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Epistemic democracy in classical Athens:
Sophistication, diversity, and innovation.

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Abstract: Analysis of democracy in Athens as an “epistemic” (knowledge-based) form of political and social organization. Adapted from Ober, *Democracy and Knowledge*, chapters 1-4. Jon Elster (ed.), volume on “Collective Wisdom” (to be published in English and French).

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Epistemic democracy in classical Athens: Sophistication, diversity, and innovation.

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1. Introduction: A successful epistemic democracy

A democracy may be said to be “epistemic” to the degree to which it employs collective wisdom to make policy.¹ Scott Page (this volume) offers a formal model of collective wisdom, in the sense of accurately predicting or characterizing an outcome, that is produced by two factors: the individual sophistication of participants and the diversity of their perspectives. The city-state of Athens, from the late sixth through the late fourth century B.C. is a case study of a participatory epistemic democracy: an intensively-studied historical example of a community whose remarkable success can, at least in part, be explained by Page’s two factors of sophistication and diversity.

Democratic Athens depended directly and self-consciously on actively deploying the epistemic resources of its citizenry to hold its place in a highly competitive multi-state environment. While the Athenian case cannot, in and of itself, prove the general validity of Page’s model, it may offer some insight into how, in the real world, increased sophistication and sustained diversity of participants produces positive results over time. To be successful, real world epistemic democracies (like other governments) must indeed accurately predict and characterize outcomes. But they must also (inter alia) create institutions for setting agendas and implementing policy. The Athenian case suggests that that, along with outcome prediction and characterization, an enhanced capacity for institutional innovation in the face of environmental change is a central feature of epistemic democracies. The capacity for institutional innovation is promoted by growing sophistication and sustained diversity of participants, while sophistication and diversity are, in turn, promoted by well-designed institutions.

In Athens, collective wisdom produced useful knowledge – a matrix of experience, expertise, and information that in turn reliably (if not invariably) yielded good (if imperfect) solutions to complex problems. Knowledge that is useful to collectivities like Athens is possessed by individuals, but it is also located in social networks, and reproduced by institutionalized processes.² Athens outperformed its city-state rivals at least in part because of its citizens’ superior capacity to produce new solutions to the ever-changing menu of challenges confronted by the Greek city-states. Athens beat its rivals by more effectively aggregating, aligning, and codifying the vast store of social and technical knowledge distributed across its large, diverse, and increasingly sophisticated population.³

Based on a variety of statistical measures of comparative city-state performance across the classical era (ca. 500-325 B.C.), Athens was preeminent among the 1000+ Greek city-states. Moreover, Athenian state capacity (measured as a composite of

military activity, public building, and domestic programs) was strongly and positively correlated with the development of Athenian democracy (measured as a composite of the percentage of adult males holding full participation rights, the power of the demos to effect policy, and the authority of law). Athenian state capacity was considerably lower both before and after the democratic era.⁴

With the exception of two brief oligarchic interludes, arising at least in part from the democracy's epistemic failures (411/10 and 404 B.C.), classical Athens was governed directly "by the people" – participation was widespread across a relatively large (ca. 30,000 adult native males) citizen body. Levels of active participation became more egalitarian over time: higher percentages of poorer and non-urban citizens took part in state governance in the fourth century B.C. than in the fifth. Participation promoted social learning (mastery of institutions and political culture) across a citizenship that was socially diverse in terms of wealth, geography, and occupation (if not in religion, ethnicity, or gender). Yet Athens avoided the ossification and institutional stagnation that can accompany deep social learning. The democracy learned from its epistemic failures; new institutions were designed and implemented in the aftermath of the late fifth-century crises. Athens' rate of institutional innovation remained high throughout the democratic era, as attested by ancient opinion and the historical record.⁵

The conjunction of a highly participatory democracy with outstanding competitive success is surprising, in light of claims by social and organizational theorists (e.g. R. Michels 1962 [1911] and O. Williamson 1975, 1985) that no truly participatory democratic organization can survive in a competitive environment. Athenian success cannot be explained by denying the reality of democracy through positing the existence of a cryptic ruling elite. Individual orators and generals certainly played important leadership roles – Pericles provides a paradigm case, although he was hardly unique. Leaders were drawn from elites of education and wealth, but individual elites gained and kept precarious leadership positions based on their proven ability to secure public goods; there was no entrenched "elite ruling class." Athens' distributed authority structure and lack of formal patronage structures denied organized groups of elites the usual mechanisms of political domination. It was the reality of the demos' control of public affairs that drew the critical attention of Greek political theorists. Democratic ideology, promoted by public discourse, and the emergence of a vibrant culture of political dissent (subjects of my earlier work on Athens) were essential to the system's functioning, but these factors, in and of themselves, are inadequate to explain why or how Athens did so well in such an intensely competitive environment.⁶

Aristotle points to an epistemic explanation for "unexpected" democratic success in an important passage in the *Politics*, in which he discusses conditions under which the "wisdom of the many" may outdo individual expertise. His point is that a "multitude [*plêthos*] is like a single person, yet many-footed and many-handed and possessing many sense-capacities [*aisthêseis*]." With its diverse perspectives, such a multitude may, under the right conditions, judge better than any individual: "for some judge a particular aspect [*of the matter*], while all of them judge the whole."⁷ But if we are to understand the basis of Athens' success, we need to go beyond Aristotle's compressed account of collective wisdom, to focus on how institutional design promoted the aggregation of the useful knowledge possessed by many diverse individuals, the alignment of people's effort based

on their common knowledge, and the codification of rules that expanded access to institutions and increased the reliability and procedural fairness of legal judgments.⁸

This chapter focuses on the aggregation of knowledge, which is distinct from the aggregation of preferences, interests, opinions, or data. Knowledge aggregation, in the sense in which I am using it here, means bringing together, in a single “solution space,” a diverse array of useful information and expertise. Suppose, for example, that a state confronts an enemy attack by sea. Organizing an appropriate defense requires mobilizing expertise and accurate information in the domains of (*inter alia*) military strategy, ship-building, public finance, and manpower availability. The totality of the relevant knowledge necessary to address a complex problem (e.g. naval defense policy) is unlikely to be possessed by any one individual. Of course, only certain kinds of social and technical knowledge will be useful for solving a given problem. Much of the knowledge possessed by residents of the state is strictly irrelevant to naval defense; Plato’s Socrates (*Protagoras* 319b-c) claims that when the subject before the citizen Assembly was ship building, the “wise Athenians” refused to listen to anyone lacking expertise in naval architecture.

No two problems faced by a state will be exactly alike (next year, the big problem may be a flood), and so there is a constant demand for innovative solutions: last year’s armada is not the answer if this year we need to rebuild levies. Yet each problem is likely to present certain features that are relevantly similar to the features of other problems (some of the manpower and finance issues will cross over from naval defense to flood relief), and so there is a constant demand for social learning and the cross-appropriation of expertise between domains (Spinosa, Flores, and Dreyfus 1997).

If the premises laid out in the previous paragraphs are correct, then (1) A better solution will emerge if (a) the specialized knowledge possessed by multiple sophisticated individuals is brought into the solution space, (b) irrelevant information and expertise is excluded from that space, and (c) each relevant knowledge input is given its appropriate weight in the final policy. (2) No fixed and limited set of experts will possess the range of knowledge necessary for addressing the multiplicity of problems that will confront a state (or other organizations) over time. (3) Adapting the aggregated knowledge relevant in one solution space to different but relevantly similar problems in another space will speed the process of innovating new solutions. Yet in order for these results to be achieved, certain conditions must pertain (section 2).

This chapter argues that the constitutional reform that inaugurated democracy at Athens (in or shortly after 508/7 B.C.) incorporated (consciously or not) design features that promoted individual sophistication and the aggregation of diverse perspectives (section 3). It focuses on two institutions that were key parts of the new regime: the Council of 500 (sections 4 and 5) and ostracism (section 6). Ostracism may be understood as a non-deliberative “preclusive prediction market,” designed to aggregate equally-weighted guesses by many citizens about “worst case” possible futures. The institution of ostracism created a mechanism whereby a plurality of guesses could preclude a possible future that was regarded by most Athenians, at a given moment, as particularly dangerous. The deliberative Council of 500 played a prominent role in agenda-setting, day-to-day administration, policy implementation, and certain legal matters. The Council employed techniques of lottery, rotation, and representative sampling to bring together groups of geographically and socially diverse decision-makers

– persons with very different life experiences and knowledge-sets. The experience of service on the Council tended to increase the political sophistication of individual citizens: they became more expert in the conduct of public affairs. The institutional rules by which the Council was selected and governed gave each individual Councilor good reasons (in the form of strong social incentives) to share his knowledge with his fellows, and to attend in turn to what they knew, when deliberating in advance of making highly consequential public decisions. The non-deliberative institution of ostracism had an effective life of less than 70 years, whereas the Council persisted throughout the democratic era and beyond. Comparing the histories of these two linchpin institutions demonstrates the Athenian democracy's capacity for institutional innovation, and clarifies the role of innovation in Athens' emergence as the preeminent Greek polis of the classical era (section 7).

2. Conditions for knowledge aggregation

Knowledge aggregation is grounded in joint action (Bratman 1999) and complicated by political scale and social diversity. The information relevant to a given outcome, along with the social and technical knowledge necessary for processing it, is lodged in the minds of a great many individuals from many walks of life (Hayek 1945). Collecting knowledge in a large (beyond face-to-face) participatory democracy demands communication among people who are, at least in the first instance, strangers to one another. Communication among strangers requires overcoming a basic collective action problem (Olson 1965): Why should a rational individual freely communicate potentially valuable information to a someone who might prove to be free rider? If the problem of knowledge aggregation is to be solved, individuals possessing potentially useful information must have some reason for sharing it. Moreover they must have access to appropriate communications technology -- a low-cost means for bringing forward what they know and making it available to the community. The community, for its part must employ a sorting method, a means of discriminating between information that is more and less useful in any given decision-making context.

Because knowledge has exchange value it can profitably be hoarded under conditions of scarcity. Unique information and technical expertise may, for example, take the form of proprietary trade secrets that are valuable only so long as those in the know are few (e.g. the secret formula for Coca Cola). Ancient examples of proprietary knowledge might include sources of raw materials, trading partners, weather patterns, craft techniques, even military formations and tactics (in the fourth century B.C., there was a ready "international market" for Greek mercenary soldiers and generals). In other cases, for example open source computer software – or, in antiquity, improved rowing techniques for propelling many-oared warships, information gains in value when it is widely known and used. In either case, if a productive epistemic equilibrium is to be achieved, incentives for communicating useful information must somehow correspond to the value of what is shared.⁹

Incentives need not be material. An implied contract between the knowing agent and those who desire access to her knowledge may be built into the common culture. Information sharing may be promoted by established relationships of reciprocity in an "economy of esteem" (Brennan and Pettit 2004). In a competitive culture, like that of ancient Greece, in which the publicly expressed esteem of others was an important part of

individual utility, some incentives for knowledge communication could be cast in the form of public honors for winning victories in state-sponsored “knowledge aggregation contests” – that is, competitions that could only be won by those willing to share what they know and capable of persuading others to do likewise. The general point is that public incentives for knowledge sharing must be valuable because knowledge is recognized as having value to individuals and groups, as well as to the community as a whole. The first principle of institutional design for an organization attempting to solve epistemic collective action problems should be providing incentives to knowledgeable individuals such that they will choose to share what they know.¹⁰

Next, the communication technology – the means available to agents for communicating useful knowledge -- should be as nearly costless (i.e. easy to use and ready to hand) as possible because the greater the costs associated with the act of communicating, the higher the incentives must be for doing so. Reducing the cost of public communications means lowering the cost to individuals of communicating what they know by compensating them for the burdens they incur in moving information to the point in an organization at which it will do some good.

Finally, there must be an epistemic sorting device, a means for distinguishing not only truth from falsity, but what sorts of expertise and what information may (in any given context) actually prove useful. If those involved in decision-making are incapable of weeding out false or irrelevant information and disregarding inappropriate expert knowledge, they will be unable to produce good policy. The sorting mechanisms must be context sensitive: Some technical knowledge that is of great value to a national assembly deliberating on matters of foreign policy will be useless to a village assembly discussing lease arrangements for communally-owned land. In the participatory Athenian context, social knowledge served as a sorting device. Experienced citizens learned habits of discrimination, of recognizing who to attend to and whose opinion to trust in what context. Sections 4 and 5, below, seek to specify how.

The conjoined imperatives of incentives, low communication costs, and sorting mean that designing an aggregation process is inherently difficult. The difficulty increases with the complexity of what must be decided, the volume and diversity of the information necessary for decision-making, and the multiplication of kinds of expert knowledge that must be brought to bear. Knowledge collection becomes more complicated as organizations grown larger and more diverse. Yet the costs to an organization of *failing* to collect and attend to the right kind of information before making major policy choices can be extraordinarily high, as the Athenians were reminded, for example, in the course of the catastrophic Sicilian expedition (415-413 B.C.) – a series of events that, if we are to trust the account of Thucydides (book 6; with Ober 1998, 104-20), resulted in large part from an epistemic failure, and certainly helped contributed substantially to the crisis of the late fifth century.

One solution to the problem of collecting knowledge is routinization, capturing the organization’s past experience by archiving data, establishing standard protocols, and socializing members into “the ways we do things around here.” Routinization can build expertise and thereby make work processes more efficient, and thus more productive. Yet, over-socialization in established routines becomes counterproductive when circumstances change. Making effective use of archived data is difficult and an over-emphasis on routines can lead to process ossification and a decline of productive

capacity. In order for an organization to remain competitive in the long run and under new conditions, it must be able to innovate: must break with established routines and draw upon information sources outside the standard banks of data. Innovation depends on tapping latent knowledge held by people who have not been fully socialized into routine patterns of behavior. This in turn means that organizations in competitive and fast-changing environments will pay a heavy price if they fail to maintain a diversity of experience, expertise, and social knowledge among their membership.¹¹

Athenian democratic institutions and practices, when viewed in their social context, can be understood as a kind of machine (cf. Elster, this volume) whose design facilitated aggregating useful knowledge and produced benefits of routinization while maintaining a capacity for innovation. The machine of Athenian government was fueled by incentives, oiled by low communication costs and efficient means of information transfer, and regulated by formal and informal sanctions. The machine served to build, over time, special kinds of social knowledge among a large segment of the Athenian population: an increased capacity to discriminate among sources of expertise and information, and to cross-appropriate relevant knowledge from one domain of application (e.g. a deliberative council) to another (e.g. a court of law). Those heightened capacities may be understood as a sort of political sophistication or expertise, an expertise in the operations of self-government.

This chapter argues that the Athenian machine performed better over time for the reasons specified in Page's formal model: More citizens became more sophisticated while preserving diversity of perspectives; growth in sophistication did not entail homogenization of perspectives. As a result, learning and innovation were simultaneously supported, and Athens thrived, over time, in its competitive environment. In order to understand how the machine came into existence, we need to attend to the origins of Athenian democracy in the late sixth century B.C.: the constitutional reforms associated with Cleisthenes that were enacted, by the Athenian demos, in the aftermath of the Athenian Revolution.

3. Cleisthenes' reforms: Demes and tribes as social networks

Consider a typical village (deme) of Athens, near the end the sixth century B.C., just before the Athenian Revolution of 508 and the institution of the democratic political order.¹² Prasiai was a settlement on the east-central coast of Attica. Farming, supplemented with some fishing and local trade, formed the economic base. Along with some slaves and perhaps a few resident aliens, the total free population of Prasiais was probably in the range of 700 persons. Of these, perhaps 180-200 were adult native males – citizens of Athens who had enjoyed limited privileges in regard to participation and certain legal immunities since the reforms of Solon in 594 B.C.¹³

After the democratic revolution of 508 the adult male Athenian residents of Prasiai, as in the other villages and urban neighborhoods of Athens, were full citizens with extensive participation rights in the central institutions of polis government. They had the opportunity to meet periodically in a local village assembly in order to vote on admitting new citizens and to decide on various matters of local concern. By the late sixth century, many of the families of the village had lived there for generations. A century and a half later, by the middle of the fourth century, a number of Prasiais had moved away, to the city or elsewhere in Athenian territory. Yet by Athenian constitutional law they

maintained membership in their ancestral deme and many of them still attended deme meetings.¹⁴

As a result of their long history of steady interaction -- social, economic, and religious if not yet extensively political -- the men of late sixth-century Prasiai knew a lot about each other: By comparative reference to other small and relatively egalitarian pre-modern rural communities, we can assume that many of the ties between adult male citizens of Prasiai were *strong*, in the sense that the term is used by modern theorists of social networks. That is to say, the local social network by which the Prasiaeis were connected to one another was based on regular face-to-face interaction and featured a good deal of overlap and redundancy. In a strong-tie network, an individual's friends are also one another's friends.

As a result of this *strong-tie* linked network of social relationships, the level of mutual social knowledge in Prasiai was high: People for the most part knew, for example, who was technically skilled in various domains, who could be counted upon and in what circumstances, whose advice was valuable on what topics. Social norms of reciprocity and propriety were clear and dictated who shared what sort of information with which others and under what circumstances. Since network ties were strong both in the ordinary sense of the word (i.e. dependable), and in the network-theory sense that a person's friends were friends with one another, social norms were correspondingly strong. Commitments made in this context were credible because people knew a lot about each other's business and when necessary free-riders were sanctioned. The environment was "safe" in that cooperation was socially mandatory and defection was difficult. The key thing, from the point of view of organizational performance, is that small-scale networks based primarily on strong ties are very good at distributing information internally, but they are poor conduits for importing or disseminating useful knowledge *outside the local network itself*. As a result of their inherently small scale and lack of diversity, closed strong-tie networks tend to be relatively unproductive. The problem is a lack of weak "bridging ties." A weak tie is defined as a friendship (which may be close: weak ties need not be superficial relationships) between two individuals whose friends are not one another's friends.

In a classic article the sociologist Mark Granovetter (1973) demonstrated that small-scale networks based on strong ties between individuals promote intensive interaction but do not allow for extensive "bridging" from one network to another. In the limit case, in which each of my friends is also each other's friend, there may be no space for bridging at all -- every new tie I form must necessarily be a tie shared by all of my existing friends. Thus there, consequently, no feasible way for me to bridge to another strong-tie network of persons. Strong-tie networks tend to operate as small and closed cliques. Lacking bridges to other networks, these cliques are resistant to the free flow of information outside the local network. Cliques render large-scale cooperation more difficult and impede coordination across an extended social network. As a result, it is harder to aggregate knowledge or align action at larger scales. The gains potentially reaped from extensive cooperation remain limited -- and the problem of scale looms as unsolvable.¹⁵

If we imagine late sixth-century Prasiai as characterized primarily by strong ties (either as a single strong-tie network or as a collection of such networks), the residents of Prasiai would have had relatively few bridging ties outside their local community;

relatively few men from Prasai (and fewer women) would have had reason to make connections with men from other towns or neighborhoods in Attica. Of course the hypothetical limit case in which *everyone's* friends were one another's friends is unlikely ever to have existed in practice. But to the extent that strong-tie networks were a general social norm in the many villages scattered across Athenian territory, overall Athenian capacity for effective joint action was likewise limited. Relatively low Athenian state capacity in the areas of military, building, and domestic policy in the pre-democratic period is consistent with the hypothesis that sixth-century Prasiai (and other Athenian villages and neighborhoods) were characterized, in the first instance, by strong-tie networks.¹⁶

It seems very likely that, with a degree of local variation, this hypothetical "Prasai situation" was replicated many times over in the predemocratic era, and throughout much of the territory of Athens. It certainly cannot be true that all sixth-century Athenians were living out their lives entirely within local strong-tie networks; we know, for example, that some Athenians were involved in regional and overseas trade so we can assume the existence of some weak ties. But it seems safe to say that something like the Prasiai model sketched out above was the seventh- and sixth-century Athenian norm – just as it was the norm throughout most of Greece. That social norm was the central problem faced by Cleisthenes in the months after the Athenian Revolution of 508 B.C.

At the moment of the revolution, the people of Athens demonstrated a capacity for at least short-term collective action at a moment of extreme national danger: Confronted by the double specter of foreign domination and a return to the pre-tyrannical oligarchic rule of a handful of "big men," many of the ordinary people of Athens gathered in the city and forced the surrender of a Spartan-led army after a three day siege of the Acropolis. They recalled Cleisthenes, who had been exiled by the would-be oligarchic rulers of the city after having "taken the people as his comrades" and proposing popular institutional changes. Back in Athens and with expectations running high, Cleisthenes took on the task of rapidly creating a new government. Whatever else it accomplished, Cleisthenes' new order had to be able to put a large and highly motivated military force into the field – and had to do so very quickly. This was no mean feat, given that in all probability Athens had never had an organized "national army." Earlier Athenian military actions had depended on *ad hoc* cooperation among the relevant local big men, but after the revolution, their authority was thrown into doubt.¹⁷

Cleisthenes' comrade-constituents, the demos that had recalled him from exile, expected a system of government suited to their newly-expressed identity as participating members of a political community. Oligarchy and tyranny, the familiar modes of archaic Greek political organization, had been discredited by the events leading up to the uprising. Although other Greek poleis experienced political upheavals in the sixth century and there was much experimentation with institutional forms (Robinson 1997), there was no "off the shelf" organizational model for Cleisthenes to follow. The "Prasai situation," the cliquish strong-tie local networks that characterized ordinary Athenian social life rendered it difficult to achieve the large-scale joint action necessary to defeat the expected Spartan attack – and then to sustain a flourishing community so that Athens' great potential (relative to its rivals) in terms of human and natural resources would be realized in fact.

If “Prasiai” was the problem, the revolutionary uprising itself pointed to the solution. Cleisthenes had been recalled to Athens after the demos had demonstrated its potential for large-scale joint action in the three-day siege of the Acropolis. Athenians clearly now thought of themselves as sharing an Athenian identity, which could potentially come to mean belonging to an extended network that included the entire polis. The design opportunity for Cleisthenes was building on a capacity revealed in a moment of crisis and based on a shared Athenian identity. The challenge was creating institutional conditions for a productive equilibrium that would enable the Athenians to reap the individual and collective benefits of social cooperation. Although Cleisthenes lacked the theoretical apparatus of modern social science, the solution he devised makes sense when it is described in terms of social network theory. Cleisthenes created institutions that employed the principles of incentives for knowledge-sharing, lowering communication costs, and context-sensitive information sorting. A key to the new system (although probably an unintended consequence of institutional design) was the emergence of many bridging weak ties between members of local strong-tie networks.

Granovetter (1973) showed that by contrast to strong ties, weak ties (i.e. the case in which my friends are unlikely to be friends with one another) *do* promote bridging across extended networks. Weak ties break down the claustrophobic environment of cliques by efficiently transferring information across an extended network. Weak ties are therefore an essential complement to strong-tie networks for social mobilization and for overall organizational cohesion. Granovetter’s key conclusion (1973:1376): was that “the more local bridges ... in a community and the greater their degree, the more cohesive the community and the more capable of acting in concert.” In the terminology used by ancient commentators on his reforms, Cleisthenes “sought to intermix” ([Aristotle] *Ath. Pol.* 21.2-3) the residents of Athenian territory.¹⁸

Cleisthenes accomplished this intermixing by inaugurating ten new and blatantly artificial “tribes.” These new tribes would play important roles in the new political system. They would also become key markers of Athenian identity. Each of the ten new tribes was named after an Athenian mythical hero; according to Athenian memory, the ten heroes were chosen by Apollo’s priestess at Delphi from a much more extensive list. Notably, the new tribes would not be territorially contiguous; each tribe drew about a third of its membership from communities located in coastal, inland, and urbanized regions of Athenian territory.¹⁹

As a result of Cleisthenes’ tribal reform, Prasiai now became one of the eleven *demes* – that is, towns, villages or urban neighborhoods – constituting the newly created tribe of Pandionis. Prasiai was designated a *coastal deme* – as were three other, nearby villages, each located near the eastern coast of Attica. These four coastal demes of the tribe Pandionis made up the coastal “third” (*trittys*) of the tribe. They were administratively joined to four inland demes to the west (the inland *trittys*), and to three city demes: neighborhoods in or near the main city of Athens (the city *trittys*). The citizens of the eleven demes, grouped in these three “thirds,” were now officially the tribe Pandionis. The same organizational principles were used in constituting the other nine tribes. The new system is represented schematically in Figure 1.

[Figure 1 about here]

Cleisthenes' organizational design was at once radical and practical. It was predicated on conjoining long-standing, familiar "natural" units – the existing villages and neighborhoods of Athens with new, unfamiliar, and highly artificial units – the ten new tribes. The tribes and their constituent "thirds" were the institutional bridges by which a stable local identity ("resident of Prasiai") was linked to a desired national identity ("participatory citizen of Athens").

Tribes would now be the basis for mustering a newly created national army. The core of the army was heavy-armed infantrymen (hoplites). Roughly speaking, these were the wealthiest one-third of the Athenian population. In the aftermath of Cleisthenes' reforms some 60 or 70 men of Prasiai might be expected periodically to march into battle as hoplites along with hoplite-villagers from nearby towns in the coastal district. This would not be anything new; we can assume that the big men of the central Athenian coast had been mustering their heavy-armed supporters against pirates and other local threats for generations. But now the men of Prasiai would also muster alongside members of tribe Pandionis who hailed from far away inland and city demes (Siewart 1982, Christ 2001).

Likewise, much of Athenian ritual life was now restructured on a tribal basis – the Prasiaeis would sacrifice and eat ritual meals, march in parades, and dance in ritual contests with their fellow tribesmen, the Pandioneis. As a result, people with very different life-histories and different sets of social and technical knowledge frequently found themselves in close social proximity to people they never would have otherwise known. The system very literally "inter-mixed" Athenians from different geographic/economic zones in a variety of psychologically powerful activities. Over time, the experience of marching, fighting, sacrificing, eating, and dancing, together in this newly "inter-mixed" grouping would, according to Cleisthenes' plan, lead to a strengthened collective identity at the level of the polis. As we shall see, the system also promoted extensive bridge-building across the existing strong-tie networks and these bridges were essential to the process of knowledge aggregation.²⁰

4. The Council of 500: Structural holes and bridging ties

Among key political institutions introduced or restructured in conjunction with the new deme/tribe system was a new Council of 500, a linchpin institution that was given control of the vital agenda-setting function. The Council was charged with agenda-setting, deciding what matters should be discussed in the full Assembly of Athenian citizens. The Assembly, which all Athenian citizens in good standing were entitled to attend whenever they pleased, was a potentially chaotic legislative body. In the democratic era thousands of citizens attended its frequent meetings (40 per year in the fourth century). The Assembly was the embodied citizenry – the demos – and as such decided all important matters of state policy, including finance and matters of diplomacy, war, and peace. The Council met very regularly in Athens, eventually in a purpose-built architectural complex. In addition to its vital function of setting the Assembly's agenda, the Council had responsibility for the day-to-day administration of state affairs, including meeting foreign delegations and reviewing the performance of out-going Athenian magistrates. The Council also played an important executive role in ensuring that policy dictated by the Assembly was properly carried out.²¹

According to Cleisthenes' plan, the new Council of 500 was to be made up of ten 50-man delegations – one delegation from each of the ten newly-created tribes.²² The members of each tribal delegation were in turn selected at deme level. Each year every deme sent forward a certain number of Councilors, based on the deme's citizen population.²³ Prasiai annually sent three Councilors as part of Pandionis' 50-man delegation. Meanwhile, the large inland deme of Lower Paiania and the city deme of Kydathenaion each sent 11 men, while tiny Upper Paiania and Konthyle each sent only one. Tribe Pandionis' annual delegation to the Council of 500 is represented schematically in Figure 2.

[Figure 2 about here]

What choices, made by an individual member of the Council, might either promote or hinder the Council's overall capacity for joint action? Lacking any detailed first-person narrative from antiquity, a thought experiment must suffice: So imagine a Councilor (*bouleutês*) from Prasiai, let us call him Poseidippos (at least one man of that name did later live in Prasiai), embarking upon a year's service on the Council in the first year after the Council was founded.²⁴ Poseidippos was probably selected by lot for service; this was, in any event, the later selection procedure. He took up temporary quarters in the city, rightly expecting to spend a great deal of time serving on the Council; in later years, at least, the Council met some 300 days each year (Rhodes 1985: 30). Let us stipulate, on the basis of our description of late sixth-century Prasiai, that among the 49 other members of tribal team, Poseidippos had strong ties with his two fellow Prasiaeis but no bridging ties to any of his other fellow Councilors. The point is that when the year's new group of Councilors first took up their office, many of the deme-delegations that made up each tribal delegation of 50 were already likely to be strong-tie networked, but there were relatively few bridging "weak ties" between the strongly-tied local deme networks. This is a microcosm, at the level of 50 men, of the large-scale problem Cleisthenes faced as he embarked upon his reform plan. The hypothetical "starting point" situation of the 50 members of the Pandionis team as they entered upon their year of service on the Council in 507 B.C. is represented in Figure 3.

[Figure 3 about here]

As he takes up his office, Poseidippos is (ex hypothesi) connected by strong-tie bonds with his two fellow Prasiaeis. He has no pre-existing connections his other fellow Councilors from tribe Pandionis. Yet he knows that he must work closely with 47 men with whom he has no current ties, weak or strong, and then with the other 450 Councilors from the nine other tribes. According to Cleisthenes' plan, the 50-man tribal teams were responsible for much of the work of the Council – each tribe would take a leading role in directing the Council's business for a tenth of the year in rotation with the other nine teams. During the period when a tribe-team was exercising its presidency, a third of its delegate-members were on 24-hour duty. In later generations, in the fifth and fourth centuries, they would eat together (using vessels carefully labeled as "public property") and sleep in a public building located in the Agora, Athens' public square.²⁵

If Poseidippos had known the terminology of contemporary network theory, he would have described the Pandionis team as a network riddled with “structural holes.” That is to say there were many substantial gaps, bridged by few or no weak ties, between the eleven deme networks, each of which featured a dense matrix of strong ties. The holes are evident on Figure 3: There are no existing weak-tie bridges, for example, between demes 1 and demes 6 and 9 or between deme 8 and demes 7, 2, and 5. In one sense, these holes are an institutional design problem, in that, as we have seen, they represent the absence of the sort of dense networking via weak ties that Granovetter identified as a prerequisite for effective joint action. And so the holes represent a problem that Cleisthenes needed to solve by his new organizational design. Yet these same structural holes also represent opportunities – both for the individual willing to take the effort to bridge them and for the organization as a whole. The presence of so many structural holes offered a key incentive to an ambitious and entrepreneurial Councilman.

As Ron Burt demonstrated in a series of influential studies (esp. Burt 1992, 1997), in a networked structure, the holes between densely linked sub-networks are points of entrepreneurial opportunity because the individuals who bridge those holes gain social capital. They do so simply by taking up a strategic position in respect to the flow of useful information and social knowledge: They become the conduit through which information passes and they reap rewards accordingly. Burt showed that, in modern business firms, the social capital accumulated by diligent bridgers of structural holes translates into material gain (e.g. higher salaries) – and thus individuals have strong incentives to identify structural holes and to establish bridging ties across them. The social capital that accumulates from bridging holes potentially benefits all members of the network, although the original bridge-builders do especially well. Among Burt’s important general points is that networked organizations with many structural holes also present many opportunities for entrepreneurial gain by individuals willing and capable of occupying bridge positions. There is, therefore, a correlation between being “full of holes” and the development and maintenance of an entrepreneurial, innovation-prone, organizational culture.²⁶

Because a given Athenian Councilor’s term was limited to a year, the value of networking on the Council was likewise limited when it is compared to institutions (e.g. the U.S. Senate) in which continuous membership may span decades. The wealthiest and most socially prominent Councilors might regard network-building under these conditions as unlikely to reward the effort. Let us stipulate, therefore, that Poseidippos is among the poorest and least well-connected Councilors on his tribal team. Like other Athenian fathers, Poseidippos seeks good marriages for his sons and daughters, but he cannot offer large dowries to suitors.²⁷ The hope of advancing his family’s position gives Poseidippos a strong incentive to try to build social capital, which might stand in lieu of larger cash settlements. Stipulate further that Poseidippos is the sort of individual who intuitively recognizes the social capital gains (and the associated utility gains over time) available to a bridge-builder. As such he will use opportunities offered by the frequent meetings of Pandionis’ tribal team of 50 to build bridges to men from other demes, starting perhaps on the basis of shared occupational interests, distant kinship relations, or common cult-membership. The personal interactions within the tribal delegation are intense, as its members struggle to accomplish their duties -- and thereby, since the

assumed context is 507 B.C., to save their polis and themselves from destruction at the hands of the angry Spartans. That intensity facilitates rapid tie-formation, and thus makes it easier for Poseidippos to form friendship ties with strangers. The result is illustrated in Figure 4.

[Figure 4 about here]

As the year goes on, Poseidippos becomes an increasingly well respected and highly valued member of his tribal team because of his bridging position. He has a handle on more and more useful information - that is, he learns what people in other demes know. He learns something, for example, about pottery manufacture from his city-deme contacts and something about upland olive farming from his inland contacts. He also accumulates more and more social knowledge. He knows who among the members of his Pandionis team is trustworthy and on what topics, who is friends and enemies with whom, and so on. He is therefore in a position to aggregate important items of information and social knowledge: to bring disparate knowledge pieces together for problem-solving. The social capital he stands to gain is a strong incentive to reveal his own latent knowledge – that is, the expertise and experience he has gained in the course of his life -- and to share his newly aggregated knowledge with others. The intimate conditions of service on the Council reduce the costs of communication. Meanwhile, Poseidippos' growing social knowledge promotes greater discrimination in respect to information sorting. As a source and a conduit of useful aggregated knowledge, Poseidippos assumes the role of informed leader in deliberations. He thereby accrues advantages for himself and he enables his tribal team to get its job done.

Of course, Poseidippos is not the only one to see the advantages of building bridging links across local networks. Many, although not all, others on his team imitate his example. As a consequence, the Pandionis delegation is soon densely networked by weak-links, as illustrated in Figure 5. The tribe-team never becomes a strong-tie network – it is not the case that everyone is everyone else's friend. But the multiple weak-tie bridges ensure that information can flow readily from one strong-tie network to another.

[Figure 5 about here]

Tribe Pandionis is not special, of course – according to Cleisthenes' design, each of the ten tribes features similar demographic diversity. Thus, structural hole opportunities exist in each tribal team, and on the Council as a whole. As a result, the bridge-building we have hypothesized for Pandionis went on within each of the ten tribal teams. Moreover, unlike strong-tie networks, weak-tie networks are scalable. The same bridge-building process went on at an extensive network level *between* tribal teams of the Council. If the social capital for being a tribal team-level bridger of local networks and aggregator of knowledge was considerable, it was that much greater at the level of an inter-tribal bridge-builder. And so, we can postulate that over the course of the year the membership of the Council as a whole becomes linked by weak-ties and came to function as a single, extended network. The upshot is that the 500 members of the Council become

more capable of working cooperatively, both at the level of the tribal delegations of 50 and as a committee of the whole.

The networking process I have hypothesized, above, based on the social composition and governmental responsibilities of the Council of 500, directly addresses the public action problems affecting knowledge aggregation. As weak-tie bridges, formed by entrepreneurial individuals, link existing strong-tie local networks across regions, across kinship groups, across occupational groups, and across social classes, useful knowledge flows across the extended network with increasing ease. As the network becomes more dense and social capital grows, social knowledge is exchanged ever more freely. As they witness and experience the social capital gains that come with communication, experts in various technical domains are more willing to share proprietary information about sources of materials, trading partners, weather patterns, and so on. Others realize that their tacit knowledge of people and processes, formerly simply taken for granted as a sort of obvious “common sense” among the members of a strong-tie network, is valuable when brought to the surface and made explicit within a diverse group of people possessing very different sorts of tacit knowledge.

As the year goes on, both the latent specialized technical knowledge and the generalized tacit knowledge necessary to making good decisions, which had formerly been isolated inside individual minds and in closed networks, becomes increasingly accessible to the deliberations of the group as a whole. As Councilors become clearer about who is good at what, and who to go to for what sort of information, they can be more discriminating about their recommendations and as a result the whole council becomes increasingly capable of doing its difficult job well.

Moreover, as the Council overcomes its collective action problems and learns to work cooperatively towards its common goal, it can potentially access external knowledge resources distributed through the entire population of Athens – and beyond. Because each Councilor has a network of contacts *outside* the Council, each Councilor is a bridge between the Council and a local subset of the larger population. As a result, the Council, as a body, can access, at fairly low cost, a good deal of the total knowledge available to the extended Athenian community. As a result, at least potentially, “Athens knows what the Athenians know.”

Finally, because Councilors ordinarily serve only for a year, and are judged, and potentially rewarded, on the basis of how well they serve the public purposes of the polis, the Council as an institution never developed a self-serving identity or corporate culture.²⁸ The rules of order remained sufficiently simple and transparent to be learned by each year’s incoming class. Because each year’s turnover is complete, all Councilors enter upon their year on something approaching equal footing; there is no in-group of “old Council hands” controlling the agenda. As Councilors build their extended networks and work together over the course of the year on problems of polis governance, they come to better grasp the larger governmental system of which they are (for a year) one part. Government ceases to be regarded as a black box, and Councilors can quite quickly become fairly expert at the work of politics.

Their growing system-level expertise conjoins with the Councilors’ growing social-knowledge based information-sorting capacity and so they are better able to judge the value of available knowledge to the larger purposes of the polis – and thus better able to make good decisions in the exercise of their office. As a result, better agendas are set,

the government is better run day-to-day, and so Athens does better overall. We can thereby begin to understand how participatory democratic institutions could help promote growth in productive capacity and overall organizational success.

5. Organizational and individual learning

So far we have focused on the first year after Cleisthenes' establishment of the Council of 500 – and so we have been assuming that Poseidippos and his 499 fellow *bouleutai* entered their first tribal team meetings and first full Council sessions innocent of what to expect, and with few pre-existing weak-tie bridges. Let us next imagine Poseidippos' son, call him Poseidippos II for simplicity's sake, as he enters upon a year's service on the Council some time in the mid 470s. Like his father, Poseidippos II lives in Prasiai. He had been formally voted upon by his father's demesmen when he reached age 18; because he had been accepted by them as a legitimate son of an Athenian man the vote was positive and thus Poseidippos II became at once a demesman of Prasiai and a citizen of Athens. Like his father, as a councilor, Poseidippos II is confronted with a new challenge -- the city had been sacked by the Persians in 480-79. Rebuilding would be expensive. It would be more difficult because Sparta had opposed Athens' plan to re-fortify and would be of no help in building and maintaining the long-term anti-Persian alliance that most Athenians saw as essential to Athens' long-term security and return to prosperity.

Unlike his father, Poseidippos II had a sense of what to expect on the Council – he knew in advance many of the rules (written and unwritten) governing work on the Council. He had his father's recalled experience to draw upon, but also the experience of a full generation of Prasiaeis who had served, three each year, and brought back home much of what they had learned to the village. Over time, every Athenian citizen who cared to avail himself of it had easy and redundant access to men who had served on the Council and had faced a variety of crises and impasses. Both their successes and their failures became part of the general lore passed on across local social networks. Former Councilors' accounts of their experience served as an incentive to future Councilors. Because he had observed men upon their return from government service over the years, Poseidippos II knew that increased status and recognition could come with a year on the Council. He recognized that that the work would be hard and at times frustrating and that he would be taken away from the pleasures and opportunities offered by his ordinary life. Yet these negative considerations were over-balanced by the anticipation of gaining honors and social capital by playing a bridge-building role and by the substantial and long-term benefits associated with that gain.²⁹

Within Poseidippos II's own lifetime, the growing aggregate experience of Council service will have changed the structure of local and cross-polis social networks. Poseidippos II had grown up in a Prasiai in which social conditions were deviating from the tightly bounded world into which his father had been born. If we stipulate that Poseidippos I's gain in social capital had enabled him to marry one of his daughters to a somewhat wealthier tribesman from an urban deme to whom he had "bridged" in the course of his Council service, Poseidippos II would have kinship ties to a different social stratum and in a different region of the polis as a result of his father's Council year.³⁰ The point here is that the "weak-tie" friendships that were forged in a year's service (as well as in other tribal activities: war, religious ritual, and so on) ramified through the lives of

many individual Athenians and thereby across the polis as a whole. As a result, each year's group of Councillors began their work in a social environment featuring more pre-existing weak-ties between deme-delegations. Local strong-tie networks were supplemented at a polis level by an increasingly rich and complex network of strong- and weak-links.

As an extensive social network of weak *and* strong ties, the polis as an organization had an enhanced opportunity to build a store of collective social capital and thus gained the ability to work more cooperatively and more effectively in addressing public action problems. At the same time, the Athenian population was large, and (at least in the early to mid fifth century) growing quite rapidly. As a result, even as the density of bridges across the extended network grew, there were always structural holes opening up and thus always new opportunities for entrepreneurial "bridge-builders" – the relatively great size of Athens and its constant exposure to demographic change (a function of, *inter alia*, war-casualties, disease, immigration, and emigration) meant that there was no meaningful risk of network ossification – the ties within the extended polis network never became so dense and overlapping as to threaten the entrepreneurial culture Poseidippos I first experienced in the late sixth century.

We can now jump ahead to the mid-320s B.C, near the end of the democratic era of Athenian history. Assuming the family line of Poseidippos I has continued, his great-great-great-great grandson, Poseidippos VI, might have served on that Council. Perhaps, like many Athenians over the generations, he has moved away from his home deme, and now lives in the city. But he still attends deme meetings (some of which are held in the city) and he literally wears his deme identity around his neck – as a bronze citizen's identification tag used (*inter alia*) in lotteries for service on boards of magistrates (Kroll 1972).

Poseidippos VI still feels the pull of the network incentives that had motivated his ancestors. But over the generations the material incentives for Council service had been formalized. He was paid a daily wage for his service and the Pandionis tribal team competed for a prize offered by the demos, honoring the year's best team.³¹ When serving as the Council's presidents, Pandionis' tribal delegation (and the other nine in rotation) still met in the Tholos that was being planned during Poseidippos II's term of service. But when he attended meetings of the full Council, Poseidippos VI usually sat in a New Bouleuterion. As before, most Council meetings were open to the Athenian public. The Old Bouleuterion, in which Poseidippos II had deliberated over the rebuilding of the city, was now dedicated to the Mother of the Gods and used to house the state archives. Here, Councilors and other Athenians could consult the record of Athenian laws and decrees. A small staff of public slaves and citizen-clerks was available to help with archives and technical matters, yet this staff never amounted to anything like a professionalized bureaucracy; the main work of the Council was still done by the Councilors themselves.³²

By 325 B.C., the accumulated and transmitted knowledge of 180 years of institutional experience and policy experiments, and the results of 180 years of networking among Athenians was potentially available, orally or in written form. The Councilors of the later fourth century, the age of Aristotle, had a very substantial store of knowledge to draw upon. In sum, because of a structured capacity for passing on what was learned, the Athenian Council had developed the character of a learning

organization. As valuable experience accumulated over time, a formal archival system was developed and many of the work routines for accomplishing the Council's work were codified.³³ Yet the regular turnover of Council membership and the diversity of experiences new Councilors brought to the table ensured that the socialization of the members of the Council never approached the level at which innovative solutions were likely to be suppressed in favor of ossified routinization. The Council was manned by amateurs, in that their experience as Councilors was limited to two terms. In practice and perhaps, therefore, in principle, terms were always non-consecutive. Yet the apparent seamlessness with which knowledge, both innovative and routinized, could be aggregated and made available to decision-makers on the Council enabled them to manifest some of the characteristics associated with experts who have thousands of hours of personal experience to call upon. The decision-making process of Council itself had, over time, evolved into a sort of "expert system," capable of addressing a wide variety of problems.³⁴

6. Ostracism: Preclusive prediction

The Council is only one example of how knowledge aggregation was facilitated by the "machine" of democratic governance in Athens. Other Athenian institutions can be better understood by reference to the role of incentives and sanctions, communication costs, and sorting within a knowledge-based system.³⁵ Ostracism, the famous (and perhaps unique) mechanism by which Athenians annually had the opportunity to vote a single man into exile is a case in point.³⁶ Like the council, ostracism was predicated on the value to the state of aggregating the knowledge dispersed across Athens' socially diverse citizen body. Yet the aggregative mechanism used in ostracism was quite different. Unlike the Council, ostracism was a non-deliberative procedure. Rather than encouraging active sharing of information and expertise among a deliberating group, ostracism aggregated many independent individual judgments. Yet, like the Council, ostracism fulfills Aristotle's general description of a collectivity, "many-footed and many-handed and possessing many sense-capacities" and thereby potentially capable making judgments that were superior to those made by any individual.

Ostracism was designed to address a specific and recurring problem which could not be solved by identifying specifically relevant information-sets or experts: How to identify individuals who were likely to pose especially serious risks to the polis -- without crushing entrepreneurial initiative? Ostracism manifests design features that are reminiscent of a modern prediction market (Sunstein 2007): it is a non-deliberative system for aggregating independent guesses about the likely future course of events. Unlike modern prediction markets, however, ostracism maintained the principle of equal votes. Furthermore, as an instrument of public policy, ostracism did more than *predict* future outcomes. Ostracism weighed the likelihood of future conditions that might come about in absence of public inaction, and *precluded* a specific future though rule-bounded joint action.

Ostracism was a highly formalized institution: Once (and only once) each year the agenda of the citizen Assembly (open to all citizens in good standing) called for the Athenians to vote on whether to hold an ostracism that year. This preliminary Assembly vote answered a first question about how the present state of affairs in the polis was expected by the majority of those present to play out in the future: "Is there now in the

polis an individual whose continued presence might put the state so greatly at risk as to justify his immediate expulsion without trial?" The answer (i.e. the majority vote) was usually, "no"; only about 15 ostracisms are known to have been carried out in the 180 years of the democracy.

If, however, the Assembly's vote was "yes," a special sort of "election" was held in the Agora: Each Athenian now had the opportunity to cast a ballot, in the form of a pottery sherd (*ostrakon*) inscribed (by himself or another) with the name of the Athenian he most wished to see expelled from the polis. He had no responsibility for justifying his vote. There was no necessary assumption of past misconduct; an ostracism was not a legal trial (although ostracized men could be tried in absentia); no charges were filed. The state did not provide information to help voters choose their targets: There were no formal "nominees" for ostracism, and no formal speeches for or against possible "candidates." The institution's design focused attention on a calculation of expected public gains and losses, rather than on justice or retribution for past actions.

Once the votes had been cast, they were sorted, counted, and the "winner" (whoever received a plurality of votes) was publicly announced.³⁷ Although (thanks to the thousands of ostraka that have been found and studied by archaeologists) we know that some Athenians voted to ostracize political unknowns, in practice the plurality vote invariably selected a prominent political figure. This second vote therefore served to aggregate many independent judgments about prominent individuals to answer the obvious follow-up question: "*Whose* continued presence would be most likely to put Athens seriously at risk?" The vote by ostraka thereby identified the alternative future ("Politician X remains in Athens") regarded as mostly likely go badly (or likely to go worst) in the absence of concerted public action.

The formalized rules of ostracism prescribed the answer to a third question: "What will we do with the man whose continued presence is considered to put our future most at risk?" He was immediately exiled for 10 years, thereby effectively precluding the future of "Politician X remaining in Athens" and the risks associated with that future. The overt effects of ostracism were limited to the individual: the ostracized man's friends and family were free to remain in Athens and he retained possession of his property. Upon completion of his ten-year exile (or upon being recalled, as several ostracized citizens were in advance of the Persian wars) an ostracized individual could return to Athens and take up his life, including (if he chose) his political career. The clear rules and the limited downside risk to prominent individuals (limited, that is, compared with the mass expulsions that had characterized archaic Greek political conflicts) served as an incentive to accept the rules of the game. The incentive appears to have worked; there was certainly no mass exit of elites from fifth-century Athenian public life.

In that, in an ostracism, the "selected" future was precluded, ostracism is quite unlike a modern prediction market, in which the majority or plurality opinion (in the form of purchased shares) is demonstrated to be right or wrong once the outcome (e.g. the result of an election) is known. This means that there was (and is) no way to know whether or not the votes cast the two stages (Assembly vote by show of hands, Agora vote with ostraka) of an ostracism came up with the "right answer" to either of the two key questions concerning future risk and the identification of the riskiest individual. But it cannot, in any event, be said that Athens suffered from a lack of bold leaders during the half-century (480's-440's) during which most recorded ostracisms were held. After an

ostracism in ca. 417 returned an anomalous “winner” (perhaps due to collusion among the two most obvious candidates), the Athenians never again answered “yes” to the first question about whether to hold an ostracism in a given year (Rhodes 1994). While the first question continued to be asked every year, the actual practice of ostracizing an individual was evidently no longer regarded by the collectivity as essential to the proper functioning of the polis. This limited institutional history contrasts quite starkly with the continued existence of the deliberative Council and other Athenian knowledge-aggregation institutions (e.g. Assembly and People’s courts).

7. Conclusions

The Athenian system of government both encouraged (through incentives) and required (in order to broaden the range of information and expertise) participation in decision-making and problem-solving from a diverse population. Equality of opportunity for public participation was a cherished Athenian value (Raaflaub 1996). The institutional design model established by Cleisthenes, and elaborated through subsequent institutional innovations, was based on offering substantial incentives (honorary, social, and material) for public service. These incentives made public service possible and more desirable across class lines. Formerly inexperienced men had the chance to become experienced in political affairs, indeed, to become quite expert at the work of democratic politics. By gaining experience and therefore confidence in their own capacities, Athenian citizens *lost* a substantial *disincentive* to political activity. Substantial power inequalities remained between elite and non-elite social strata. But opportunities for political activity were to some degree equalized across class lines by the use of the lot (Taylor 2007) and pay for service.

The model I have presented here predicts that, over the course of time, the population of “politically active citizens” should be increasingly representative of, and indeed functionally coextensive with, the citizen population as a whole. An initial over-representation of wealthy citizens, and by those with easy geographical access to the city-center, should lessen as poorer and more geographically distant citizens came to appreciate the potential value of their own participation, both to themselves and to their community. This prediction is borne out by Clare Taylor’s demographic analysis of some 2200 politically active Athenians in the fifth and fourth centuries. In the fifth century 19% of identifiable politically active citizens were wealthy (i.e. from liturgy-paying class: ca. 4% of the total population) and 58% came from near-city demes (aggregate bouletic quota 123/500: ca. 25% of the total population). In the fourth century, by contrast, only 11% of citizens known to be politically active were wealthy and 31% were from near-city demes. Taylor’s numbers do not prove that citizens’ growing experience with government processes (or any other candidate variable) *caused* the trend towards equalization in levels of participation. Her results are, however, consistent with the model offered above. The opposite result (growing inequality of participation) would, by contrast, falsify it.³⁸

The social context of knowledge aggregation processes explains how Athenian institutional design promoted learning – both organizational learning, so that the system as a whole became more expert, and individual learning by citizens engaged in a lifelong civic education. The principles of representative sampling through a lottery and rotation inhibited emergence of a limited elite of entrenched “policy experts.” The circulation

through a variety of kinds of public service (military, judicial, magisterial) by a great many citizens, who remained diverse in terms of age, geographic home, economic class, and occupation, facilitated innovative problem-solving. Innovations emerged continuously as teams of citizen-magistrates brought into being new constellations of social and technical knowledge by aggregating an ever-changing repertoire of diverse information and expertise. Innovation was stimulated through cross-appropriation of knowledge between domains of expertise, and from one solution space to another.

Like all decision-making processes, the Athenian system was fallible and sometimes produced bad policy. Yet overall and over time, democratic Athens fared well enough to outdo all of its city-state rivals. The postulated value of aggregated knowledge, drawn from a large and diverse population, to problem-solving in the fluid and competitive environment of world of the Greek city-states solves the riddle of “unexpected” Athenian success. It offers at least a partial explanation for why Athenian democracy, with its costly participatory decision-making institutions, is so strongly correlated to improved state capacity and superior competitive performance.

Ober. Figures (5 total).

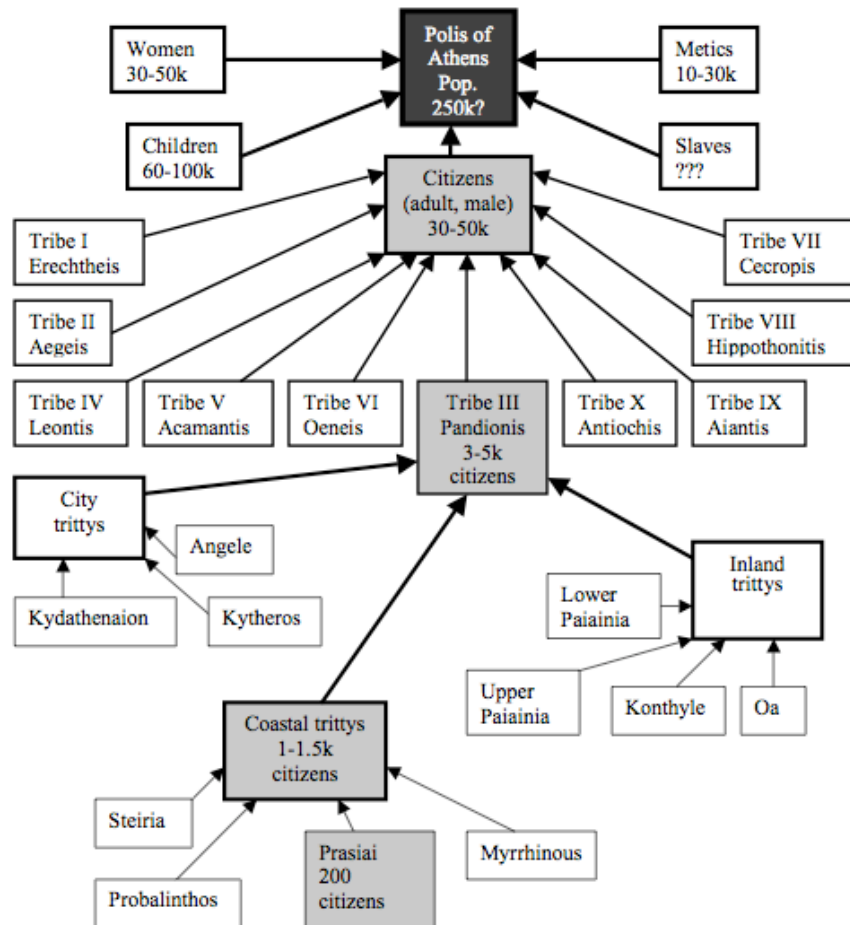


Figure 1. Four levels of Athenian civic subdivisions: status groups, tribes, trittys, demes.

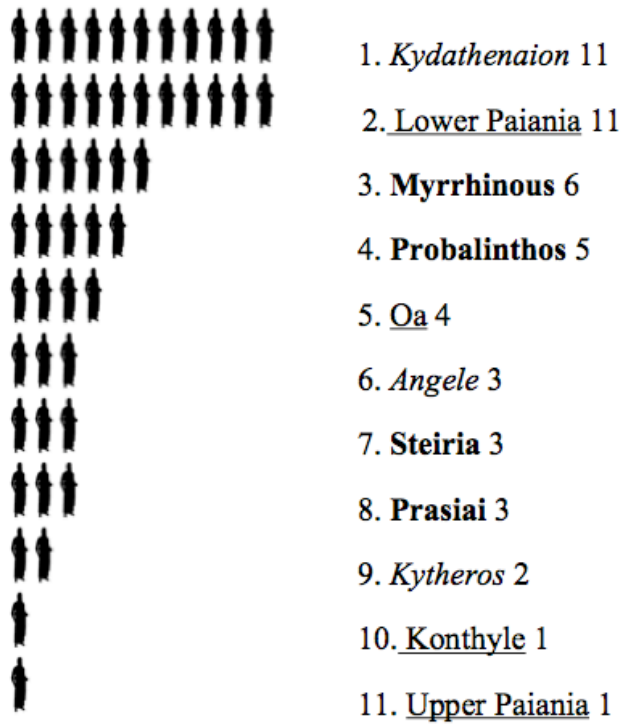


Figure 2. Tribe Pandionis' delegation of Councilmen for one year (quotas by deme). City demes = *italics*, inland = underlined, coastal = **bold**

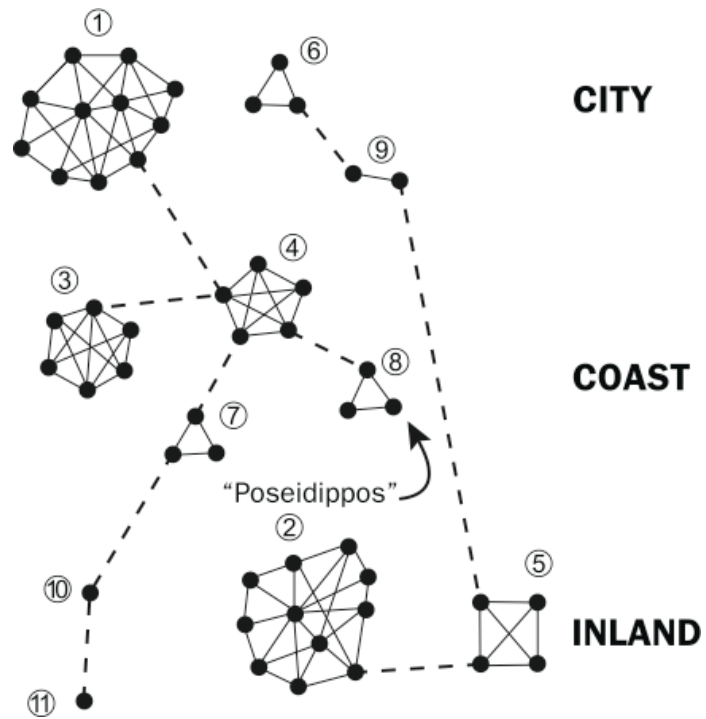


Figure 3. Pandionis' tribal team as a social network: starting position. Solid lines within deme networks (numbered 1-11) are hypothetical strong ties. Dashed lines between deme networks are hypothetical weak ties. Prasiai is deme 8.

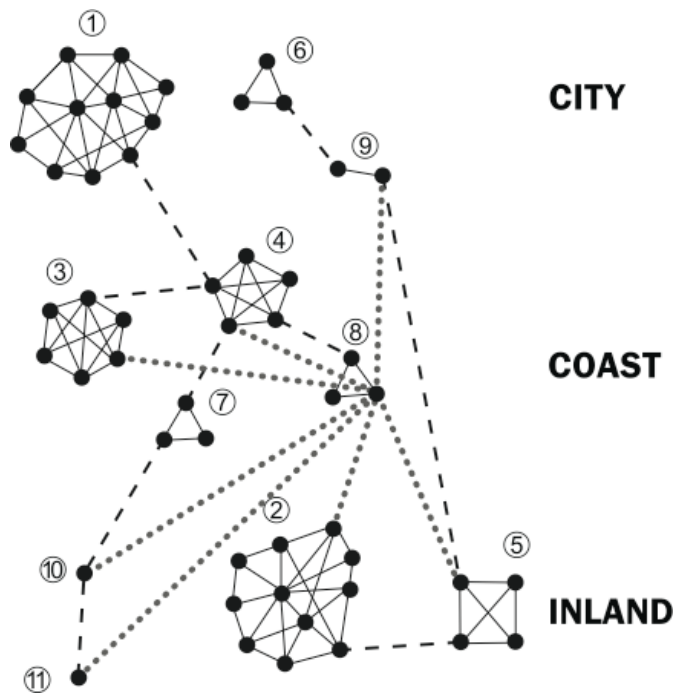


Figure 4. Pandionis tribal team network, stage 2. Dotted lines represent hypothetical new weak ties established by "Poseidippos."

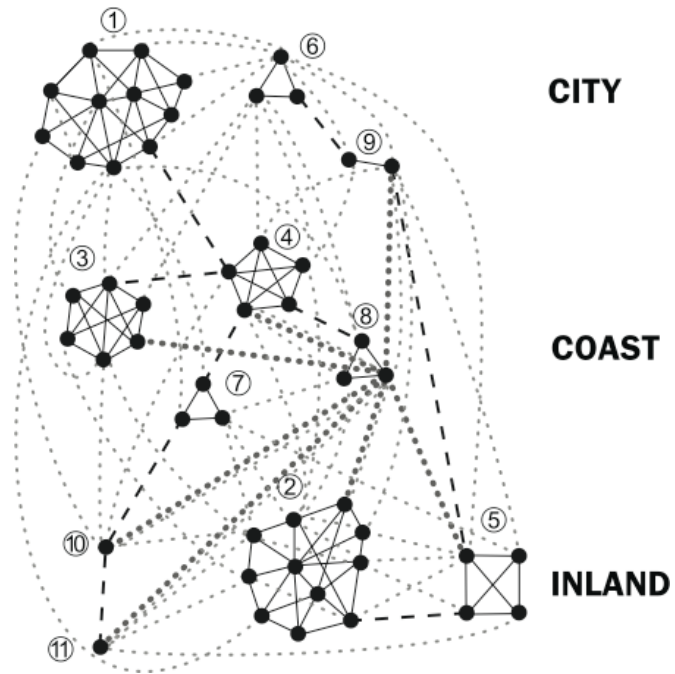


Figure 5. Pandionis tribal team network, stage 3. Dotted lines represent hypothetical new weak ties established by various team members.

Ober. Bibliography.

- Anderson, Elizabeth. 2006. "The Epistemology of Democracy." *Episteme: Journal of Social Epistemology* 3:8-22.
- Anderson, Greg. 2003. *The Athenian experiment: Building an imagined political community in ancient Attica, 508-490 B.C.* Ann Arbor Mich.: University of Michigan Press.
- Benkler, Yochai. 2006. *The wealth of networks: How social production transforms markets and freedom.* New Haven: Yale University Press.
- Brown, John Seely, and Paul Duguid. 1991. "Organizational Learning and Communities-of-Practice: Toward a Unified View of Working, Learning, and Innovation." *Organization Science* 2:40-57.
- . 2000. *The social life of information.* Boston: Harvard Business School Press.
- Burt, Ronald S. 1992. *Structural holes: The social structure of competition.* Cambridge, Mass.: Harvard University Press.
- . 1997. "The Contingent Value of Social Capital." *Administrative Science Quarterly* 42:339-365.
- . 2004. "Structural Holes and Good Ideas." *American Journal of Sociology* 110:349-99.
- Camp, John McK. II. 2001. *The archaeology of Athens.* New Haven: Yale University Press.
- Chang, Myong-Hun, and Joseph E. Harrington. 2005. "Discovery and Diffusion of Knowledge in an Endogenous Social Network." *American Journal of Sociology* 110:937-76.
- Cox, Cheryl Anne. 1998. *Household interests: Property, marriage strategies, and family dynamics in ancient Athens.* Princeton, N.J.: Princeton University Press.
- Davenport, Thomas H., and Laurence Prusak. 1998. *Working knowledge: How organizations manage what they know.* Boston, Mass: Harvard Business School Press.
- Diani, Mario, and Doug McAdam (Eds.). 2003. *Social movements and networks: Relational approaches to collective action.* Oxford ; New York: Oxford University Press.
- Dixon, Nancy M. 2000. *Common knowledge: How companies thrive by sharing what they know.* Boston: Harvard Business School Press.
- Ericsson, Anders. 1999. "Expertise." Pp. 298-300 in *The MIT Encyclopedia fo the Cognitive Sciences.* Cambridge, MA: MIT Press.
- Estund, David M. . 2008. *Democratic Authority: A Philosophical Framework.* Princeton: Princeton University Press.
- Fleck, Robert K, and F. Andrew Hanssen. 2006. "The Origins of Democracy: A Model with Application to Ancient Greece." *Journal of Law and Economics* 49:115-146.
- Forsdyke, Sara. 2005. *Exile, Ostracism, and Democracy: The Politics of Expulsion in Ancient Greece.* Princeton: Princeton University Press.
- Frost, Frank J. 1984. "The Athenian Military before Cleisthenes." *Historia* 33:283-94.
- Gargiulo, Martin, and Mario Benassi. 2000. "Trapped in Your Own Net? Network Cohesion, Structural Holes, and the Adaptation of Social Capital." *Organization Science* 11:183-96.
- Gomme, A.W. 1951. "The Working of the Athenian Democracy." *History* 36:12-28.
- Gould, Roger V. 1995. *Insurgent identities: Class, community, and protest in Paris from 1848 to the Commune.* Chicago: University of Chicago Press.
- Granovetter, Mark S. 1973. "The Strength of Weak Ties." *American Journal of Sociology* 78:1360-1380.
- . 1983. "The Strength of Weak Ties: A Network Theory Revisited." *American Journal of Sociology* 78:1360-1380.

- . 1985. "Economic Action and Social Structure: The Problem of Embeddedness." *American Journal of Sociology* 91:481-510.
- Hansen, Mogens Herman. 1983. "Rhetores and Strategoi in Fourth-Century Athens." *Greek, Roman, and Byzantine Studies* 24:151-80.
- . 1984. "The number of rhetores in the Athenian ecclesia, 355-322 B.C." *Greek, Roman, and Byzantine Studies* 24:227-38.
- Hansen, Mogens Herman, H.L. Bjertrup, T.H. Nielsen, L. Rubinstein, and T. Vestergaard. 1990. "The Demography of the Attic Demes: The evidence of the Sepulchral Inscriptions." *Analecta Romana* 19:24-44.
- Hansen, Morten T. 2002. "Knowledge Networks: Explaining Effective Knowledge Sharing in Multiunit Companies." *Organization Science* 13:232-49.
- Hedrick, Charles W. 1999. "Democracy and the Athenian Epigraphic Habit." *Hesperia* 68:387-439.
- Henry, Alan S. 2002. "The Athenian state secretariat and provisions for publishing and erecting decrees." *Hesperia* 71:91-118.
- Jackson, Peter. 1999. *Introduction to expert systems*. Harlow, England ; Reading, Mass.: Addison-Wesley.
- Jones, Nicholas F. 1999. *The associations of Classical Athens: The response to democracy*. New York: Oxford University Press.
- Kaiser, Brooks A. . 2007. "The Athenian Trierarchy: Mechanism Design for the Private Provision of Public Goods." *Journal of Economic History* 67:445-80.
- Krackhardt, David. 1992. "The Strength of Strong Ties: The Importance of Philos in Organizations." Pp. 216-39 in *Networks and organizations: Structure, form, and action*, edited by Nitin Nohria and Robert G. Eccles. Boston, Mass.: Harvard Business School Press.
- Levitt, Barbara, and James March. 1988. "Organizational Learning." *Annual Review of Sociology* 14:319-40.
- List, Christian, and Philip Pettit. 2004. "An Epistemic Free-Riding Problem?" Pp. 128-58 in *Karl Popper: Critical Appraisals*, edited by Philip Catton and Graham Macdonald. London: Routledge.
- Lyttkens, Carl Hampus. 1992. "Effects of the Taxation of Wealth in Athens in the Fourth Century B.C." *The Scandinavian Economic History Review* 40:3-20.
- . 1994. "A Predatory Democracy? An Essay on Taxation in Classical Athens." *Explorations in Economic History* 31:62-90.
- . 2006. "Reflections on the origins of the polis. An economic perspective on institutional change in ancient Greece." *Constitutional Political Economy* 17:31-48.
- Maurizio, Lisa. 1998. "The Panathenaic Procession: Athens' Participatory Democracy on Display?" Pp. 297-317 in *Democracy, empire, and the arts in fifth-century Athens*, edited by Deborah Dickmann Boedeker and Kurt A. Raaflaub. Cambridge, Mass.: Harvard University Press.
- Millett, Paul C. 1989. "Patronage and its avoidance in classical Athens." Pp. 15-48 in *Patronage in Ancient Society*, edited by A. Wallace-Hadrill. London: Routledge.
- Morris, Ian. 1998. "Archaeology as a Kind of Anthropology (A Response to David Small)." Pp. 229-39 in *Democracy 2500? Questions and challenges*, edited by Ian Morris and Kurt A. Raaflaub. Dubuque, Iowa: Kendall/Hunt Pub. Co.
- Ober, Josiah. 1989. *Mass and elite in democratic Athens: Rhetoric, ideology, and the power of*

- the people*. Princeton, N.J.: Princeton University Press.
- . 1996. *The Athenian revolution: Essays on ancient Greek democracy and political theory*. Princeton, N.J.: Princeton University Press.
- . 1998. *Political Dissent in Democratic Athens: Intellectual Critics of Popular Rule*. Princeton, N.J.: Princeton University Press.
- Ober, J. 2007. "Natural Capacities and Democracy as a Good-in-Itself." *Philosophical Studies* 132:59-73.
- Ober, Josiah. 2008. *Democracy and Knowledge: Learning and Innovation in Classical Athens*. Princeton: Princeton University Press.
- Osborne, Robin. 1985. *Demos, the discovery of classical Attika*. Cambridge Cambridgeshire ; New York: Cambridge University Press.
- . 1990. "The demos and its divisions in classical Athens." Pp. 265-93 in *The Greek city: From Homer to Alexander*, edited by Oswyn Murray and S. R. F. Price. Oxford and New York: Clarendon Press.
- . 1994. "Ritual, Finance, Politics: An Account of Athenian Democracy." Pp. 1-24, edited by Robin Osborne and Simon Hornblower. Oxford: Clarendon Press.
- Osterloh, Margit, and Bruno S. Frey. 2000. "Motivation, Knowledge Transfer, and Organizational Form." *Organization Science* 11:538-550.
- Padgett, John F. , and Christopher K. Ansell. 1993. "Robust Action and the Rise of the Medici, 1400-1434." *American Journal of Sociology* 98:1259-1319.
- Page, Scott E. 2007. *The difference: How the power of diversity creates better groups, firms, schools, and societies*. Princeton: Princeton University Press.
- Pritchard, David. 2004. "Kleisthenes, Participation, and the Dithyrambic contests of late archaic and classical Athens." *Phoenix* 58:208-228.
- Purcell, Nicholas. 1990. "Mobility and the Polis." Pp. 29-58 in *The Greek city: From Homer to Alexander*, edited by Oswyn Murray and S. R. F. Price. Oxford and New York: Clarendon Press.
- Quillin, James. 2002. "Achieving Amnesty: The Role of Events, Institutions, and Ideas." *Transactions of the American Philological Association* 132:71-107.
- Raaflaub, Kurt, Josiah Ober, and Robert W. Wallace. 2007. *The Origins of Democracy in Ancient Greece*. Berkeley and Los Angeles: University of California Press.
- Rhodes, P. J. 1985. *The Athenian Boule*. Oxford: Clarendon Press.
- . 1994. "The Ostracism of Hyperbolus." Pp. 85-98 in *Ritual, Finance, Politics: Athenian Democratic Accounts Presented to David Lewis*, edited by Robin Osborne and Simon Hornblower. Oxford: Clarendon Press.
- Rubinstein, Lene. 2000. *Litigation and cooperation: Supporting speakers in the courts of classical Athens*. Stuttgart: Verlag.
- Schmitt-Pantel, Pauline. 1992. *La cité au banquet: Histoire des repas publics dans les cités grecques*. Roma, Italie: Ecole française de Rome.
- Schwartzberg, Melissa. 2004. "Athenian Democracy and Legal Change." *American Political Science Review* 98:311-25.
- . 2007. *Democracy and legal change*. Cambridge and New York: Cambridge University Press.
- Siewert, Peter. 1982. *Die Trittyen Attikas und die Heeresform des Kleisthenes*. München: C.H. Beck.
- Sunstein, Cass R. 2006. *Infotopia: How many minds produce knowledge*. New York: Oxford University Press.

- Taylor, Claire. 2007. "An oligarchy of the city? The sociological impact of election and lot in Athenian democracy " *Hesperia* 76:323-46.
- . 2008. "A New Political World." Pp. 72-90 in *Debating the Athenian Cultural Revolution: Art, Literature, Philosophy, and Politics 430–380 BC*, edited by Robin Osborne. Cambridge: Cambridge University Press.
- Teegarden, David. 2007. "Defending Democracy: A Study of Ancient Greek Anti-Tyranny Legislation." in *Department of Classics*. Princeton: Princeton University.
- Trails, John S. 1975. *The political organization of Attica: A study of the demes, trittyes, and phylai, and their representation in the Athenian Council*. Princeton, N.J.: American School of Classical Studies at Athens.
- Vanderpool, Eugene, James McCredie, and A. Steenberg. 1962. "Koroni: A Ptolemaic Camp on the East Coast of Atica." *Hesperia* 31:26-61.
- Waldron, Jeremy. 1995. "The Wisdom of the Multitude: Some Reflections on Book III Chapter 11 of the Politics." *Political Theory* 23:563-84.
- Walker, Rob. 2004. "The Hidden (in Plain Sight) Persuaders." *New York Times Magazine* December 5:69-76 and ff.
- Wenger, Etienne. 1998. *Communities of Practice: Learning, Meaning, and Identity*. Cambridge, U.K. ; New York, N.Y.: Cambridge University Press.
- Whitehead, David. 1983. "Competitive outlay and community profit: Philotimia in Democratic Athens." *Classica et Mediaevalia* 34:55-74.
- . 1986. *The demes of Attica, 508 7-ca. 250 B.C.: A political and social study*. Princeton, N.J.: Princeton University Press.
- . 1993. "Cardinal virtues: The language of public approbation in democratic Athens." *Classica et mediaevalia* 44:37-75.
- Wilson, Peter. 2000. *The Athenian institution of the Khoregia. The Chorus, the city, and the stage*. Cambridge: Cambridge University Press.

Ober. Notes.

¹ On epistemic features of democracy, see E. Anderson 2006; Ober 2008, chapter 1; Estlund 2008, esp. 232: “it is very natural and plausible to think that if democracy has any epistemic value it is partly to do with the sharing of diverse perspectives.” Page 2007 emphasizes both the epistemic potential and the problems associated with socially diverse groups of decision-makers. Of course, even successful democracies experience epistemic failures; an epistemic democracy ought to be able to learn from its failures and to design institutions that make similar failures less likely in the future; see below. Sections 2-6 of this chapter are adapted from Ober 2008, especially chapter 4.

² The terms “data,” “information,” and “knowledge” are variously defined by organizational theorists. Davenport and Prusak (1998: 1-6) suggest that data are facts about events, information is data that have been given relevance and purpose, and knowledge is a matrix of experience, values, insight, and contextual information which allows for the incorporation of new experiences and information. See also Dixon 2000: 13; Brown and Duguid 2000: 119-202. Expertise, as an unusually high level of mastery of a particular domain of endeavor: Ericsson 1999.

³ For a detailed description of Athenian democracy, its history and institutions, see Hansen 1999. Athens is a good case study because its documented history includes pre- and post-democratic eras, as well as a long (185 year) period of democratic self-government. Athenian history can readily be subdivided into multiple phases, allowing us to assess democracy’s origins, recovery, persistence, and demise. The evidence base is rich: Substantial numbers of government documents (in the form of inscriptions) enable us to trace institutional changes. A large corpus of public speeches allows analysis of democratic ideology. Athenian democratic government was subjected to probing critical-theoretical scrutiny by prominent contemporary intellectuals (e.g. Thucydides, Plato, and Aristotle).

⁴ Comparative Athenian performance: Ober 2008 chapter 2; the statistical measures of Athenian success serve to confirm the *communis opinio* of specialists in ancient Greek history.

⁵ More egalitarian participation in fourth than in fifth century: Taylor 2007, 2008 and below. Danger of ossification: Levitt and March 1988. Athenian diversity: Ober 2005, chapter 4.

⁶ The Athenian political elite: Hansen 1983, 1984; not a ruling elite: Ober 1989. Lack of formal patronage: Millett 1989; democratic ideology: Ober 1989; dissent: Ober 1998.

⁷ 3.11 = 1281a40-b10. Trans. C. Lord, adapted. Waldron 1995 underlines the importance of this passage and emphasizes its deliberative character. See Ober 1998: 319-24, 2008: 110-114, for discussion and bibliography. Estlund, 2008, chapter 12 contrasts Condorcet’s theorem (and variations thereof) to Aristotle’s diverse-perspectives approach.

⁸ Ober 2008 devotes individual chapters to the epistemic processes of knowledge aggregation (4), alignment (5), and codification (6), arguing that it is the integration of these three processes, over time, that produced the result of superior Athenian performance.

⁹ Trade secrets: Davenport and Prusak 1998: 16-17. Incentives as essential for effective knowledge sharing: Sunstein 2006: 69-70, 201, 203-5. Open source software and related forms of non-market productivity: Benkler 2006.

¹⁰ On the vocabulary of “honor-loving” and Athenian public practices associated with it, see Whitehead 1983, 1993. Non-material incentives for knowledge-sharing: Davenport and Prusak: 22-51 (internal “knowledge markets”); Osterloh and Frey 2000. Walker 2004 discusses modern “word of mouth” marketing techniques, suggesting that for at least some people the experience of sharing some kinds of information (in this case about new products) with others is valued in itself, and that material incentives are relatively less important. Similarly: Dixon 2000: 6-7.

¹¹ Difficulty of making effective use of archived data: Brown and Duguid 1991 and 2000. Routinization versus innovation in organization theory: Levitt and March 1988.

¹² The revolution and the constitutional reforms: see note 17, below. Osborne 1990 answers the question “what is a deme and why does it matter?” See further, below.

¹³ On Prasiai see Vanderpool, McCredie and Steinberg 1962; Whitehead 1986 index s.v.; Camp 2001, 281.

¹⁴ Deme life and diachronic history of residence patterns in rural Attica: Osborne 1985a, 1987; Whitehead 1986; Jones 1999.

¹⁵ Granovetter 1973. See, further, Granovetter 1983, 1985; Krackhardt 1992; Gargulio and Benassi 2000; Diani and McAdam 2003. Padgett and Ansell 1993 and Gould 1995 are a notable examples of how social network theory can be used to explain an actual historical situation (the rise of the Medici in 15th century Florence and social movements in Paris in the later 19th century). M.T. Hansen 2002 explores knowledge networks in multiunit firms, an organizational situation with striking analogies to Athens and its constituent demes. Chang and Harrington 2005 emphasize the need for persistent diversity within networks and quality of ties for effective network performance based on both innovation and learning.

¹⁶ Purcell 1990 rightly warns against overstating the insularity of archaic Greek villages. The point is that, in comparison with later Athenian history, Prasiai of the late sixth-century is likely to be relatively lacking in bridging ties.

¹⁷ Athenian revolution: Ober 1996 chapter 5; Forsdyke 2005; Pritchard 2005; Raaflaub, Ober, and Wallace 2007. No Athenian regular army before 508: Frost 1984; Siewert 1982.

¹⁸ The value of social networks in building “communities of practice, and thus to organizational performance is well attested in business literature: Wenger 1998; Davenport and Prusak 1998: 37-39, 65-67; Brown and Duguid 2000: 142-43; 157-59; Benkler 2006.

¹⁹ G. Anderson 2003 offers detailed review of Cleisthenes’ program, with bibliography.

²⁰ On the intertwining of ritual, financial, and civic life in the Athenian tribe, see Osborne 1994. Sacrificing and eating: Schmitt-Pantel 1992. Marching: Maurizio 1998. Dancing: Wilson 2000: esp. 56-57, 75-76; *contra*: Pritchard 2004. Tribal networks were also helpful, especially for nonelite Athenians, in legal disputes: Rubinstein 2000.

²¹ Rhodes 1985 is the fundamental and indispensable description of the Council of 500, its origins, and its role in Athenian government; see esp. chapter 3 for an analysis of the Council’s main areas of responsibility: finance, army and navy, public works, and religion.

²² Rhodes 1985: 17-18, favors a later date (ca. 462 B.C.) for the introduction of the tribal delegations serving in rotation as “presidents” of the Council, but he notes that the scholarly *communis opinio* is that the tribal teams were a Cleisthenic innovation.

²³ Quotas are based on fourth-century evidence. Here I assume that the system was put into place in the immediate post-revolutionary period, and (with Traill 1975: 101-103) remained essentially unchanged through 322 B.C. The main lines of the argument I develop here would not be much affected by the kinds of changes that have been proposed to date, e.g. by Hansen et al. 1990.

²⁴ I am assuming here that the Council, along with the deme/tribe system, was put into existence in the immediate aftermath of the Revolution of 508; an alternative view holds that the system was not fully functional until 501/0: Rhodes 1985; 1, 191-93; Badian 2000.

²⁵ On the Tholos as the headquarters of the presiding tribal delegatio), see Rhodes 1985 16. Cf. Camp 2001 69-70.

²⁶ On structural holes, see Burt 1992, 1997, 2004; Gargiulo 2000. Much of Burt’s work builds on insights that are intuitively obvious – one need not have mastered network theory to recognize that advantages accrue to those willing to build bridges between cliquish sub-networks within a larger body that must undertake a common enterprise. The diligently “networking” social entrepreneur is a common feature of institutions of all kinds. The principle is the same whether it is a secondary school, a business firm, a professional association – or a Greek council.

²⁷ Dowries were very substantial expenses: Cox 1998.

²⁸ This key insight was developed by Gomme 1951

²⁹ There is no obvious way to test whether the independent variable of Council service led to a rise in the dependent variable of individual or family utility. The question deserves further study; see, further, Taylor 2008.

³⁰ On inter-deme marriages, see Osborne 1985: 27-38 (documenting 32 intra-deme and 131 extra-deme marriages), with Cox 1998 38-67. More research is needed on the question of how public service might have affected marriage patterns.

³¹ Pay: 5 obols/day for ordinary service, 6 obols (1 drachma)/day for service while the members of the tribal team are serving as presidents: Rhodes 1985: 16-17. Annual prize for best tribal delegation, offered by the Council in the early fourth century and by the demos by the mid-fourth century: Rhodes 1985: 8, 22-23.

³² The Old and New Bouleuteria: Rhodes 1985: 31-33; Camp 2001: 44, 127. Meetings open to public: Rhodes 1985, 40-43. Before the 360s a principal “secretary to the council” and, after the 360s other three citizen- were annually assigned to the Council, but their tenure (like that of all Athenian citizen-clerks) was annual. Secretaries: [Aristotle], *Ath. Pol.* 54.3-5 with Rhodes 1985:16, 134-42; Hansen 1999: 123-24, 244-45; Henry 2002. Public slaves (*huperetai*) looked after of records in the Metroon and the records of the *poletai* and perhaps a half-dozen other public slaves were available to assist the Council. Rhodes 1985: 142-43 emphasizes the modest size of the Council’s staff: there is no warrant for imagining a substantial professionalized bureaucracy, comparable to that typical of parliamentary democracies, working in the background.

³³ The formulaic language of enactment and disclosure typical of Athenian decrees (Hedrick 1999) is one piece of evidence for routinization.

³⁴ The term “expert system” ordinarily refers to electronic computing techniques that seek to simulate (and thereby regularize and make easily accessible to end users) the decision-making processes of experts: Jackson 1999.

³⁵ Lyttkens 1992, 1994, 2006 (taxation); Quillin 2002 (amnesty); Schwartzberg 2004, 2007 (law and diplomacy); Fleck and Hanssen 2006 (agricultural economy); Kaiser 2007 (trierarchies); and Teegarden 2007 (anti-tyranny legislation) are notable examples of explanatory approaches to various aspects of Athenian institutions, which emphasize rational action and incentives, although they do not focus in the first instance on dispersed knowledge.

³⁶ Forsdyke 2005 is the standard and indispensable account of Athenian ostracism. The evidence for ostracism outside of Athens is exiguous: Forsdyke 2005, appendix 2.

³⁷ Regrettably, we do not have the vote count for any given ostracism; the literary record does not record that information, and *ostraka* found by archaeologists can not be dated with enough accuracy to provide a random sample for a given year. So we do not know how large the “winning” plurality would have been in practice. My sense (based on the large numbers of *ostraka* naming prominent leaders) is that the winning plurality was never small – i.e. that in a given year, most of those who voted to hold an ostracism, and those who cast *ostraka*, were focused on one of a handful of individuals. See, further, Rhodes 1994.

³⁸ Taylor 2008 forthcoming, arguing persuasively that exogenous factors (e.g. demographic changes due to disease, war, rural migration to the city) are inadequate to explain the growth in participation. Taylor’s figures fit well with the conclusions of Morris 1998a: 235-36, who notes that in comparative terms, and especially in comparison with the pre-democratic period, the pattern of landholding in fourth-century Athens was “*extremely egalitarian*” (Morris’ emphasis: Gini coefficient of 0.382-0.386).