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# Epistemic Aspects of Representative Government\*

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## Epistemic Aspects of Representative Government

In the Federalist No. 68, Alexander Hamilton (1788/1961: 458) commends the Philadelphia Convention's plan for an Electoral College to choose the president, saying:

It was desirable that the sense of the people should operate in the choice of the person to whom so important a trust was to be confided. This end will be answered by committing the right of making it ... to men chosen by the people for the special purpose....

It was equally desirable that the immediate election should be made by men most capable of analyzing the qualities adapted to the station, and acting under circumstances favourable to deliberation... A small number of persons, selected by their fellows from the general mass, will be most likely to possess the information and discernment requisite to so complicated an investigation.

This article aims not so much to test that conjecture as to calibrate it – to define the parameters within which, and the reasons for which, it may or may not be true. It goes on to assess, in like manner, the epistemic consequences of bicameralism, of party government, and of representative government in its two modes (trustee and delegate).

What we refer to as “the Federalist’s conjecture” is the proposition that a smaller group of more competent people is epistemically superior to a larger group of less competent ones. In this article, we fix our focus on the two reasons that Hamilton offers for that proposition. (There may well be

others, but we do not explore them here.<sup>1</sup>) Hamilton's first reason has to do with the supposed fact that members of the smaller group will be more "capable": they will have been selected because they "possess the information and discernment" required for the task. Call that the Selection Effect (Vermeule 2009a: 45-6; 2009b: 27-8). Hamilton's second reason has to do with the supposed fact that, as a smaller group, electors would be "acting under circumstances favorable to deliberation." Call that the Deliberation Effect.

In Hamilton's own statement of the proposition, and in popular discussions both before and since, emphasis falls most heavily on the first factor, the Selection Effect. Condorcet (1785/1976: 50) was neither the first nor the last to say that "a very numerous [group] cannot be composed of very enlightened men" and to commend a smaller and more select decision-making body in consequence.<sup>2</sup>

But it is simply not the case that a smaller group of more competent people will always be epistemically superior to a larger group of less competent ones. Ironically, that is the clear lesson of Condorcet's very own

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<sup>1</sup> People might pay more attention to the task when they are members of a small group specifically assigned responsibility for the task than they would have done when members of a larger group in which the task is everyone's job and no one's (Vermeule 2009a: 46-7; 2009b: 28-30). Or people in the smaller group might take their role responsibilities seriously and be less likely to sacrifice the public interest to their own interests, as Madison (1788/1961: 62) speculates in Federalist No. 10.

<sup>2</sup> Madison (1787b), perhaps echoing Condorcet, had written similarly in Federalist No. 58 that "the larger the number, the greater will be the proportion of members of limited information and weak capacities." Montesquieu (1721/1973: 167), anticipating them both, wrote in Persian Letters that "there are very few good minds, and everyone agrees that there is an infinite number of bad ones."

Jury Theorem (CJT).<sup>3</sup> Whether the Federalist's conjecture will be true depends on four things:

- 1) The number of people in each group, large and small.
- 2) The independence and individual competence of people in each group.
- 3) How the agenda is set and voting is structured in each group.
- 4) How much deliberation contributes to the collective competence of each group.

In Section I we offer some sample calculations to illustrate the implications of that theorem for the Federalist's conjecture. There, we see that, given voting bodies of the size found in modern polities, the Selection Effect alone is unlikely to suffice to vindicate the Federalist's conjecture. If the Federalist's conjecture is to be true at all in such a polity, that will be largely due to the Deliberation Effect instead, as we show in Section II.

The general upshot of the Condorcet Jury Theorem is that, all else held equal, smaller groups are epistemically less reliable than larger groups. Whenever a smaller group is included as part of an overall decision-making procedure, the poorer epistemic performance of that smaller group compromises, to a greater or lesser extent, the epistemic competence of the overall process. Those small-group elements in a decision-making process

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<sup>3</sup> Assuming the average voter is individually better than random (perhaps that is what Condorcet doubted when making the above statement, but he offers no grounds for such doubts there).

constitute, in Adrian Vermeule's (2009a: 50-3; 2009b: 33-5) felicitous phrase, "epistemic bottlenecks." Examples include cases of smaller upper chambers in bicameral legislatures and small pivotal parties in parliaments. In Section III we provide some sample calculations to suggest what sorts of epistemic costs we might incur because of those particular epistemic bottlenecks.

Representatives who take a "trusteeship" attitude toward their role constitute another epistemic bottleneck. Where a large number of voters elects a small number of trustee-style representatives, that compromises the epistemic performance of the political process. In Section IV we provide sample calculations to show the epistemic costs that might follow from representatives taking a trustee-style attitude toward their tasks, compared to delegate-style representatives, or to making decisions by the direct vote of the electorate as a whole.

Actual representative assemblies, however, are typically composed of some representatives who take a trustee-style approach to their task and others who take a delegate-style approach. In Section V we provide sample calculations to show how many delegate-style representatives it takes in such a mixed assembly to make that assembly's overall epistemic performance almost as good as that of an assembly composed of trustees alone. 'Almost as good' might be good enough, because once again trustees are capable of benefiting from the Deliberation Effect in the assembly, in a way electorally-bound delegates are not.

## I. The Folly of the Selection Effect

Assume that a large number of voters has to vote on two alternatives, of which one is the correct or better choice. The Condorcet Jury Theorem (CJT) tells us that, when voting with simple majority rule, the majority is more likely to be right than the average voter. (Likewise, it has subsequently been shown, when voting by plurality rule on any number of options, under conditions analogous to those of the CJT [List and Goodin 2001].) Even better, the probability that the majority is right increases quickly with the number of voters and approaches 1 for large groups. The CJT rests on the following conditions:

- 1) each voter is competent, i.e. each voter has the same probability  $p > 0.5$  to vote for the correct alternative (or more generally, voters on average are better than random<sup>4</sup>);

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<sup>4</sup> It has been shown that the CJT holds even if the competence assumption is relaxed. Rather than having equal competence for all voters, it suffices to have an average competence in the two-option case of over  $p=0.5$  (Grofman, Owen & Feld 1983) to approach a group competence of 1 for large groups (Owen, Grofman & Feld 1989; Dietrich 2008). For some highly skewed distributions of individual competences, however, it is possible for group competence to be worse than the average individual competence, making the majority less likely to be right than the average voter (Owen, Grofman & Feld 1989).

- 2) the votes are statistically independent (conditional on the state of the world regarding the correct alternative<sup>5</sup>), i.e. voters are not influenced by each others' votes;
- 3) all voters vote truthfully for the alternative they believe to be correct.

Obviously, much in political life does not accord with those assumptions completely. Equally obviously, that model captures something important in politics, even if a lot of other things are going on. Insofar as politics is about finding correct options, and insofar as politicians and voters are genuinely interested in finding these, the CJT has clear relevance.

According to the CJT, it is perfectly possible for the majority among a large number of less competent (but still better-than-random<sup>6</sup>) voters to be more likely correct than the majority among a small number of more competent voters. The Federalist's seemingly-obvious conjecture is thus not necessarily true. It all depends on the average competence of people in each group, and on the number of people in each group.

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<sup>5</sup> Dietrich (2008) draws attention to an important problem for the application of the CJT. He shows that the independence assumption does not usually hold because conditioning on the state of the world does not rule out dependence induced by common causes that influence the voters. He points out that one could condition on all common causes influencing voters in the present decision problem, thereby making the independence assumption true. However, such a move renders the competence assumption unjustified, since there is no way of knowing the competence of individuals for each specific problem. A possible way to avoid this conundrum is to change the CJT framework and conditionalize competence and independence not on the state of the world, but rather on the available evidence (Dietrich and List 2004), as discussed below.

<sup>6</sup> Of course if the average voter is worse than random the CJT works in reverse; perhaps that is what Condorcet meant, in the passage quoted above.

The standard Condorcet Jury Theorem employs the following formula to calculate the probability  $\Pr(n,p)$  that a majority vote among  $n$  voters will yield the correct outcome<sup>7</sup>, when the probability of each of the voters voting for the correct outcome is  $p$ :

$$\Pr(n, p) = \sum_{h=(n+1)/2}^n \binom{n}{h} p^h (1-p)^{n-h} \quad (1)$$

Based on formula 1, we can undertake some sample calculations to see how the Federalist's conjecture might fare under various assumptions. First let us look at how the CJT operates in the smaller-scale settings where its consequences are more easily calculated and hence to which it has most familiarly been applied. Table 1 presents results for various values of  $p$  and  $n$ .

[Table 1 about here]

Focus on the case of 1001 people, each of whom is individually only  $p=0.550$  likely to be correct in a two-option choice. Suppose members of that group, following the Federalist's advice, decide to leave the choice to a small group of 11 persons who are more capable than themselves. How competent

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<sup>7</sup> Formula 1 assumes that  $n$  is odd. Throughout this article, when  $n$  is even and ties arise, we treat ties as a failure to reach the correct conclusion.

does each of those 11 persons have to be, for that smaller group to outperform the larger group epistemically? Well, given 1001 persons with average competence of  $p=0.550$ , the probability that a majority among them is correct is  $\text{Pr}=0.999$ . For a majority vote among merely 11 people to be as reliable as that, those 11 people would have to be individually over  $p=0.800$  likely to be correct. Maybe it is not strictly impossible, but it certainly seems unlikely that those 1001 people can find 11 people that much more competent than themselves.

So far as the Selection Effect is concerned, the Federalist's conjecture becomes even more implausible as the number of voters grows very large, as is the case in real-world electorates.<sup>8</sup> Take for example the 2008 US election.<sup>9</sup> There, the president was elected indirectly by an Electoral College consisting of 539 members, instead of being elected directly by the 131,000,000 people who voted in that year's presidential election.

For the sake of this example, suppose (contrary to fact but in line with the Federalist's hopes and expectations) that members of the Electoral College exercise their own judgment, rather than necessarily voting the same way as the citizens of the state they represent. And let us make the modest assumption that voters among the electorate as a whole are individually

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<sup>8</sup> Most legislatures of moderately large countries have on the order of 500-600 members (Inter-Parliamentary Union 2008). To avoid computational overload, we calculate  $\text{Pr}(n,p)$  for large values of  $n$  using by normal approximation; see Appendix 1 for details.

<sup>9</sup> Other large- $n$  examples appear in Appendix 2.

$p=0.510$  competent. For a majority among the 539 members of the Electoral College to be epistemically as reliable as a majority among 131,000,000 such voters, members of the Electoral College would have to be individually  $p=0.976$  competent.<sup>10</sup> That seems inconceivable.

Thus, the Federalist's conjecture is unlikely to be true by virtue of the Selection Effect alone. Among groups the size of contemporary electorates, anyway, it seems unlikely that a small group of individuals can be chosen that is sufficiently more competent for its collective competence to exceed that of the electorate as a whole.

## **II. Factoring in the Deliberation Effect**

The second and much less discussed prong of the Federalist's conjecture is that the smaller group might be more likely to be correct by virtue of its deliberative superiority.

There are at least three mechanisms by which deliberation might make a small group collectively more competent without altering the individual competence of the people comprising it:

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<sup>10</sup> How competent each member of the smaller group would have individually to be, in order for the collective competence of the majority among the smaller group to equal the collective competence of the majority among the larger group, is given by the number in the top-left of each cell in Table A2.1 in Appendix 2.

1) In the course of deliberation the group might uncover some new evidence.

Perhaps this is what Hamilton refers to when he claims that the small group “will be most likely to possess the information” to choose correctly. From this perspective, the CJT result should be interpreted in the light of the evidence available to the voters. The competence of individuals or groups is then construed as the ability to reach the judgment an ideal interpreter of the evidence would find. The CJT thus interpreted shows that the majority of a large group of independent voters (now independent conditional on the evidence) converges on the competence of an ideal interpreter who processes that evidence in the best possible way, and who chooses the option most likely to be true given that evidence (Dietrich and List 2004).<sup>11</sup> But that falls way short of saying that a large group of better-than-random independent voters is almost certain to reach the correct decision, tout court. The probability of being correct is upper-bounded by the probability that the evidence is pointing to the correct result. For instance, if the group competence is approximately 1, but the available evidence is patchy and only has a reliability of 60% - even for an ideal interpreter of the evidence - then the group will be right in 60% of the cases, even though it has a competence

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<sup>11</sup> This extension is plausible because the quality of judgments depends on the available evidence. It also explains why groups can be wrong even if the CJT results would suggest near infallibility. It is therefore sensible to read results regarding group competence as the probability to reach the judgment of the ideal interpreter, not as the probability of absolute correctness.

of 1. If deliberating together enhances the evidence base, it increases the likelihood of the group choosing the correct alternative, without the individual competence of its members increasing. Consider the example of a small group with collective competence 0.844 (this is the CJT result for 101 individuals with individual competence  $p=0.55$ ) facing evidence that leads to a 70% probability to identify the correct result, under the best interpretation. The probability that the group reaches the correct decision is  $0.844 * 0.7 + (1 - 0.844) (1 - 0.7) = 0.638$ . If the group can increase the quality of the evidence by deliberation to 75%, the probability to reach the correct result also increases to  $0.844 * 0.75 + (1 - 0.844) (1 - 0.75) = 0.672$ . If deliberation unearths better evidence, the chance to be correct increases without an increase in individual competence.

- 2) Allied to that is the thought that all the CJT proves is that the majority of a large group of independent voters who are better-than-random is almost certain to choose the best alternative from among the alternatives presented to them. If the correct alternative is not among the set presented to them, they cannot choose it. Insofar as deliberation among a small group leads them to add new alternatives to the menu for choice, and insofar as at least one of those added alternatives is better than the previous alternatives (or indeed the correct alternative), the group is able to select a better or correct alternative from the new set of

alternatives. That is another way in which deliberation among small groups can cause the collective competence of the group to increase, without the individual competence of its members increasing. The exact implications of this mechanism depend on the details, in particular the probability that the best alternative is one of the two alternatives to start with, how a group decides to add new alternatives, and how the vote among the final set of alternatives is conducted.

- 3) A third effect might be on processes of reasoning. Among large groups, decisions are inevitably taken by aggregating people's votes on the "bottom line." Among smaller groups, there are more discursive opportunities for "premise-probing" (Goodin 2008: 87-92). That can obviously improve individual-level decision-making, insofar as each internalizes the lessons learned from those probes of her own and others' premises and revises her chain of reasoning accordingly. It can also improve group-level decision-making, insofar as the decision processes of the group incorporates votes on premises and not just votes on the "bottom line" (Bovens & Rabinowicz 2006; List 2006; Pigozzi 2006). Incorporating premises is often (but not always) a better way to pool information and therefore reach better results.

Those are all ways in which a Deliberation Effect might occur, independently of any Selection Effect.

Exactly how much those various Deliberation Effects might contribute to a smaller group's epistemic competence will vary with circumstances, which we make no effort here to model in any formal way. Suffice it to say that those various Deliberation Effects are bound to contribute something. Let us, for the sake of argument, suppose they contribute only a little something. Let us suppose that the superior deliberative circumstances of smaller representative assemblies will make them at least one-percentage point more likely to reach the correct decision than the electorate as a whole.

Assuming we can count on the Deliberation Effect for that last one percentage point, we can then use the CJT formula to calculate how big the Selection Effect has to be in order for the Deliberation and Selection Effects combined to vindicate the Federalist's conjecture. To do that, we need merely calculate how individually competent each member of the representative assembly would have to be, in order for the assembly's collective competence to be within one percentage point of that of the electorate as a whole.

Return to the case of the 2008 US presidential election.<sup>12</sup> If we can rely upon the Deliberation Effect to improve the smaller Electoral College's collective competence by one percentage point, then voters who are  $p=0.510$  individually competent only have to choose representatives who are  $p=0.551$  individually competent in order for the collective competence of the 2008 US

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<sup>12</sup> Once again, examples of other assemblies and other values of  $p$  are shown in Appendix 2.

Electoral College to exceed the collective competence of the electorate as a whole.<sup>13</sup> That would seem to be an eminently realistic ambition.

Thus, the Federalist's conjecture is plausibly true. But to be plausibly true, the conjecture has to rely heavily on the Deliberation Effect. It cannot rely upon the Selection Effect alone.

### **III. Institutional Epistemic Bottlenecks**

One lesson of the CJT is that incorporating a smaller decisional body in the political process constitutes a bottleneck that undermines the epistemic reliability of the process overall. There are various familiar examples of such small decisional bodies in the institutional architecture of modern democracies. Smaller upper houses in bicameral legislatures are one

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<sup>13</sup> Indeed, if we can assume the Deliberation Effect can be relied upon for at least a one percentage point improvement in the assembly's collective competence, voters can sometimes even choose representatives who are individually less competent than themselves and the assembly's collective competence will still exceed that of the electorate. Appendix 2's Table A2.1 shows, for example, that in the 2005 House of Commons MPs need to be only over  $p=0.546$  competent for their collective competence to exceed the collective competence of an electorate composed of voters whose individual competence is  $p=0.550$ , or, indeed, anything higher. The explanation of this result – and of why the required competence for representatives does not increase with increasing competence of individual voters after some point – is that the electorate has achieved a collective competence of virtually 1, and ever-higher competences among individual voters cannot improve that performance. In those cases, the question is simply what individual competence is required among members of a representative assembly of the requisite size to achieve collective competence of 0.990. And with representative assemblies the size of the UK House of Commons, that level of collective competence is achieved with surprisingly low levels of individual competence.

example.<sup>14</sup> Small pivotal parties in parliaments are another. Just how much of an epistemic bottleneck might those be – assuming epistemic performance is one attribute (among many others) by which we should evaluate our political institutions?

### **A. Strong Bicameralism**

By “strong bicameralism” we mean having two directly-elected sets of representatives sitting in separate chambers of differing sizes, each of which has a veto on legislation.

We focus upon the particular example of the US Congress, comprised of a larger House of Representatives (with 435 members) and a smaller Senate (with 100 members). Suppose each of them takes a trustee-style attitude toward the representational task, voting purely on the basis of his or her own judgment. Further suppose that the average competence of individuals in each chamber is  $p=0.55$ . Finally, let us take the number of people in 2008 voting for members of the House of Representatives (112,588,380) as the

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<sup>14</sup> Condorcet was himself bitterly opposed to bicameralism, as he reiterated to Franklin when the draft of the new draft US Constitution arrived in France in November 1787 (Rosenkranz 2007: 1293). The problem is not, however, just (or even mainly) that “bicameralism amounts to splitting the sample information and results in the effective sample size” (Brennan and Hamlin 1992: 177). The larger problem is the “bottleneck” problem we outline below: not that we have 435 instead of 535 people sitting in one chamber, but rather that we have a mere 100 sitting in one chamber with a veto on the other.

number of people who presumably would have voted in a referendum that year if direct democracy had been employed.

With those assumptions in place, we are in a position to explore the epistemic consequences of giving the smaller upper chamber a veto on legislation passed by the larger lower chamber, comparing the result to a unicameral representative government, and to direct democracy. With an electorate the size of 2008's, the probability of the majority among them coming to the correct conclusion is almost one, so long as voters on average are individually only better than random at reaching the correct conclusion.<sup>15</sup> So the probability of a correct decision from a direct-democratic vote would be  $\text{Pr} \approx 1.0$ . If the US Congress consisted of the House of Representatives alone, the probability of a correct decision from the 435 of them would, on the assumptions outlined above, be  $\text{Pr} = 0.982$ . That is not that far off direct democracy's mark. But the actual US Congress is strongly bicameral. For an enactment to become law, it must pass both the 435-member House and the 100-member Senate. On the assumptions above, the probability both chambers will reach the correct decision and thus enact it into law drops to  $\text{Pr} = 0.828$ .<sup>16</sup>

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<sup>15</sup> Of course, for a group of any given size, however large, there is some value of  $p$  so very close to 0.5 that the probability that a majority among the group is correct will fall appreciably short of 1.0. But for a very large group  $p$  has to be very, very, very close to 0.5 for that to be the case.

<sup>16</sup> To capture the tie-breaking power of the the Vice President in the Senate, we model the Senate as a group with 101 members. For a decision to be made, both chambers have to vote for the correct alternative.

From the CJT, we know (within the restrictive assumptions of the CJT of course) that the smaller chamber in a strongly bicameral legislature must necessarily constitute something of an epistemic bottleneck.<sup>17</sup> Now we are in a position to say just how much of a bottleneck it might be, in some real-world political settings. On the assumptions above, requiring legislation to be passed by the Senate rather than the House alone reduces the epistemic competence of the US Congress from just over 98 percent to just under 83 percent – a 15 percentage point reduction. Of course, epistemically direct democracy would be even better, but only by a small margin. It is strong bicameralism that carries much greater epistemic cost. The Senate would only cease to be an epistemic bottleneck if it reached a collective competence close to one – which would require an extraordinarily strong Deliberation Effect, or extremely competent Senators. And say what one might about the competence or the superior deliberative capacities of the smaller upper chamber, it seems highly unlikely that they will be able to close a gap of that magnitude.<sup>18</sup>

### **B. Parliaments with Small Pivotal Parties**

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<sup>17</sup> Game theoretic considerations may point in just the opposite direction, of course. Interplay between the two chambers might for example lead to better results, because each chamber hates to be corrected by their colleagues from the other chamber.

<sup>18</sup> Of course, it may appear that sticking with the status quo is often a good decision, and the “epistemic bottleneck” should better be seen as an institutional check against rushing into wrong policies. But in the epistemic framework discussed here, the status quo can be included among the available alternatives. In that case, failing to reach any decision (neither for the status quo, nor for anything else) can only be described as a decision failure.

In the real world, representative assemblies are almost invariably organized along party lines. In strongly whipped parliaments, representatives virtually always vote in line with the instructions of their party, rather than exercising their own independent judgment or following the instructions of their constituents.

In a parliament with strong parties of that sort, there are only as many independent sources of judgment at the point of voting on legislation as there are parties. Of course there are more physical bodies in the lobby. But all those MPs are not independent sources of judgment: they all vote as their party dictates. Reducing the number of points of independent judgment in that way can have dire epistemic consequences, the CJT teaches us.

Let us suppose however those MPs are not purely lobby fodder, just doing as they are told and not exercising any independent judgment anywhere at all. Let us suppose that they exercise independent judgment in the party room, rather than on the floor. That is to say, rather than exercising independent judgment when voting on legislation, they instead exercise independent judgment within the party in trying to shape its policies in ways they think best.<sup>19</sup> For the model described below, let us further assume

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<sup>19</sup> I.e. as trustee-style representatives, rather than following any instructions from the voters in their constituencies.

(clearly contrary to fact!) that party policy is chosen purely by a majority vote among the party's MPs.

To model this situation, let us imagine a parliament that is strictly whipped, which is to say that there is a strict (in UK parlance, "three-line") whip on every issue and MPs always vote strictly according to their party's instructions. Assume there are 603 MPs and that 302 votes are required to enact legislation. Further suppose that MPs are individually  $p=0.55$  competent, both across the parliament as a whole and within each of the parties into which they may be divided.

With those assumptions in place, we are now in a position to calculate the epistemic consequences of dividing legislatures into parties and, in particular, of there being some small pivotal party that must be included in any legislative majority. Suppose first there were no parties at all in the parliament, as was the Federalist's original vision (Madison 1787/1961: 57). On the assumptions sketched above, the probability that a majority vote in such a parliament would be correct is  $\text{Pr}=0.993$ . Introducing parties as such does not do much to reduce that. If the parliament were divided into two almost-equal parties (one with 302 MPs, the other with 301), the probability that a majority vote in parliament would be correct – which is just the probability that the majority among those 302 MPs in the government party room would be correct – is still  $\text{Pr}=0.954$ . And if there were three equal parties (201 MPs each) then on the above assumptions the probability that a

majority comprising any two of them would reach the correct decision would be  $\text{Pr}=0.983$ .<sup>20</sup>

It is not the dividing of parliament into well-whipped parties that causes epistemic damage, but rather the introduction of unequally sized parties. And even that, as such, is not the problem. Suppose the parliament were comprised of two large parties (275 MPs each) and one small one (with 51 MPs). If any combination of parties could constitute a majority, then the probability of a correct decision emerging from that parliament is still  $\text{Pr}=0.976$ . Epistemic problems arise only where the small party is pivotal, that is to say, has to be included in the winning majority.<sup>21</sup> On the assumptions described above, having to include such a small pivotal party in the majority reduces the probability that the parliament would make a correct decision to  $\text{Pr}=0.762$ .

Again, we should realize from the CJT that some small pivotal party having to be included in any majority that forms must necessarily constitute something of an epistemic bottleneck. The contribution of the calculations just presented is to enable us to say just how much of a bottleneck it might be, in real-world political settings. On the assumptions above, having to include a small pivotal party of the sort described would reduce the epistemic competence of the parliament in question from over 97 percent to just over 76

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<sup>20</sup> Calculated as described in Appendix 3.

<sup>21</sup> We further assume here that the smaller party is pivotal for reasons that are independent of the substance of the position it takes on the policy under discussion: otherwise complex issues of endogeneity arise.

percent – a drop of 21 percentage points. Of course, from an epistemic point of view, not dividing parliament into strong parties would be even better, but only modestly so. It is small parties being pivotal that carries the much greater epistemic cost.

#### **IV. Delegate versus Trustee-style Representatives**

Having calibrated the epistemic costs of familiar "bottlenecks" – small upper chambers, small pivotal parties – in the institutional architecture of legislative assemblies, let us turn our attention back to the representatives themselves.

So far we have been assuming that representatives act as "trustees," each voting on the basis of his or her own independent judgment as to what is best. Alternatively, of course, representatives could act as "delegates," each voting strictly according to instructions given by his or her electors. To what extent would representatives taking this different attitude toward their task solve the epistemic problems discussed in Sections I-II above?

##### **A. Constituency-based Representation with Delegates**

Making public decisions through a legislative assembly composed entirely of representatives who take a delegate-style attitude toward their task is

importantly different, from an epistemic point of view, from direct democracy. The reason is that representatives represent particular constituencies. First let us reflect upon the epistemic consequences of bunching voters into constituencies, even if their representatives see their role purely as delegates.

To calculate the probability that delegate-style representatives acting on instruction in this way reach the correct collective decision, we need to apply the CJT formula twice. First we use it to calculate the probability that the majority of constituents is correct in the instructions they give to their representative. Since the representatives always vote as instructed, we equate that with the probability that each representative's own vote will be correct. We then use the CJT formula for a second time to calculate the probability that a majority of representatives with that level of individual competence will reach the correct collective decision.

Think for example about the 2005 British General Election. Each of the 646 Members of Parliament was elected by around 40,000 voters. So long as the individual competence of each voter is relevantly over one-half, with numbers like 40,000 the probability that the majority among them is correct is going to be very close to 1.<sup>22</sup> Representatives instructed by these large constituencies will reach correct decisions with near-certainty. Thus, there is

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<sup>22</sup> Of course there is some  $p$  so close to 0.5 that that will not be true. For example, to achieve collective competence of  $\text{Pr}=0.99999$ , the average individual competence of 40,000 voters needs to be above  $p=0.5108$ .

virtually no epistemic difference between delegate-style representative government and direct democracy, where electorates are of the size we typically see in real-world politics. There is virtually no epistemic cost in dividing voters up into constituencies, so long as they are represented by delegate-style representatives.

### **B. An Epistemic Advantage of Trustee-Style Representatives**

Is there any credible scenario by which the collective competence of a group of trustee-style representatives might overtake that of groups of delegate-style representatives? Looking at it one way, it seems unlikely. After all, trustees would have to be individually as competent as delegates for their collective competence literally to equal that of the same number of delegates under the same circumstances. And since the competence of each delegate following the instructions of large numbers of better-than-random constituents is very close to 1, the individual competence of trustees have to be near 1 to match that.

But assemblies the size of the 2005 UK House of Commons could perform almost as well (be within one percentage point as accurate as) the electorate as a whole with individual competences of individual

representatives being as low as  $p=0.546$  on average (see Appendix 2). The Deliberation Effect can plausibly close that sort of a gap.

Notice, however, that the Deliberation Effect can work only for trustee-style representatives, not for delegate-style ones. However much delegate-style representatives discuss matters with one another in the assembly, at the end of the day delegates must by definition vote as they have been instructed by their constituents.<sup>23</sup> Trustee-style delegates are not so bound, and their votes can indeed be changed by deliberation within the chamber. That affords trustee-style representative government some real scope for “closing the epistemic gap” between it and delegate-style representative government.

### **C. Assemblies with Both Delegates and Trustees**

So far we have been treating representative assemblies as if they were comprised either of all trustees or all delegates. A more realistic scenario is

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<sup>23</sup> With one possible exception: Perhaps it would be logically possible for delegates to ask their constituents to instruct them again after the deliberation, and for the constituents to use the advantage of better information or better options after the deliberation in issuing these new instructions. Then the collective competence can improve even with a delegate-style approach. Of course, this depends on constituents benefiting from deliberations to which they were not themselves directly party.

that, on any given issue, some representatives behave as trustees and some as delegates.<sup>24</sup>

In modeling that scenario, we take the case of an assembly with 99 representatives, each of whom is elected by 101 constituents. We assume the individual competence of each representative, when acting as a trustee on the basis of his or her own judgment, is  $p=0.550$ . We assume the individual competence of each constituent is also  $p=0.550$ , which (from formula 1) means that the collective competence of a majority among the 101 of them is  $Pr=0.844$ . A representative who acts as a delegate votes strictly in accordance with the majority of his or her constituents, so each delegate-representative's individual competence is in this scenario  $p=0.844$ .

Figure 1 displays the way in which the collective competence of such an assembly varies, depending upon the number of the representatives who behave as delegates.<sup>25</sup> Where there are no delegates and all trustees among the 99 members of the assembly, the collective competence of the assembly is 0.844. But as we see from Figure 1, it rises rapidly with just a few delegates, closely approaching 1 by the time there are just 20 delegates in the 99-member assembly.

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<sup>24</sup> Maybe some representatives act as delegates and others as trustees on all votes and all issues. Or maybe different representatives assume each of those roles on different occasions, so each representative sometimes acts as a delegate and sometimes as a trustee. The model we describe is interpretable under either description.

<sup>25</sup> Calculated as described in Appendix 4.

[Figure 1 about here]

Thus, it does not take anything like half of the representatives behaving as delegates for the collective competence of an assembly to come very close to one. At first blush this might come as a surprise. But upon reflection, it should not be so surprising. If the individual competence is low, most results will end up around an equal split of opinions. If there is a small group that votes more reliably, that increases substantially the group's collective competence overall.<sup>26</sup>

### **V. But What if the Electorate is Worse than Random?**

Throughout our discussion, we have been assuming that the individual competence of members of the electorate is relevantly greater than one-half.<sup>27</sup> If it is, then given the size of real-world electorates it is almost certain that the majority of them reach the correct decision. But if it is not – if voters are worse than random in making their political choices – then by the same CJT logic it is virtually certain that the majority of them will reach the wrong

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<sup>26</sup> As List (2003) has shown, group competence depends on the absolute margin (and not the proportion).

<sup>27</sup> “Relevantly” in the sense of footnote 15 above.

conclusion. In that case, trustee-style representatives exercising their own independent judgment – even if the probability of their being right is low – would be epistemically superior to the almost-certain error of the majority among the electorate at large.<sup>28</sup>

One final way of vindicating the Federalist's conjecture, then, would be to suppose that the average competence of individual voters is  $p < 0.500$ . Then trustee-style representative government is always epistemically superior to direct democracy. But that way of vindicating the Federalist's conjecture would leave another large question unanswered, which is why we should let people with competence  $p < 0.500$  choose their own representatives. By the CJT logic, we know that they would virtually always make the wrong choice.

Hence, this line of thought would vindicate the Federalist's conjecture if and only if the electorate is better at choosing people than policies. Here are some reasons why they might be:

- Trustee-style representatives may be much better at complex decisions. Perhaps the electorate is not systematically better than random to make complex decisions, but is better than random at choosing trustees based on general character evaluations.

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<sup>28</sup> Indeed, if the competence of representatives is  $p < 0.500$ , it would be epistemically superior to leave the decision to one of them (call her the Dictator) rather than taking a majority vote. By CJT logic, if people's probability of being correct is  $p < 0.500$ , then the probability  $Pr$  that the majority among them is correct is less than the probability of any one of them being correct ( $Pr < p$ ). An even better procedure, of course, would be to flip a coin, or, indeed, do exactly the opposite of what the majority has decided.

- Direct democracy asks people to decide on many issues in which their personal stakes are very low (Downs 1957; Owen & Grofman 1984). Under such conditions biases and attempts to influence voters are more likely to succeed.
- Similarly, if voters think their competence is low, they might be tempted to “epistemically free-ride” by just siding with the majority. Such a lack of independence may lead to cascades and thus bad outcomes (List & Pettit 2004; Vermeule 2009a: 46-7; 2009b, 28-9).
- It is possible that many people do not make up their own mind but rather follow opinion leaders. In modeling terms this can be represented as a reduction of  $n$ .<sup>29</sup> In the extreme case, people follow either Fox News or CNBC, so that the station with more followers always wins, and  $n$  is effectively reduced to 1.

Of course, the last three of these forces will work to contaminate voters’ choices of representatives as well. Those last three forces will also work to contaminate the decisions of representatives – who will after all be accountable to their electorates come the next election, and who are likely to act as “delegates,” at least in part, in view of that fact.

Beyond all that, however, notice that the Federalist’s conjecture will be vindicated if and only if the electorate is better at choosing people than

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<sup>29</sup> It can also be modeled, more generally, as a relaxation of the independence condition. See Ladha (1992) for formal results pertaining to that approach.

policies in a very precise way. Individual voters must be individually significantly less competent than  $p=0.500$  at choosing policies but significantly more competent than  $p=0.500$  at choosing people. Perhaps sometimes the electorate's differential competence at choosing people and policies takes that very specific form, pivoting around 0.500. But again, that seems unlikely to be the case with any generality, which is what would be required for the Federalist's conjecture to be vindicated with any generality.

### **Appendix 1: Estimation of group competence with large n.**

We calculate results for  $Pr(n,p)$  for large  $n$  by normal approximation to avoid computational overload:

$$Pr(n, p) \approx 1 - \Phi \left( \frac{(n-1)/2 + 0.5 - np}{\sqrt{np(1-p)}} \right),$$

where  $\Phi$  is the cumulative distribution function of the normal distribution.

### **Appendix 2: Calibrating the Selection Effect in Real-world Representative**

#### **Assemblies**

In Table A2.1 we explore the collective epistemic competence of three actual assemblies:

- First is the case most immediately on Hamilton's mind: the Electoral

College for the first US presidential election in 1789. There were 69

members voting in the Electoral College that year.<sup>30</sup> There were 38,818

votes cast for electors that year.<sup>31</sup>

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<sup>30</sup> Each cast two votes, so there were 138 electoral votes cast but only 69 actors exercising independent judgment à la the CJT.

<sup>31</sup> That may seem a surprisingly small number of votes, but less than two-thirds of states that year chose electors by any form of popular election, and even where they did the franchise was severely limited.

- Second is the Electoral College in 2008. That year 538 members of the Electoral College were chosen on the basis of 131,237,603 popular votes.
- Third is the UK House of Commons in 2005. That year 27,110,727 popular votes were cast for 646 MPs.

[Table A2.1 about here]

For each of those representative assemblies, we calculate two statistics. The first, appearing in the upper left corner of each cell in Table A2.1, is how competent each individual in the representative assembly would have to be in order for the assembly's collective competence literally to match that of the electorate as a whole. That is the individual competence of each representative that would be required in order for the Federalist's conjecture literally to be true of those assemblies by virtue of the Selection Effect alone.

We calculate those isocompetence values using the Grofman-Dummkopf-Witkopf theorem (Grofman et al. 1983). Let there be two groups, the first of size  $n$  with individual competence  $p_1$ , the second with size  $n+y$  and competence  $p_2$ , such that  $p_1 > p_2$ . The Grofman-Dummkopf-Witkopf theorem states that the two groups are approximately equally competent if:

$$y = \frac{n(p_1 - p_2)(p_1 + p_2 - 1)}{4(1 - p_1)p_1(-1/2 + p_2)^2}.$$

Solving for  $p_1$  yields

$$p_1 = \frac{1}{2} + \frac{1}{2} \sqrt{\frac{n - 4np_2 + 4np_2^2 + y - 4p_2y + 4p_2^2y}{n + y - 4p_2y + 4p_2^2y}},$$

which we use to derive the isocompetence values stated in Table A2.1.

In the bottom right corner of each cell in Table A2.1, we report how individually competent each member of the representative assembly would have to be, in order for the assembly's collective competence to be within one percentage point of that of the electorate as a whole.

The results reported in the lower right corner of the cells in table 2 are derived by using the inequality

$$\Pr(n_1, p_1) + 0.01 \geq \Pr(n_2, p_2),$$

with  $n_1 < n_2$  and  $p_1 > p_2$ . We estimate  $\Pr(n_2, p_2)$  with normal approximation, and use Mathematica© to solve for  $p_1$ .

### **Appendix 3: Multi-Party Parliaments**

Let there be three parties A, B and C with respective collective competences  $\Pr_A$ ,  $\Pr_B$  and  $\Pr_C$ . Assume that any combination of two parties constitutes a majority. To determine the competence of a parliament with strictly whipped parties  $\Pr_{\text{Parl}}$ , we calculate the probability of a majority for the correct alternative:

$$\Pr_{\text{Parl}} = \Pr_A \Pr_B (1 - \Pr_C) + \Pr_A (1 - \Pr_B) \Pr_C + (1 - \Pr_A) \Pr_B \Pr_C + \Pr_A \Pr_B \Pr_C.$$

If, for some reason, party A has to be part of the winning majority, the competence of the parliament reduces to

$$\Pr_{\text{Parl}} = \Pr_A \Pr_B (1 - \Pr_C) + \Pr_A (1 - \Pr_B) \Pr_C + \Pr_A \Pr_B \Pr_C.$$

#### **Appendix 4: Group competence with delegate-trustee mix**

Let there be an assembly with  $d$  delegates and  $t$  trustees, with overall size  $n = d + t$ . Delegates have competence  $p_d$  and trustees competence  $p_t$ . Let  $v = \langle v_1, v_2, \dots, v_n \rangle$  be the voting profile. The set of all logically possible voting profiles that instantiate a majority for the correct solution is denoted  $W$ . Let  $c_d(v)$  be the number of delegates, and  $c_t(v)$  be the number of trustees that vote for the correct solution in  $v$ . The group competence is

$$\Pr(d, t, p_d, p_t) = \sum_{v \in W} (p_d)^{c_d(v)} (1 - p_d)^{d - c_d(v)} \binom{d}{c_d(v)} (p_t)^{c_t(v)} (1 - p_t)^{t - c_t(v)} \binom{t}{c_t(v)}.$$

## References

- Bovens, Luc & Rabinowicz, Wlodek. 2006. Democratic answers to complex questions – an epistemic perspective. Synthese, 150, 131-153.
- Brennan, Geoffrey and Alan Hamlin. 1992. Bicameralism and majoritarian equilibrium. Public Choice, 74: 169-79.
- Condorcet, Marquis de. 1785/1976. Essai sur l’application de l’analyse à la probabilité des décisions rendues à la pluralité des voix. Paris: l’Imprimerie Royale, 1785. Reprinted in part pp. 33-70 in Condorcet: Selected Writings, ed. Keith Michael Baker. Indianapolis: Bobbs-Merrill, 1976.
- Dietrich, Franz. 2008. The premises of Condorcet’s jury theorem are not simultaneously justified. Episteme, 58, 56-73.
- Dietrich, Franz & List, Christian. 2004. A model of jury decisions where all jurors have the same evidence. Synthese, 142, 175-202.
- Goodin, Robert E. 2008. Innovating Democracy. Oxford: Oxford University Press.
- Grofman, Bernard; Guillermo Owen; and Scott L. Feld. 1983. Thirteen theorems in search of the truth. Theory & Decision, 15: 261-78.
- Hamilton, Alexander. 1788. Federalist No. 68. Pp. 457-62 in The Federalist, ed. Jacob E. Cooke. Middletown, Conn.: Wesleyan University Press, 1961.

- Ladha, Krishna. K. 1992. The Condorcet Jury Theorem, free speech, and correlated votes. American Journal of Political Science 36(3), 617-634.
- List, Christian. 2006. The Discursive Dilemma and Public Reason. Ethics, 116, 362-402.
- List, Christian. 2003. On the significance of the absolute margin. British Journal for the Philosophy of Science, 55, 521-544.
- List, Christian and Robert E. Goodin. 2001. Epistemic democracy: generalizing the Condorcet Jury Theorem. Journal of Political Philosophy, 9, 277-306.
- List, Christian and Philip Pettit. 2004. An epistemic free-riding problem? Pp. 128-158 in Karl Popper: Critical Appraisals, ed. Philip Catton and Graham Macdonald. Abington: Routledge.
- Inter-Parliamentary Union. 2008. PARLINE database on national parliaments. Available at <<http://www.ipu.org/parline-e/parlinesearch.asp>>.
- Madison, James. 1787a. Federalist No. 10. Pp. 56-65 in The Federalist, ed. Jacob E. Cooke. Middletown, Conn.: Wesleyan University Press, 1961.
- Madison, James. 1787b. Federalist No. 58. Pp. \*\*-\*\* in The Federalist, ed. Jacob E. Cooke. Middletown, Conn.: Wesleyan University Press, 1961.

Montesquieu, Charles de Secondat, baron de. 1721. Persian Letters, trans C.

J. Bett. Harmondsworth, Mddx.: Penguin, 1973.

Owen, Guillermo, Bernard Grofman and Scott L. Feld. 1989. Proving a distribution-free generalization of the Condorcet Jury Theorem.

Mathematical Social Sciences, 17, 1-16.

Pigozzi, Gabriella. 2006. Belief merging and the discursive dilemma: an argument-based account to paradoxes of judgment aggregation.

Synthese, 152, 285-298.

Rosenkranz, Nicholas Quinn. 2007. Condorcet and the constitution.

Stanford Law Review, 59: 1281-1308

Vermeule, Adrian. 2009a. Law and the Limits of Reason. Oxford: Oxford University Press.

Vermeule, Adrian. 2009b. Many-minds arguments in legal theory. Journal of Legal Analysis, 1 (#1 Winter): 1-45.

Table 1: Probability that the majority of a group is correct, for given group sizes and competences

probability of each member of the group being correct

	0.501	0.510	0.550	0.600	0.700	0.800	0.900	
group size	11	0.503	0.527	0.633	0.753	0.922	0.988	$\approx 1$
	101	0.508	0.580	0.844	0.979	$\approx 1$	$\approx 1$	$\approx 1$
	1001	0.525	0.737	0.999	$\approx 1$	$\approx 1$	$\approx 1$	$\approx 1$

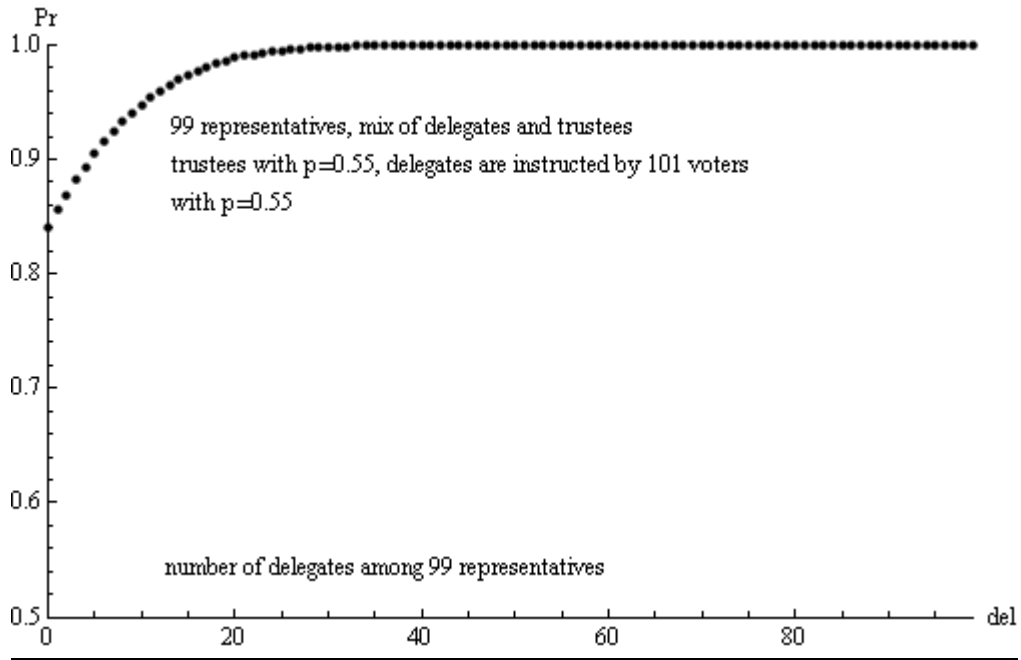


Figure 1: The epistemic competence of an assembly mixing delegates and trustees

Table A2.1: Estimated necessary competence of representatives to make their collective decision epistemically equal to that of the electorate or no more than 1% point worse

probability of each member of the electorate being correct

= within 1%	0.501	0.510	0.550	0.600	0.700
US Electoral College 1789	0.524 0.522	0.714 0.637	0.961 0.637	0.990 0.637	0.998 0.637
US Electoral College 2008	0.649 0.551	0.976 0.551	0.999 0.551	≈ 1 0.551	≈ 1 0.551
UK House of Commons 2005	0.690 0.546	0.986 0.546	0.999 0.546	≈ 1 0.546	≈ 1 0.546