uncertainties and, at about the same time as the McKelvey and Ordeshook paper, Ledyard (1984) developed a rational expectations model of turnout with incomplete information about voting costs.¹ Nevertheless, the conventional wisdom at the time (and still, for many audiences) was that, without a uniformly well-informed electorate, elections are poor instruments for democratic policy selection. McKelvey and Ordeshook's particular contribution in their paper was to suggest that such a pessimistic conclusion is premature.

¹See also Palfrey and Rosenthal (1985).

McKelvey and Ordeshook 1985 (McK&O = Chapter 15 of this book) was one of the very first papers in positive political theory to apply the concept of a rational expectations equilibrium from the economic theory of large markets to study a spatial model of electoral competition. The key feature of rational expectations equilibria is that although players in a game make decisions without full information about their consequences, in equilibrium everyone's expectations must prove correct; thus equilibrium actions must induce beliefs in observers that confirm their prior expectations. McK&O was also one of the first election-oriented formal theory articles to speak directly to the empirical literature referenced above. Indeed, they describe their paper "as an attempt to bring the informational assumptions of [formal] models more in line with what we know empirically" (1985:56. See Chapter 15 in this book, page 316).

In the McK&O model, two symmetric candidates compete by choosing policies in a one-dimensional policy space under plurality rule. Although candidates know that all voters have symmetric, single-peaked preferences over the policy space, they do not know and no individual voter knows the true distribution of these preferences. In addition to the candidates, there are two non-strategic interest groups with opposing and extreme policy preferences. Each group's sole role in the model is to endorse a candidate. Since all voters are assumed to know the endorsers' preferences, the endorsements reveal to all players the relative positions of the candidates' platforms (i.e., whose platform is to the left of the other's). The endorsements, however, do not reveal the candidates' exact platforms. This matters because not all voters observe the policy platforms directly. Instead, the electorate is partitioned into two subgroups, a set of *informed voters* who directly observe the candidates' platforms and a set of *uninformed voters* who do not observe the platforms. Instead, uninformed voters observe the endorsements and the results of a poll. Intuitively, we can think of the poll as reporting the distribution of votes that would occur if everyone voted as they say they would in answer to the question, "If the election were held today, for whom would you vote, given the endorsements?" In any equilibrium of voter strategies that is conditional on the candidates' platforms, the poll data must, in expectation, reflect the realized distribution of votes. Finally, McK&O assume that indifferent voters abstain and that every uninformed voter believes dogmatically that he or she is the only uninformed voter.

The equilibrium concept, a *rational expectations political equilibrium* (REPE), is a list of payoff-maximizing mutual best response strategies, one for each agent in the polity, such that the expected equilibrium distribution of votes justifies each agent's beliefs when choosing his or her strategy. Today, a theorist might use a

more commonly-known and more widely evaluated equilibrium concept, such as perfect Bayesian equilibrium (PBE) or a variant of the self-confirming equilibrium (SCE), to solve this kind of model. At the time McK&O were working on their problem, however, concepts such as SCE did not exist and concepts such as PBE were neither as well known nor as widely accepted as they are today. So it was quite reasonable (and enterprising) for them to develop their own concept — a concept that adapted elements of the rational expectations logic, itself quite popular in economics at the time, into the empirical context of mass elections with two candidates.

McK&O establish three main results regarding such equilibria. The first result is that, given any pair of candidate platforms, almost all voters vote as if fully informed about these platforms. This outcome occurs because voters use the polls and endorsements to infer how to vote. Those voting for the rightist candidate e , for example, reason from the poll data that “if *that* many voters are voting for candidate e , he can’t be *too* liberal” (1985:63. See Chapter 15 in this book, page 323). The second result exploits this logic to prove that, in any REPE, candidates converge on a common platform and there is a continuum of such equilibria. In any such equilibrium, the poll data splits the population in half and, consequently, no uninformed individual receives any information that suggests that a change of vote would be advisable, in which case neither candidate has any incentive to change his or her platform. A potential problem with this finding is that these sets of consistent beliefs can in principle arise at a great many policy positions. Mitigating such an inference is McK&O’s third main result, which shows that there exists a unique “informationally stable” REPE and it is such that both candidates converge on the true median of the distribution of all voters’ ideal points. Here, an REPE is said to be “informationally stable” if it is robust with respect to candidates making small decision errors with respect to voter beliefs. Intuitively, any deviation from the equilibrium induced by such errors is self-correcting.

As a heuristic for thinking about how REPE might be realized in the model, McK&O suggest a dynamic process under which the candidates first adopt platforms, the groups make their endorsements, and there follows an arbitrarily long sequence of polls asking the question, “For whom would you vote?” Voters are presumed to update their beliefs between polls and report honestly at each step. Once the polls converge (if they do) to a stable distribution, the candidates adjust their platforms and the procedure repeats until no candidate wishes to change his or her platform. Fixing the candidate platforms arbitrarily with the associated endorsements and focusing exclusively on the poll sequence, McK&O provide two ancillary results. First, they demonstrate that “*regardless* of the initial starting

behavior of the uninformed voters, this process converges to the full information voter equilibrium" (1985:73, below, p. 334). In other words, as long as some informed voters are in the population, the entire electorate eventually casts the same votes they would have cast if all were informed. Second, they show that the speed of convergence to the fully informed outcome depends on the extent to which pivotal voters are informed. In other words, if voters whose ideal points are close to the midpoint between the two candidates' platforms also tend to be informed, then the polls reveal more to uninformed voters. If, by contrast, such "pivotal voters" are uninformed, then the poll provides a less precise signal of how uninformed voters whose ideal points are near the midpoint should vote. These dynamics are worth emphasizing: the uninformed voters have no candidate-specific information beyond the endorsement and the poll, and the endorsement merely reveals which candidate is to the left of the other. So even in relatively extreme informational conditions, every person in the electorate eventually behaves as if fully informed.

Taking these results together, it follows that if we restrict attention to the stable REPE, none of the main inferences from the descriptive literature regarding electoral inefficiencies obtain! In the stable REPE, highly uninformed voters vote as if fully informed and highly uninformed candidates converge on the platform predicted when all agents are fully informed and everyone participates. Moreover, McK&O provide qualitative support for their thesis with experimental data.²

From a contemporary theoretical perspective, not everything about McK&O's model is compelling. The assumption that each uninformed voter assumes he or she is the *only* uninformed voter and thus treats poll data as reflecting the true distribution of realized ideal points is worrisome, especially so when McK&O offer the dynamic mechanism described above through which REPE might be achieved. Along the sequence, the polls can change quite dramatically, reflecting bandwagon voting behavior, and it is these changes that drive the convergence of beliefs. But an uninformed voter's observations in such sequences can be inconsistent with the rational expectations idea that he believes himself to be uniquely uninformed (i.e., a single vote should not lead to any observable change in the poll data over the sequence.) A second, and more subtle, analytical concern is with the assumptions that indifferent voters necessarily abstain and that voters vote sincerely. Abstention is admissible but voting is costless and there is uncertainty. Thus an instrumentally rational uninformed voter should condition his or her vote

²Ledyard (1984) proved a similar result using a rational expectations approach. However, his model rests on quite different informational assumptions. In particular, Ledyard assumed costly voting with the distribution of voter preferences and the candidates' platforms being common knowledge. The only source of uncertainty in his setup concerned the realized distribution of voting costs.

(or abstention) decision on the event that he or she is pivotal. Whether or not such behavior is consistent with the McK&O assumptions is unclear. Moreover, the introduction of costly voting makes the stability result less convincing; for instance, frictions due to voting costs might render multiple equilibria stable. And finally, McK&O presume the candidates are committed to implement the policy platform on which they are elected even though not everyone knows exactly what the platform might be. (But having said this, it should be noted that neither candidate has a policy preference so there is little reason for either to do otherwise.)

The McK&O paper explicitly addressed two issues and raised a variety of other interesting questions. The two explicitly considered topics concern the ability of the electoral process to aggregate privately held and asymmetric information within a large electorate, and the candidates' strategic choice of electoral platforms under uncertainty with a rational electorate. Less directly, McK&O also address questions regarding policy bias, information acquisition, the impact of endorsements on information aggregation, and the effect of candidate advertising. Their work and that of their contemporaries mark an important turning point in the effort to understand the role of information in political decision making. We now turn to some of the subsequent insights that this work helped to promote.

3. Developments in Understanding Electoral Competition under Uncertainty

In this section, we consider the progress made on the questions addressed in McK&O (1985), focusing especially on the ability of electoral competition to aggregate information and on strategic candidate behavior in the presence of informational limitations. As observed earlier, these questions have been the subject of discussion and speculation for a long time. With the exception of studies on various properties and implications of the Condorcet Jury Theorem, formal analysis of these issues is relatively recent.³

The first significant attempt following McK&O to address information aggregation questions in electoral competition is due to Ledyard (1989). Ledyard focuses on the consequences of asymmetrically informed candidates, rather than voters, and assumes that candidates acquire private information about the distribution of voter preferences by commissioning polls. In this setting, his findings are more sanguine than those of McK&O. Specifically, the zero-sum character of

³The Condorcet Jury Theorem is concerned with the problem of a committee choosing one of two given alternatives when individuals have common full information preferences but differ with respect to their beliefs about which alternative is most in their interests. Young (1988) provides an excellent account of the Jury Theorem. See also Ladha (1992) and Austen-Smith and Banks (1996).

two-candidate elections with plurality rule, coupled with the strategic advantage to a candidate of keeping any private information private, greatly mutes any candidate's incentive to collect information or to reveal what they have learned through their choice of electoral platform. Similar results were discovered independently by Harrington (1992). Banks (1990a) attacked this problem in a different way. Taking the classical Downsian model, Banks assumes that a candidate knows her *type* and that all voters do not. In his model, a candidate's type refers to the policy that she would implement if elected. Moreover, voters are fully rational and, in equilibrium, draw inferences about a candidate's type using her choice of electoral platform. In a (suitably refined) sequential equilibrium, Banks shows that as it becomes more costly for a candidate to misrepresent her true policy intentions during a campaign, the closer do candidate platforms and the final policy outcome converge to the full information median voter outcome in equilibrium. On the other hand, when such costs are not so severe, there is no assurance that the full information equivalent electoral outcome is realized, although all voters' beliefs in equilibrium satisfy a rational expectations property.

Unlike McK&O, in which there are both fully and only partially informed voters, neither the Ledyard nor the Banks model admits asymmetric information across the electorate. These models focus instead on candidate platform selection. In a paper on information aggregation and turnout in large elections, Feddersen and Pesendorfer (1996) reverse this focus, allowing for greater informational asymmetries across voters than McK&O but fixing candidate platforms exogenously. Their model assumes there are two given and distinct candidate platforms, A, B , and two possible states of the world, a, b . There is a finite number of voters, where the actual number is unknown to any individual. Each individual in the realized electorate is either a "partisan" for one or the other of the candidates, or an "independent." Partisans prefer a given candidate whatever the true state of the world whereas independents prefer candidate A in state a and prefer candidate B in state b . Initially, all members of the electorate know only their type (partisan for A , partisan for B , or independent) and have a common belief about both the size of the electorate and the likely true state of the world. Before voting, assumed costless as in McK&O, each voter privately observes a signal about the true state. With some probability, this signal reveals the true state to the voter. With the complementary probability, the signal conveys no new information to the voter. Everyone is assumed to understand the process by which information is distributed. Although voting is costless, Feddersen and Pesendorfer make no assumptions about individual voting behavior beyond those implicit in the presumption that voters are instrumentally rational and Bayesian.

Feddersen and Pesendorfer demonstrate two remarkable results. First, in any perfect Bayesian equilibrium in undominated strategies, there is positive but not full participation: in particular, costless voting does not imply all individuals with a strict preference (conditional on beliefs) necessarily vote, or that all indifferent individuals (conditional on beliefs) necessarily abstain. And second, despite such voting behavior and informational limitations, the probability that the electoral outcome is exactly the outcome arising when the electorate is fully informed and participation is 100% converges to one as the size of the electorate increases to infinity. In other words, Feddersen and Pesendorfer confirm the full information equivalent voting results reflected in McK&O's analysis. Moreover, they do this without any endorsements; poll data; or, in contrast to McK&O, ad hoc assumptions about voters' beliefs and, when indifferent, their voting behavior. The "trick" here is to observe that rational voters who do not use dominated strategies condition their decision on the event of being pivotal in the election and, in turn, this event implies a great deal about the distribution of information in the electorate at large.⁴ In particular, as the size of the electorate grows to infinity, the *proportion* of the population voting informatively on the basis of the counterfactual event of being pivotal becomes vanishingly small, but the absolute *number* of such voters is growing arbitrarily large. Feddersen and Pesendorfer prove that the latter tendency dominates the former, thus establishing full information equivalence.

In two subsequent contributions, Feddersen and Pesendorfer (1997, 1999) extend their analysis to the spatial model in which voters have single-peaked preferences and there is considerably more heterogeneity in both preferences and information than assumed in their first paper. These papers establish that the full information equivalent voting results for large electorates obtain for any supermajority rule shy of unanimity and, furthermore, that they are robust to variations in informational quality and to extreme correlations between partisan bias and informational asymmetries. On the other hand, it turns out that apparently "technical" assumptions on the coarseness of the signal space governing individuals' information (i.e., the extent to which available information about the true state of the world is vague/coarse or specific/fine) can be substantively consequential, and this is a topic that warrants deeper investigation.

Subsequently, other scholars have built on Feddersen and Pesendorfer by examining the information aggregation properties of majoritarian elections in richer

⁴To the best of our knowledge, the first recognition of the implications of conditioning behavior on being pivotal in the presence of incomplete information is due to Ordeshook and Palfrey (1988), who study committee voting over amendment agendas with incomplete information.

settings. Razin (2003), for example, explores a spatial model in which the winning candidate may change his or her policy platform after the election (that is, the post-election legislative policy and the policy promoted during the campaign might differ). In the model, voters do not abstain, are uncertain about the true state of the world, and have symmetric single-peaked preferences over a one-dimensional issue space. However, the Left (respectively, Right) candidate must choose from a moderate or a relatively extreme position to the left (respectively, to the right) of the median voter. In this model, Razin shows that uncertain voters weigh a signaling motive (to influence the candidates) against a pivot motive (to influence the post-election policy choice). When these incentives operate in opposing directions, it is possible for electoral outcomes to be different than would be the case if all voters were completely informed. Further limitations on the full information equivalence results have been established by Kim (2004) and Gul and Pesendorfer (2006). That such limitations arise in richer models should not be surprising; what is surprising is that, as McK&O clearly saw, there exist non-pathological settings for which the full information equivalence results obtain at all.

Despite the Ledyard (1989) and Banks (1990a) papers discussed above, far less progress has been made regarding how voter uncertainty affects candidates' strategies. Although there now exists a sizeable literature on probabilistic voting models in which candidates are uncertain about everything that affects voter decisions or about the true distribution of voter preferences itself, voters in this literature are not making decisions under incomplete information about which candidate is most in their interest.⁵ Prominent examples here include Coughlin and Nitzan (1981) and Banks and Duggan (2004), who show that, when candidates are unsure about the realized distribution of non-policy (but decision-relevant) attributes within the electorate, candidates' equilibrium platforms maximize expected utility aggregated across the electorate.⁶ Unfortunately, when there is a unique policy that maximizes aggregate utility, these models also predict zero expected turnout when voting is costly. Unlike in Ledyard (1989), Banks (1990a), and Razin (2003), therefore, the candidates' decision calculus in these models need not internalize strategic responses by voters who might learn about other decision-relevant parameters from the candidates' choices. An exception here is Gul and Pesendorfer (2006), who consider a spatial competition model that is

⁵Coughlin (1992) provides an excellent survey and synthesis of the probabilistic voting literature to that date. See also Calvert (1986).

⁶Ledyard (1984) establishes a similar result without probabilistic voting in a model in which the only source of uncertainty is the distribution of voting costs.

similar to Razin's, allowing for voter ignorance about candidate platforms and the distribution of other voters' preferences. As with Razin, they find conditions under which the electoral outcome is different than would have occurred if all voters were completely informed. In particular, the median voter's ideal point may not be an equilibrium policy outcome. Moreover, these failures are more acute when candidates care more about winning than about policy.

In addition to the two central concerns in McK&O (1985), information aggregation and strategic candidate policy choice, the paper raised several related issues about whether an electorate containing uninformed voters can produce the same electoral outcome as when all voters have complete information. Subsequent work has addressed this issue in different ways. For instance, Harrington (1993) considers the signaling role of candidate platform choice when candidates know more than voters about the policy consequences of their platform choices. Harrington proves that competition constrains, but does not eliminate, politicians' abilities to use their knowledge advantages to manipulate electorates for self-serving purposes. In particular, as signaling costs rise, electoral outcomes converge to those that would be realized under complete information.⁷ Martinelli (2003), in turn, extends the standard Downsian framework to voter uncertainty about candidate platforms. He assumes that voting is costless but that individual information acquisition is costly. He proves that even though most voters do not become informed as the electorate grows, full information and full participation equivalence results remain for large elections. And while McK&O observed bandwagon-like behavior between successive polling results in the dynamic version of their model, Fey (2001) and Callander (2003) use dynamic, sequential voting models with fully rational and incompletely informed individuals to develop richer equilibrium theories of bandwagon voting. Callander, in particular, identifies conditions under which an equilibrium bandwagon can lead to the full information equivalent outcome in large elections.

McK&O also raise questions about how to conceptualize voter reasoning in an election model. Much of their attempt to advance the debate is contained within the structure of the model (in particular, the inclusion of polls and endorsements) and in the development of the REPE concept. While the perfect Bayesian equilibrium concept used by much of the post-McK&O literature on electoral competition under incomplete information also implies a rational expectations property

⁷See also Piketty (2000), who, like Razin (2003), considers the signaling role of voting on candidate behavior in elections with incomplete information.

on agents' beliefs, tracking differences between these concepts reveals subsequent trends in how theorists model voter reasoning.

Save for the assumption that uninformed voters believe themselves to be uniquely uninformed, voters in McK&O are rational to the extent that they make appropriate inferences about how best to vote. They do not, however, condition their voting decision on being pivotal. Moreover, to insure that individuals do vote when they have a strict preference, despite each individual being an infinitesimally small proportion of the electorate in the limit, McK&O assume voters receive an arbitrarily small consumption benefit from voting for their most preferred candidate. In effect, voters recognize that they have negligible weight in the election and seek to choose rationally on this basis (there is no cost to voting). Perhaps the closest model to McK&O in this respect is due to Myerson and Weber (1993), who consider large electorates with multiple candidates and strategic, rather than substantive, uncertainty among voters under a variety of vote counting rules. The focal uncertainty for voters in Myerson and Weber regards the decisions of other voters rather than the policy positions of the candidates. M&W's analysis hinges on a rational expectations equilibrium in voter behavior consistent with the motivation underlying McK&O. Individuals do not explicitly condition on the event of being pivotal, but use polls as in McK&O, adjusting beliefs so that, in equilibrium, all voters are choosing best decisions relative to their beliefs, and the expected and the realized aggregate vote distributions are mutually consistent. In other words, both McK&O and Myerson and Weber build models of voter behavior in large electorates that mirror the price-taking models of individual choice behavior in large economic markets. More recently, Myerson (1998, 2000, 2002) has introduced a theory of large Poisson games to allow for very rich informational environments, including uncertainty about the electorate's size, policy preference uncertainties, voting cost uncertainties, and so forth. The theory of large Poisson games is an innovation on par with McK&O's and Ledyard's (1984) introduction of rational expectations ideas to the theory of elections with imperfect and incomplete information.

4. Developments in Understanding Endorsement Credibility

The role of the endorsers in McK&O is essentially technical: they are non-strategic and their endorsements insure that all voters know the relative spatial locations of the two candidates. Without this knowledge, *prima facie* absurd equilibria could arise in which, say, all uninformed voters who would surely prefer the leftmost candidate surely vote for the rightmost candidate, and conversely. But

as suggested by Grossman and Helpmann (1999) among others, endorsers have substantive interests in the outcome of the election and cannot be expected to reveal all of their private information regardless of the circumstance. Endorsements are instances of strategic information transmission from possibly self-interested agents. This fact raises important questions about the credibility and influence of those offering endorsements and has led theorists to examine the role of endorsements when endorsers are more strategic than those of McK&O.

The focal theoretical insight on what an endorser will do in this situation comes from Crawford and Sobel (1982).⁸ Their model features a sender and a receiver. The receiver's job is to make a choice, and we can think of this player as somewhat analogous to a voter in McK&O. Before the receiver chooses, a sender sends a message to the receiver about the consequences of her choice. In the electoral context, the message can be interpreted as an endorsement, although the quality of this endorsement is endogenously determined rather than fixed as presumed in McK&O. Unlike the receiver, the sender knows the consequences of the receiver's actions.

Crawford and Sobel (1982:1431) find that "equilibrium signaling is more informative when agents' preferences are more similar." The intuition underlying the results is as follows: if outcomes that are good for the receiver also benefit the sender, then the sender has an incentive to reveal what he knows and the receiver should follow the endorsement (see also Calvert 1986; Farrell and Gibbons 1989). By contrast, if what is good for a sender is bad for a receiver, and vice versa, then the receiver rationally places little weight on the sender's endorsement and the sender similarly has little incentive to offer any useful information. This result calls into question the extent to which McK&O's results are robust to cases where the endorsement comes from a goal-oriented actor rather than the truth-telling endorsement device of the initial model. It leads us to ask about what and how much a receiver must know about a sender to treat the endorsement as credible. Several lines of research in political science address this question and the literature is large and growing (see Banks 1990b for a relatively early survey). Here, we focus on two of many game-theoretic efforts to show how variations in player and institutional attributes affect whether or not endorsements are credible, thus promoting more informed choices.

Austen-Smith (1994) extends Crawford and Sobel's model to a case where the sender is not automatically endowed with superior knowledge about what choice

⁸In an unpublished working paper, Green and Stokey (1980) independently established related results in a very different model.

is good for the receiver. Instead, prior to playing the Crawford-Sobel game, the sender can purchase such information. Only the sender knows the price of becoming informed. If he chooses to become informed, he can demonstrate as much to the receiver, but he has no way to document his lack of information when he is uninformed. The paper's main result is that such uncertainty about the sender's knowledge actually expands the set of circumstances in which the receiver can use the endorsement to make the same choice she would have made if fully informed. The intuition underlying this counterintuitive result is that receiver uncertainty about the sender's knowledge and the sender's cost of becoming informed can induce the receiver to be uncertain as to whether certain messages are being sent by an informed or uninformed sender. Such uncertainty, in turn, can induce the receiver to treat seriously some messages that would otherwise be dismissed as wholly unreliable. This paper thus demonstrates how the credibility of endorsements depends on receiver knowledge of speaker attributes as well as contextual variables such as the cost of being informed.

Lupia and McCubbins (1998) expand on Crawford and Sobel's template in a different way. Like McKelvey and Ordeshook, they base their inferences on models and experiments. In each endeavor, the sender's expertise (i.e., whether he knows more than the voter), the sender's interests (i.e., whether he prefers the same outcomes as the receiver), and the receiver's knowledge of these and other factors are parameterized and independently determined. Varying these factors one at a time or in multiples, Lupia and McCubbins demonstrate conditions under which the endorsement is credible. A preliminary result (shown theoretically and in experiments) is that the receiver's *perceptions* of key sender attributes trump the sender's actual attributes in determining whether the receiver will base her choice on the endorsement. Later, they further introduce institutional forces such as observable costly effort (a cost for making any statement, following Spence 1974 and Lupia 1992) and threats of verification. They clarify how such forces affect what senders say and what receivers believe. Their main result shows that even if voters are relatively ignorant about an endorser's knowledge and interests, there exist institutional settings under which endorsements remain effective in promoting relatively informed voter decisions.

Collectively, such work clarifies the conditions under which the endorsements of strategic agents can nevertheless induce voters to vote as they would under full information. This theoretical work is increasingly complemented by empirical work that yields comparable results, particularly in developed countries (see, e.g., Lupia 1994; Bowler and Donovan 1998; Sekhon 2005). That such conditions

exist in a general set of circumstances, and appear in real elections, is a testament to the applicability of McKelvey and Ordeshook's original claim. So while endorsements are not a universal remedy for voter ignorance, theorists and empirical scholars in political science have made considerable progress in clarifying the conditions under which they are sufficient for "informed voting."

5. What Has Been Learned and What Is to Be Done?

As suggested by the preceding brief survey of the literature, since McK&O's seminal contribution a good deal has been learned about information aggregation in large two-candidate elections with fixed candidate platforms, the relative values of which are uncertain to voters. We have also learned about the signaling role of policy choice and about voting equilibria in elections with strategic uncertainty and we have engaged in deeper inquiries about strategic endorsements, communication in campaigns, costly information acquisition, and the dynamics of sequential voting (bandwagons). On the other hand, there has been no major advance on McK&O in regard to strategic platform choice (or strategic obfuscation thereof) in the spatial model (although Gul and Pesendorfer 2006 is promising), and we are unaware of any general model of information dynamics in elections with more than two candidates (although Kedar 2005 provides a platform focusing on important aspects of electoral institutions from which such a theory can be built). Similarly, there is still no generally intuitive and analytically tractable model of strategic voting in large elections (although Myerson's theory of Poisson games is an attempt at such).

The gaps in our understanding of the role of information in large elections, and in the tools available for improving that understanding, suggest the main open research problems on the topic. Rather than offer personal (and doubtless idiosyncratic) lists of problems here, we want to highlight three that we think both pressing and promising topics for study.

The first problem concerns integrating a general strategic theory of candidate behavior with a similar theory of voter choice under incomplete information. One benefit of pursuing such a theory will be a better understanding of how electoral institutions influence policy outcomes. This benefit will arise because candidates have an incentive to think about voter responses when selecting policy platforms and while legislative policy outcomes rarely correspond exactly to winning candidates' platforms they are nevertheless affected by the policy goals that candidates for office espouse. In this regard, it is worth noting that relatively few elections

around the world involve only two candidates. However, the properties of information aggregation in multicandidate elections, even with fixed (uncertain) candidate platforms, are as yet quite opaque to social science. Since a general theory of strategic candidate behavior includes a theory of the number of candidates who run for office, clarifying the information aggregation properties of multicandidate elections can provide a wide range of interesting inferences.

The second problem is closely related and involves how best to model incomplete information among voters. There are many ways in which voters' lack of information might be modeled. In any given model, it is not always transparent exactly which particular informational assumptions are generating the focal conclusion. McK&O, for example, assume that voters know the location of their ideal point relative to the population at large and, as discussed in some detail above, that each voter believes that all others are fully informed and rational. These are relatively restrictive assumptions. It is reasonable to ask whether McK&O's formal conclusions are robust, for instance, to settings in which voters have mistaken or varying beliefs about each other. Analogous questions can be asked about many other election theories.

In formal models, such questions have long been difficult to explore. A common practice is to assume that even incompletely informed players share with all other players (whether informed or not) correct and common prior beliefs about the true state of the world or about the type of a focal player. Indeed, the equilibrium concepts used to solve most existing models of incomplete information presume that all players share such beliefs — at least along the equilibrium path. In many political contexts, however, we know that players can have wildly different beliefs about important phenomena. Liberals and conservatives, for example, hold different beliefs about the social ramifications of topics such as gay marriage, abortion, and religious education. Similarly, before, during, and after the O. J. Simpson murder trial, blacks and whites in the United States had very different beliefs about Mr. Simpson's guilt. In some situations, it is possible that people are so polarized in their background assumptions that any presumption of complete and common priors is *prima facie* implausible.

One approach that game theorists are now exploring with increasing frequency is to study games where players do not assume that all other players are utility-maximizing (McKelvey and Palfrey 1992, 1995) or where players have distinct prior beliefs (see, e.g., Piketty 1995). An important and emerging line of theorizing goes further, relaxing the assumption that players' prior beliefs are complete. In the self-confirming equilibrium concept, for example, players need

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