Randomly Selected Representative Committees

Michael J. Hasday[†], Josep E. Peris[‡], Begoña Subiza[‡]

[†] *University of Massachusetts School of Law, Dartmouth, Massachusetts, U.S.*
[‡] *Universitat d'Alacant, MQiTE and IUDESP, Alacant, Spain.*

Abstract

There are many real-world examples where decisions are made by a committee rather than all of the members of a court, legislature, or other body. The members of such committees are usually chosen either using random selection or using direct selection by a designated authority. However, neither of these methods satisfies both of the lodestar principles that each member of the body has an equal opportunity of being selected to serve on each committee and that the collective view of each committee is representative of the collective view of all of the members of the body. We present a new committee selection method that has the core benefits of random selection (equal opportunity) and direct selection (the possibility of representativeness) while avoiding their pitfalls. This new method consists of creating a pool of "average" committees in which each member of the body serves on the same number of committees included in the pool, and then randomly selecting a committee from the pool.

Keywords: Representative Committee, Panel Assignment, Random Selection, Outlier Panel
JEL classification: D63, D71, K40

1. Introduction

In courts and legislatures around the world, many decisions are made by a committee of members rather than the entire body as a whole. Almost all democratic legislatures, and the highest courts of many nations—including Canada, Israel, South Africa, and the United Kingdom—employ committees (Benda, 1996; Alarie and Green, 2017). Committees allow courts and legislatures to be more efficient, and their smaller size may enhance collegiality and decision-making (Benda, 1996; Alarie et al., 2015).

In the judicial setting, for example, the United States federal appellate courts decide many of their cases in panels of three that are selected from the entire appellate circuit (Levy, 2017), and the Supreme Court of Canada, which has nine judges, decides some of its cases by a committee of five or seven judges (Alarie et al., 2015). In the legislative context, committees play a key role in screening, drafting, and amending legislation (McElroy, 2006). Legislatures use both standing/permanent committees, which have jurisdiction over proposed legislation, and ad hoc committees, which are formed for a particular purpose and then disbanded once the task is completed (Benda, 1996).

There are two general methods that courts or legislatures use to select their committees: random selection and direct selection. In random selection, the members of the committee are randomly selected from the full set of members. For example, the United States federal appellate courts mostly use this selection method to form its three-judge panels (Brown and Lee, 2000; Levy, 2017). Giving each of the members an equal chance to be selected for the committee and preventing any manipulation of the composition of the committee for strategic purposes are some advantages of the random selection method. However, the pitfall of this method is the possible creation of "outlier" committees, where the collective view of the committee does not reflect the collective view of the full set of members (Hasday, 2017).

In direct selection, one or more individuals (the "Selector") simply select the members for the particular committee. For example, the chief justice of the Supreme Court of Canada selects the judges for any five- or seven-judge panel (Alarie et al., 2015). Legislatures almost always use a variation of the direct selection method, where party leaders ultimately decide (after getting input from members) which members are assigned to which committees (Damgaard, 1995). The advantage of the direct selection method is that it provides the Selector with the ability to select for representative committees, or committees with members that have the most expertise for the issue at hand. However, the pitfall of this method is strategic manipulation, because there is nothing to prevent the Selector from forming a committee that reflects his or her own individual policy views (Hasday, 2017). In addition, this method does not provide equal opportunity for all members to be selected.

This paper presents a new committee selection method that has the core benefits of random selection (equal opportunity) and direct selection (the possibility of representativeness) while avoiding their pitfalls. In a nutshell, the method works by first assigning each member of the whole membership a number based on where the member falls on an ideological spectrum, which then allows a determination as to how close (or how far) every possible committee would be to the "average" committee. A pool of committees is then created out of the committees that are closest to the "average" committee, with the cut-off for the pool based on the point where each member serves in the pool of committees the same number of times. Finally, a committee is randomly selected from the pool.

The new method provides for representativeness by selecting a committee from a pool of "average" committees; i.e., committees that are representative of the full set of members. In addition, because each of the members will serve on the same number of average committees, the new method will also provide for equal opportunity. Finally, by randomly selecting a committee from the pool of average committees, instead of directly selecting the committee members, the method will protect against strategic manipulation on the part of the Selector and eliminates the incentives on the part of the members to align themselves with the Selector in order to get favorable committee assignments. We call this method Randomly Selected Representative Committees ("RSRC").[1]

2. Related Literature

Our proposal is related to, but distinct from, various rules and proposals that aim to ensure ideological diversity on committees. For example, the statutes establishing the Securities and Exchange Commission, the Federal Communications Commission, and the Federal Trade Commission provide that each has five commissioners, but only three of which can be from the same political party (Feinstein and Hemel, 2017). Similarly, the Delaware Supreme Court, which has five judges,

[1]While RSRC can be used in courts, legislatures, and other kinds of societies, the balance of this paper will discuss RSRC mostly in the judicial context.

is required to have three judges from one major political party and the other two judges from the other major political party (Delaware Judiciary, 2020). More recently, Epps and Sitaraman (2019) proposed a reform of the U.S. Supreme Court in which there would be fifteen justices, five of which are Democrats, five of which are Republicans, and five of which are mutually agreed upon by the other ten justices. However, in each of the above-mentioned examples, the panel sits en banc so the representativeness is not, and cannot be, tied to anything concrete, but rather is an abstract, political concept.

Tiller and Cross (1999) proposed a party balance requirement for U.S. federal appellate court panels in which every three-judge panel would be required to have at least one Democratic appointee and at least one Republican appointee. Unlike the prior examples, the Tiller and Cross proposal applies to subset panels. However, as in the prior examples, the Tiller and Cross proposal was concerned with representativeness in the political sense, rather than tying it to the ideological makeup of the membership of particular circuits. For example, if a particular circuit of the U.S. federal appellate courts consisted entirely (or almost entirely) of Democratic or Republican appointees, then the Tiller and Cross proposal would import judges appointed from outside the circuit to ensure ideological balance, which would potentially make the resulting panels less representative of the full circuit than even random selection.

Other rules, norms, and proposals aim to achieve representativeness closer to our definition but do not provide an equal opportunity for the members to be selected for any particular committee. For example, the ratios of Democrats and Republicans on U.S. Senate committees generally match the overall party ratio in the full body (Schneider, 2006), but of course every member does not have the same chance to serve on any committee. Bartrum et al. (2018) proposed a multi-step method for selecting three-judge panels that are representative of a nine-member body as a proposed reform of the U.S. Supreme Court. Under the Bartrum et al. method, the parties to the case would engage in a fair division scheme to select the panel, in which the final step has one of the parties selecting the panel from a list of two panels that the other party proposed. However, their method makes it more likely that the perceived centrist members of the court will be selected for the panel.

The importance of selecting committees with the dual properties of representativeness and equal opportunity has been recognized in the formation of so-called citizen assemblies, where civil-society organizations or public authorities assemble panels of ordinary citizens to assist on policy matters (Flanigan et al., 2021). However, in practice, citizen assemblies aim mostly for "descriptive representation"—where the demographics of the committee (but not necessarily the policy views) match those of the population.[2] Moreover, because such assemblies rely upon citizens accepting invitations to participate in the process, individuals from demographic groups that have lower participation rates will inevitably have a greater chance to be selected for the committee (Flanigan et al., 2021).

For example, in 2018, the voters of the state of Michigan passed an amendment to the Michigan constitution that established a citizen assembly called the Independent Citizens Redistricting Com-

[2]It is not surprising that citizen assemblies have leaned heavily toward descriptive representation because ordinary citizens—unlike judges and legislatures—do not have verifiable voting records. Without such verifiable records, there is a heightened risk that applicants will provide false information about their political beliefs, in an attempt to skew the representativeness of the assembly or to increase their odds of being selected for the assembly by placing themselves in an ideological group with lower participation rates.

mission where 13 citizens are purportedly "randomly" chosen from the pool of applicants (which can be any registered voter) to draw the boundaries for the state's legislature and U.S. congressional delegation (State of Michigan, 2020). However, the complex selection method that is used deviates from randomness in order to have the demographic and geographic makeup of the commission members reflect the makeup of the state and for the commission to end up politically balanced with four Democrats, four Republicans, and five members without any party affiliation. Accordingly, while every applicant has a chance to serve on the committee, an applicant's odds are greater if the applicant's attributes—demographic, geographic, and party affiliation (or lack thereof)—are underrepresented in the applicant pool.

Hasday (2017) proposed a method to form representative committees via an algorithm that utilized a ranking of the full set of members on a spectrum, e.g., from most liberal to most conservative, which he called the rank-order method. In this method, the ranking is ordinal, meaning the ideological distance between successive members on the spectrum is constant. This allowed for a relatively simple procedure to form the committees: if x equals the number of members in the society and n equals the number of members desired on the committee, then an "average" committee has a ranking of $(x + 1)/2$ and committees are selected from the pool in which the sum of the ranks of the n members on the panel equals $n(x + 1)/2$. The algorithm also contained a step to remove certain committees from the pool in order to have the members equally (or close to equally) distributed among the committees remaining in the pool.[3]

Hasday (2019) also proposed a "grouping method" where instead of ranking the judges on a spectrum, the judges would be placed into two equal groups, based on where they fell on the spectrum, i.e., the liberal half or the conservative half. The committee is then formed by randomly selecting the same number of judges from each group.

The method presented in this paper improves upon Hasday's previous methods in two respects. First, it allows for rankings that are cardinal, rather than ordinal, meaning the ideological distance between successive members on the spectrum can vary. This enables the ranking to more precisely capture the "gaps" between the judges, which could prove particularly advantageous in highly polarized societies, e.g., where there are large differences between Democrats and Republicans and no ideological overlap between the two parties. Second, it completely equalizes the chance of any particular judge to be selected for the panel for any particular case.

Recently, Huang et al. (2020) developed a new method that is similar to the "grouping method" but the number of "groups" (or "buckets", as they call them) equals the number of judges on the panel. Then one judge is randomly selected from each bucket to form the committee. In order to ensure that each bucket contains the same number of judges, some judges may be randomly eliminated before the buckets form. A more detailed comparison between RSRC and the Bucket method is presented at the end of this paper.

[3]In a prior iteration of the rank-order method designed specifically for the U.S. federal appellate courts (Hasday, 2000), the final ranking was based on the average of the ordinal rankings by the litigants.

3. A Normative Justification of RSRC based on the Condorcet Jury Theorem

The Condorcet Jury Theorem ("CJT") provides theoretical backing for RSRC and can also illuminate the circumstances where RSRC has advantages over current methods, as well as the circumstances where current methods may be superior. CJT holds that if every member of a group has a greater than 50 percent chance of selecting the correct answer among two alternatives, and the members decide independently, the group's probability of arriving at the correct answer by majority vote improves as more members join the group (Condorcet, 1785). Accordingly, if we assume that because judges are selected for their general expertise in legal matters they have a better than 50 percent chance at selecting the right legal answer, CJT suggests that the most accurate voting method for courts is to have the full set of judges decide every case (Krishnamurthi, 2020).[4]

However, given caseload pressures, many courts have determined that it is impracticable for the full set of judges to vote on every case and have opted to use a subset of the judges, i.e. panels, to decide many of the cases. Accordingly, as Abramowicz (2000) points out, by the logic of CJT, a representative panel is more likely to lead to the "correct" answer than an outlier panel.

Intriguingly, even if it were practical to have the full set of judges decide every case, smaller panels may have an inherent advantage over larger groups for the types of cognitively difficult choices that judges face. One of the key assumptions of the CJT is that votes are uncorrelated—that is, each member comes to his or her conclusion independently and is not influenced by the positions of the other members. Judges, of course, are supposed to deliberate with each other before reaching a decision. But deliberation may, in fact, lower the accuracy of the final decision due to information cascades or "groupthink" where would-be dissenters start doubting their positions in the face of the majority views (Austen-Smith and Banks, 1996; Sunstein, 2005). For difficult questions—which require a degree of work before arriving at the correct answer—the members of smaller groups are more likely to vote independently than members of larger groups (Kao and Couzin, 2014). Members of larger groups may be more likely to follow the lead of an opinion leader or rely on the same source material, as a time saving device, given that in larger groups each vote counts less (thus making it rational to skip the work involved in figuring out the answer) and there is more likely to be a member that the shirking member "trusts" to get the right answer. The correlated votes of larger groups then may overwhelm the uncorrelated votes, and lead to inaccurate decisions.

The risk of small groups, however, is that all the members will be from the same ideological faction, which increases the odds that members' votes will be correlated (Ladha, 1992; Hessick and Jordan, 2009). Ladha (1992) posits that small groups can be protected from this risk if its members are from different ideological factions, whose votes are more likely to be uncorrelated. In a similar vein, many commentators have observed that the most accurate decisions are produced by judicial panels with a diversity of views (Sunstein et al., 2006; Jordan, 2007; Ifill, 2000). In short, under certain assumptions, RSRCs are likely to arrive at the most accurate decisions because their views represent the view of the full set of judges while their small size and ideological balance protects them from the dangers of information cascades or "groupthink."

[4] We also need to assume that there is a "right" answer to the particular legal question, in the broad sense that one answer can be considered better than the alternative, or else CJT would not apply (Hessick and Jordan, 2009).

However, there may be circumstances where the current methods remain superior. Random selection may be optimal in matters where it is not possible to accurately predict how any particular judge will react to the case or identify which judges have the greatest expertise, such as a standard breach-of-contract action between two corporations. Random selection may also be optimal in matters where it is possible to identify which judges have the greatest expertise but you cannot fully trust the Selector to select the experts and refrain from strategic manipulation.

Direct selection may be the superior method in situations where it is possible to identify the most expert members of the group and you can fully trust the Selector to select the experts and refrain from strategic manipulation. For example, if you could identify in advance those members with the greatest expertise on a particular issue—say, those with an 80 percent chance of arriving at the right answer—then a committee of these super-experts is likely to be more accurate than either a randomly selected committee or a RSRC. Under these circumstances, the increased accuracy derived from the direct selection method likely outweighs any concerns about not providing each member an equal chance to be selected for the committee.

Outside of this limited context, however, it is difficult to find any advantage of direct selection over RSRC. While direct selection offers at least the possibility that the selected committee will be representative of the full set of members, there is inherent danger in such a system, particularly if the Selector is the chief judge as is common practice. The "temptation" for the chief judge Selector to select for his or her own policy views instead of the views of the full membership as a whole may be too great for a particular case.

Even if the Selector is a non-ideological court administrator instead of the chief judge, there may be professional pressures on the administrator to select in a non-representative fashion under a direct selection method. If the administrator is chosen by a majority of the members, the administrator could select the committee to be representative of the "majority" instead of the full membership as a whole, resulting in an outlier committee. For example, let's say that a committee has 10 members, seven of which are known to be conservatives and three of which are known to be liberals. On this particular issue, all the liberals side with Position A along with three of the seven conservatives. The Selector—because he or she was chosen by the conservatives—may nonetheless stack the committee with Position B conservatives because that is the position supported by the majority of the conservatives, although a minority position of the membership as a whole.

It may not always be possible to identify the optimal selection method for a given case. However, the answers to the following three questions can provide some guidance:

Predictability: Is it possible to predict the reactions of the judges based on the type of case?

Identification of Experts: Can you identify the expert judges in advance?

Trust: Can you trust the Selector in refraining from strategic manipulation?

Table 1 shows the suggested method based on the answers to these questions.

The calculus might change depending on whether, and the extent, the court or legislature allows the full set of members or a supervisory body to override the subset decisions, which can help "fix" the flaws of random selection or direct selection. For example, three-judge panel decisions of the U.S. federal appellate courts can be reversed by an en banc panel of the appellate court or by the

Predictability	**Identification of Experts**	**Trust**	**Suggested Method**
Yes	*Yes*	*Yes*	Direct
Yes	*Yes*	*No*	RSRC
Yes	*No*	*Yes*	RSRC or Direct
Yes	*No*	*No*	RSRC
No	*Yes*	*Yes*	Direct
No	*Yes*	*No*	Random
No	*No*	*Yes*	Direct or Random
No	*No*	*No*	Random

Table 1: Suggested Method Based on Predictability, Identification of Experts, and Trust.

U.S. Supreme Court, although these oversight mechanisms are used in less than one percent of the cases (Copus, 2020). On the other end of the spectrum, the bills that make it out of legislative committees are then considered by the full body (Benda, 1996), so outlier committees and the strategic manipulation of committees may be less of a concern in the legislative context.

Finally, Wald (1999) suggests that outlier decisions may even have some benefit for the judicial system in the aggregate, because having "extreme" decisions on both sides of an issue may illuminate the "correct" answer for the oversight court. However, more recent scholarship has questioned the value of such "percolation" for oversight courts (Coenen and Davis, 2021) and dissenting opinions can play this role with less costs to the outcomes of individual cases (Hasday, 2000), particularly where, as in the U.S. federal appellate courts, the available oversight mechanisms are rarely employed.

4. Making the Ranking

When describing representativeness of a committee we try to capture the idea that the "position" of the committee is close to that of the whole set of members. But, what do we mean by "position" of a committee? Judges may be ranked or characterized by ideological criteria on a spectrum (i.e., from more conservative to more liberal). Then, each member has a "characteristic" and each committee has a position determined by the average of the characteristics of its members.

There are two main ways that this ranking can be made: objectively and subjectively. An objective ranking will be performed by a computer via an algorithm based on "objective" criteria, which can be background variables of the judges or actual rulings by the judges. Background variables can be anything that serves as a statistically significant predictor for how the judge will rule in cases, such as the party of the appointing president for U.S. federal appellate judges (Sunstein et al., 2006).

These background variable predictors can be combined so that the judges can be placed on a spectrum. For example, on the U.S. federal appellate courts, one issue with using the proxy of the party of the appointing president is that it is binary in a two-party system, and does not provide a ranking of the judges, i.e., it does not tell you that one Democratic-appointed judge is more liberal than another. However, Giles et al. (2001) have combined this proxy with other background variables—specifically, the ideologies of the home state senators when the judge was appointed—in order to place the U.S. federal appellate court judges on a spectrum.

Other background variables could potentially be used for certain types of cases. For example, for the U.S. federal appellate courts, the sex of the judge is an independent predictor for sex discrimination cases, but for many types of cases the sex of the judge does not have independent predictive value (Boyd et al., 2010).

Alternatively, the objective criteria can be based on the prior rulings of the judges. For example, Martin and Quinn (2002) have developed a model for U.S. Supreme Court justices on a one-dimensional spectrum that is based on how often a particular justice votes with other justices. The model automatically adjusts the positions of the justices based on their votes and can position newly appointed justices on the spectrum by taking advantage of the "overlap" between the justices. This simple model can predict about 75 percent of the votes by justices from 1937 to the present.[5]

Lauderdale and Clark (2012) created a more complex, multi-dimensional model for U.S. Supreme Court justices that is tailored for the particular topic of the case. For example, this model can account for the fact that a particular justice may be on the "liberal" part of the spectrum for tax cases but on the "conservative" part of the spectrum for criminal procedure cases.

Finally, scholars have started using machine learning techniques to predict how individual judges will rule in a particular case. For example, Katz et al. (2017) built a machine-learning model to predict the individual justice votes and case outcomes for the U.S. Supreme Court, and Copus (2017) built a similar one for the Ninth Circuit Court of Appeals. In short, there can be little doubt that making a ranking via a computer—based on either background variables and/or actual case rulings—is technologically feasible.

However, there may be challenges with a purely objective ranking. First, although technologically feasible, every court system may not have the resources to develop an objective ranking. Second, while judges might find a ranking based on actual rulings acceptable, a ranking based on background variables might be seen as more problematic, as it uses proxies which might not hold true for a particular judge. Indeed, Wald (1999) criticized the Tiller and Cross proposal because its use of the proxy of the party of the appointing President does not treat judges as individuals and explicitly labels judges as Democrats or Republicans. However, the use of background variables might be unavoidable for newly appointed judges until they have issued an adequate number of rulings. Third, there might be particular objections with the use of personal characteristics as background variables, such as the sex of the judge.

An alternative to an objective ranking is a subjective ranking. A subjective ranking is simply the opinion of one or more persons of the location of the judges on the spectrum for the particular case. Posner (2008) suggests that it is fairly obvious to close court observers where the judges should be placed for politically charged cases, so the chief judge or a court administer could conduct the ranking themselves, much like they now do under direct selection systems. Another option for a subjective ranking is to have the litigants rank the judges and then average the rankings (Hasday, 2000), although this approach might favor the more well-resourced party who is better able to perform the ranking.

[5]Similar models have been developed for legislatures, such as common space scores (Shor and McCarty, 2011).

A final option for a subjective ranking is to have multiple outside experts rank the judges and then average the rankings. For example, Wijtvliet and Dyevre (2019) surveyed 46 EU competition law experts to construct a ranking of General Court judges under various dimensions. The authors found that the pro-business ranking of the median panel member could be used to predict the outcomes of competition and state aid cases.

In sum, an objective ranking based on the actual rulings of the judges may be optimal, as it addresses the concerns raised by Wald (1999) about the use of proxies and does not have the subjectivity of rankings based on personal opinions. However, where such an objective ranking is not feasible, a ranking based on either background variables or the average ranking of outside experts could be employed.

In our model we will assume that each judge or potential committee member has been assigned (exogenously) a specific position, represented by a real number. This allows a cardinal comparison of the differences in judges' positions and a determination of the average position of the entire set of members and that of each possible committee.

5. Addressing Possible Concerns with RSRC: Gamesmanship and Practical Considerations

We define strategic manipulation as a situation in which an individual manipulates the composition of the committee to produce outcomes that reflect the manipulator's policy views. This risk is obvious where courts use direct selection, and scholars have found evidence that such "gaming" occurred by the chief justices of the Appellate Division of the Supreme Court of South Africa from 1950 to 1990, the chief justices of the Supreme Court of Canada from 1986 to 1997, and the Chief Justice of the Supreme Court of Israel from 2015-2017 (Hausegger and Haynie, 2003; Givati and Rosenberg, 2020).

More surprising, however, is that scholars have likewise found evidence of strategic manipulation in the U.S. federal appellate courts, which purport to randomly assign judges to panels. However, U.S. federal appellate courts do not generally require true randomness because of their complex scheduling issues (Levy, 2017), and this discretion allows for "at least some degree of manipulation" (Brown and Lee, 2000). Indeed, Barrow and Walker (1988) found evidence that the chief judge of the Fifth Circuit Court of Appeals manipulated panels in civil rights cases from 1960 to 1967. More recently, Peppers et al. (2012) and Budziak (2015) found evidence of strategic manipulation in the chief judges' placement of visiting judges (i.e., judges from outside the circuit) on panels.

It is against this backdrop that the possibility of strategic manipulation in RSRC should be evaluated since not even random selection can totally preclude strategic manipulation. In theory, RSRC is vulnerable to manipulation through the formulation of the ranking. If a subjective ranking is used, it is possible that one or more of the rankers will submit a false ranking for strategic purposes. If an objective ranking is used based on background variables, it is possible that this will affect how judges are chosen as there might be a premium on appointing judges with "misleading" proxies. If the objective ranking is based on the actual rulings of the judges, it is possible that judges will alter how they rule in cases they care less about in order to "trick" the algorithm.

All of these potential strategies, however, are both more complex to pull off and have less certain payoffs than the more direct "panel stacking" strategies employed to manipulate the current systems, so it is unclear whether these vulnerabilities are more theoretical, rather than actual, risks. There are also measures that can be taken to protect against these strategies. For example, it is much less likely that a subjective ranking will be manipulated if you have multiple independent experts perform the ranking instead of the chief judge (who could have a conflict-of-interest) or even the litigants in the case (where there is a risk of possible collusion between the parties in order to establish a precedent that could be used for future cases).

Perhaps the most concerning manipulation possibility is the “trick the algorithm” strategy, the goal of which is for the judge to position herself on a non-representative panel in favor of the ideological direction of the judge. For example, a liberal judge might falsely take conservative positions in a series of unimportant cases, so when such judge is assigned a case she considers important, she can then take a liberal position with like-minded jurists (as she will be taking the “conservative” spot).

But how plausible is it that a judge will engage in such gamesmanship? As a general matter, it is not far-fetched to believe that judges will alter their votes under certain incentives. For example, on the U.S. federal appellate courts, judges who are being considered for a promotion to the U.S. Supreme Court have been shown to alter their rulings in order to gain favor with the U.S. president (Black and Owens, 2016). However, as Baum (2006) argues, judges are much more likely to alter their votes for an immediate benefit that accrues to them personally than for a future, abstract policy benefit that accrues to the public. Indeed, under the “trick the algorithm” strategy, the judge does not even know what the “payoff case” is and can do nothing to increase her odds of being assigned to any particular case. The best evidence that judges will not engage in this strategy might be that it is analogous to the concept of “vote trading” or logrolling (except the judge is effectively trading votes with herself rather than with another judge) which is reported to virtually never occur in the U.S. judiciary (Hessick and McLaughlin, 2014).

In any event, there can be safeguards built into a system that uses RSRC. For example, RSRC can be paired with the possibility of en banc review, so even if a judge managed to execute the “trick the algorithm” strategy the resulting outlier decision could be reversed by the full set of judges. In addition, RSRC could be used on an advisory basis for courts that use direct selection with the chief judge having the discretion to “veto” the RSRC panel if it appeared to be the product of mischief.

Finally, practical concerns about the implementation of RSRC, as well as concerns about possible gamesmanship, can be addressed through the targeted use of the procedure in circumstances where RSRC does not replace current systems in their entirety but is used in a complementary fashion. For example, several circuits of the U.S. federal appellate courts require true random selection for death penalty cases (Levy, 2017), presumably because of the life-and-death stakes of these appeals. However, there are compelling reasons to question whether random selection, even in its strictest form, is actually “fair” in this context. Beim et al. (2020) found that not only are the outcomes of these cases dependent on the identities of the three judges randomly assigned to the inmate’s first death penalty appeal, but whether the inmate is eventually executed can also be predicted by the panel composition, as the oversight mechanisms of en banc and/or U.S. Supreme Court review are performed too infrequently to rectify the inconsistencies. The authors suggest that the random selection of judges to death penalty appeal panels may even be unconstitutional under the U.S. Supreme Court’s decisions of *Furman v. Georgia* (1972) and *Gregg v. Georgia* (1976) which can be reasonably construed as prohibiting “arbitrariness” in death penalty sentencing.

Accordingly, there is a confluence of factors that would make RSRC's targeted use in this context ideal. First, the need for consistent decision-making and representativeness in this area is readily apparent. Second, these cases have already been selected for a specialized assignment procedure by several circuits. Third, it would be relatively straight-forward to perform a ranking of judges based on the particular judge's threshold for granting relief, and, in fact, Beim et al. (2018) did such a ranking in an earlier draft of their paper. Fourth, to the extent there is a concern about possible gamesmanship in RSRC, it is unlikely to occur in this context due to the similar nature of these cases.

In the legislative context, direct selection can result in representative committees (Battista, 2004; McElroy, 2006) but can also result in "party stacking" where members of the majority party are overrepresented on important committees (Hedlund et al., 2009). While it may not be practical to have RSRC to select standing committees in legislatures, RSRC could be used as the selection method for ad hoc committees, particularly for politically sensitive investigations. Famous examples of ad hoc investigative committees are the Senate Watergate Committee (1973-74), the House Select Committee on the Iran-Contra Affair (1987) (Congressional Oversight Manual, 2020), and more recently the House Select Committee to Investigate the January 6^{th} Attack on the United States Capitol ("Jan. 6 Committees"). In a highly polarized environment, party leaders might be incentivized under direct selection to stack an investigative ad hoc committee with the most partisan members, and members might engage in intense jockeying (including making promises to the party leaders on how they will behave) to secure placement on the committee. Case in point: the selection process for the Jan. 6 Committee broke down when the leader of the majority party refused to seat some of the "extreme" members that the leader of the minority party selected for the minority party's share of the committee appointments (Broadwater and Fandos, 2021). RSRC could serve as a vehicle to de-politicize, and enhance the perceived fairness, of an investigative ad hoc committee, so it functions akin to a grand jury. Other reasons why ad hoc investigative committees are an ideal setting for RSRC are that they generally do not require subject matter expertise on the part of the members and the infrequency that these committees are formed protects it from members attempting to game placement on the committee.

6. Formalizing our Proposal

As mentioned above, our goal is to build a set of eligible committees so that every member has an equal chance of being selected when randomly choosing a committee, and all committees fully represent the entire body. Since, in general, both objectives are not possible, we give priority to the first, and seek the most representative group subject to that constraint. In order to achieve these objectives, the pool of committees to be formed for random selection should fulfill the following properties:

- *Equal Opportunity for the Members*, i.e., each member should have the same chance to serve on any particular committee. Political theorists have touted the equal opportunity property as the core advantage of random selection because it advances the societal goals of social and democratic equality (Engelstad, 1989; Stone, 2016) and allows for allocative justice, i.e., it is the fairest method to assign members to a committee where each member of the body has an equal claim to such assignment (Stone, 2016). To the latter point, Samaha (2009) has argued that this "equal opportunity" principle is particularly important in certain judicial settings, where judges are of "equal status" (p. 71) and therefore have an equal right to be on any panel. Additionally, since a judge or legislator has an equal chance to serve on a committee regardless of where they are situated on the ideological spectrum, this principle prevents possible discord among the various ideological camps, as well as strategic positioning by the members. It also eliminates any incentive among members to curry favor with a Selector, which may include voting in the way the Selector desires in order to be placed on the most desirable committees (Feinstein, 2013).

- *Representativeness*, i.e., the selected committee should have a position relatively close to that of the entire set of members. On a fundamental level, this principle is justified on an agent-principal view of committees where the committee is intended to be the faithful servant of the membership as a whole (Ginsburg and Falk, 1991). In the judicial setting, this property will enhance the consistency, predictability, and fairness of the decision-making (i.e., like cases will be decided in a like manner), which are the cornerstone values of any legal system (Hasday, 2000). Finally, this "representative" property can be justified based on the Condorcet Jury Theorem, as discussed above.

- *Coherence in Representativeness*, i.e., if a committee is in the pool of committees, a more representative committee should also be in the pool of committees. This principle will ensure that the pool of committees has the lowest expected difference in position from that of the entire set of members, given the constraint that each member has an equal opportunity to serve on the particular committee.

We consider throughout that $N = \{1, 2, ..., n\}$ with $n > 2$ is the set of members that can be part of a committee of size $s < n$. As discussed in Section 4, we assume that members in N are identified by an exogenously characteristic position that can be represented by a positive real number $\alpha_i \in \mathbb{R}_+$, that determines a vector of characteristics, $\alpha = (\alpha_1, \alpha_2, ..., \alpha_n)$. Then, each α_i places the i-member within a spectrum of possible positions.

A simple example is to consider that α_i is a dichotomous variable, taking the values of either 0 or 1. For instance, in a two-party system, 0 will represent a member selected by the "right" political party and 1 will represent a member selected by the "left" political party. Another intuitive example is to consider α_i a number in some interval (e.g., from 0 to 100) denoting the precise political position of a member: 0 will represent the extreme right position, whereas 100 will represent the extreme left position; any intermediate number will correspond to intermediate political positions.

We suppose that we are not in a trivial case, and the characteristics of the members are not equal for all members: $\alpha_i \neq \alpha_j$ for some $i, j \in N$.

Let C_s be the set of all the possible committees of size s with members in N. The set C_s contains m committees, where

$$m = \binom{n}{s} = \frac{n!}{(n-s)!s!}$$

Each committee $c \in C_s$ can be denoted by a vector in $\{0, 1\}^n$, $c = (c_1, c_2, ..., c_n)$ such that s, and only s, entries of the vector have the value 1, representing which members belong to the committee. We write that member $i \in c$, if $c_i = 1$ and $i \notin c$, if $c_i = 0$.

We denote by $\Lambda(N) = \sum_{i \in N} \frac{\alpha_i}{n}$ the average position of the whole set of members. We refer to $\Lambda(N)$ as the position of N. In the same way, $\Lambda(c) = \sum_{i \in c} \frac{\alpha_i}{s}$ represents the average position of committee $c \in C_s$. For instance, in the dichotomous example $\Lambda(N)$ denotes the proportion of members selected by the "left" political party in the entire set of members, whereas $\Lambda(c)$ represents this proportion in a committee c. Obviously, a desirable property is that the proportion in any selected committee coincides with the proportion in the entire set (or, at least, these proportions be as close as possible). A similar argument applies to the non-dichotomous example.

We denote by $d(c, N) = |\Lambda(c) - \Lambda(N)|$ the distance between the average positions of the entire set of members and that of the committee c. We call this value the distance of the committee c to N. The closer the position of a committee is to $\Lambda(N)$ (the smaller the distance of c to N) the more representative of the whole set of members N the committee is.

The feasible pools of committees are elements in the power set $\mathcal{P}(C_s)$ (the set with all the subsets of C_s). Note that $\mathcal{P}(C_s)$ is in general a very large set, even for a small number of members (for instance, with 6 members and committees of size 3 we have more than one million possible pools of committees). For each pool $P \in \mathcal{P}(C_s)$, consider the vector $K(P) = \sum_{c \in P} c$. Then, $K_i(P)$ represents the times that member i appears in the committees within P. Note that, in order to guarantee equal opportunities for all members, we are interested in pools of committees for which all the entries of vector $K(P)$ are equal: $K_i(P) = K_j(P)$, for all $i, j \in N$.

With the aim of selecting a committee representative of the whole set of members N in a 'fair' way, we propose to choose it randomly from a 'particular' pool of committees. Then, the main question is: what should be in this 'particular' pool of committees so that the required properties are fulfilled?

If $P \in \mathcal{P}(C_s)$ is the pool of committees that we use to choose randomly within, let us formalize the properties it should fulfill. We say that P provides:

- **Equal Opportunities for all Members** (**EOM**): All members have the same probability of being in the selected committee. This fact is true when all members appear the same number of times in P, that is

$$K_i(P) = r, \text{ for all } i \in N, \text{ where } r \in \mathbb{N}$$

- **Coherence in Representativeness** (**CR**): If a committee is in P, a more representative committee should be in P too.

$$\text{If } d(c', N) < d(c, N) \text{ and } c \in P, \text{ then } c' \in P$$

- ε-**Representativeness** (ε-**R**): P guarantees that the selected committee has a position relatively close (the distance should be smaller than ε) to that of the whole set of members.

$$\text{For any } c \in P,\ d(c, N) \leqslant \varepsilon$$

From these properties, EOM is an essential requirement, since it guarantees equal opportunities for all members. Coherence tries to avoid not considering committees that have a position closer to the position of N than other committees being selected (for instance, for strategic purposes). Finally, Representativeness is also a desirable property, although, obviously, we cannot obtain a pool satisfying ε-R for any $\varepsilon \geqslant 0$ because there could even be no committees at a distance smaller than ε. Then, our goal is to obtain a pool satisfying EOM, CR and ε-R for an ε as small as possible.

7. The Optimal Pool of Committees

We first consider pools of committees in $\mathcal{P}(C_s)$ satisfying Equal Opportunities of Members and Coherence in Representativeness. Let us denote by $\mathcal{H}^{eq}$ the set of pools that fulfill the first condition:

$$\mathcal{H}^{eq} = \{P \in \mathcal{P}(C_s) : K_i(P) = K_j(P), \text{ for all } i, j \in N\}$$

and denote by $\mathcal{H}^{ch}$ the sets of pools satisfying coherence:

$$\mathcal{H}^{ch} = \left\{P \in \mathcal{P}(C_s) : d(c', N) < d(c, N),\ c \in P,\ \text{then } c' \in P\right\}$$

and finally denote by $\mathcal{H}$ the set of pools that fulfill both conditions

$$\mathcal{H} = \mathcal{H}^{eq} \cap \mathcal{H}^{ch}.$$

Obviously, this set is non-empty, $\mathcal{H} \neq \varnothing$, because $C_s \in \mathcal{H}$. For each $P \in \mathcal{H}$, $d(P) = \max_{c \in P} d(c, N)$ is the distance to N of the committee in P with the farthest position to N. Let us select the elements in $\mathcal{H}$ that minimize the previous distance:

$$\mathcal{H}^* = \left\{\arg\min_{P \in \mathcal{H}} d(P)\right\}$$

We denote by $d^* = \min_{P \in \mathcal{H}} d(P)$.

Given two pools $P^1, P^2 \in \mathcal{H}^*$, $P^1 \neq P^2$, by construction there are committees $c^1 \in P^1$ and $c^2 \in P^2$ so that $d(c^1, N) = d(c^2, N) = d^*$. Moreover, coherence implies that for any committee c such that $d(c, N) < d^*$, then $c \in P^1$, and $c \in P^2$. Therefore, P^1 and P^2 only differ in committees that are farthest away from the position of the entire group. Since we want to select committees whose position is as close to $\Lambda(N)$ as possible, we want to minimize the number of committees that are farthest away in order to maximize the chances to randomly select a 'good' committee. We formalize this discussion as follows.

For any $x \in \mathbb{R}_+$, $pr(P, x)$ represents the probability that a committee in P be exactly at a distance x to N. Then,

$$pr(P, x) = \frac{|c \in P : d(c, N) = x|}{|P|}$$

If we consider the particular case $x = d^*$, then $pr(P, d^*)$ is the proportion of committees in the pool P at the maximum distance (that is, the proportion of least representative committees in P). A higher number signifies a greater chance that a committee from this pool will be a 'bad' representation of the entire body. Therefore, we are interested in selecting pools so that $pr(P, d^*)$ is as small as possible; that is, we will use the pools in which the probability of selecting a committee at the greatest distance from N (the worst committees) is as small as possible. This leads us to the following definition of *optimal pool*.

Definition 1. *A pool of committees $P^* \in \mathcal{P}(C_s)$ is said to be* ***optimal*** *if:*

1. $P^* \in \mathcal{H}^*$
2. *For all $P \in \mathcal{H}^*$, $pr(P^*, d^*) \leqslant pr(P, d^*)$*

In general, there may be several optimal pools of committees. We denote by $\mathcal{O}(C_s)$ the set of all optimal pools of committees.

Observe that if we have two different pools P^{*1}, P^{*2} in $\mathcal{O}(C_s)$, then condition 1 of optimality in the above definition guarantees that both pools minimize the distance to the position of the entire set, $d(P^{*1}) = d(P^{*2}) = d^*$, and all members have the same chance to be randomly selected, $K_i(P^{*1}) = K_j(P^{*1})$, $K_i(P^{*2}) = K_j(P^{*2})$, for all $i, j \in N$. Moreover, condition 2 of optimality means that $pr(P^{*1}, d^*) = pr(P^{*2}, d^*)$.

7.1. ***Properties of the optimal pool***

Being $\mathcal{H}$ a finite set, $\min_{P\in\mathcal{H}} d(P)$ always exists and then $\mathcal{H}^*$ is a non-empty set. So, $\mathcal{O}(C_s)$ will contain pools P^* in $\mathcal{H}^*$ such that $pr(P^*, d^*) \leqslant pr(P, d^*)$ for any $P \in \mathcal{H}^*$. As $\mathcal{O}(C_s) \subseteq \mathcal{H}^* \subseteq \mathcal{H}$, each pool $P^* \in \mathcal{O}(C_s)$ is obviously a pool fulfilling EOM and CR properties. Furthermore, for each $P^* \in \mathcal{O}(C_s)$ and each $c \in P^*$, $d(c, N) \leqslant d^*$, so P^* also fulfills d^*-representativeness.

If there is some pool $P \in \mathcal{P}(C_s)$ not contained in $\mathcal{O}(C_s)$, $P \notin \mathcal{O}(C_s)$, fulfilling EOM and CR properties, then it should be in $\mathcal{H}$ and $d(P) \geqslant d(P^*) = d^*$, for all $P^* \in \mathcal{O}(C_s)$. Therefore, if P provides ε-representativeness, $\varepsilon \geqslant d^*$. In conclusion, each P^* in $\mathcal{O}(C_s)$ is a pool providing EOM, CR and ε-representativeness, for ε as small as possible.

Although the previous notion of optimal pool gives us an easy way of studying the existence and properties of this family of pools, the computation of $\mathcal{O}(C_s)$ is not an easy task by using the definition. The problem lies in the large number of sets of pools of committees in $\mathcal{P}(C_s)$. Next, we present an algorithm to obtain pools in $\mathcal{O}(C_s)$ in an easy way, without having to use the sets in $\mathcal{P}(C_s)$.

Keep in mind that, in order for a pool of committees to fulfill EOM, it is not possible for it to have any number of committees. In particular, the number of committees in the pool (k) multiplied by the number of members in each committee (s) must be a multiple of the total number of members in the entire body (n). That is, if $P \in \mathcal{P}(C_s)$ provides EOM and it has k committees ($|P| = k$) then, $ks = rn$ with r being a natural number. Thus, $k = \dfrac{rn}{s} \leqslant m$ and the possibilities for the number of committees in P are the integers values in $\left\{\dfrac{n}{s}, \dfrac{2n}{s}, \dfrac{3n}{s}, ..., m\right\}$.

For instance, if the entire body contains 7 members ($n = 7$) and we want to select committees with 3 members ($s = 3$), then $m = 35$ and there are more than 34 billion possible pools of committees. But, any optimal pool can only contain 7, 14, 21, 28 or 35 committees, and other size pools need not to be checked for optimality.

On the other hand, the coherence property (CR) makes the "best" committees (the ones with the nearest position respect to the entire body) always selected. Therefore, optimal pools will only differ on some committees that are at distance d^*.

These considerations allow us to obtain an easy algorithm providing optimal pools.

7.2. An algorithm to obtain an optimal pool

By means of the following process we can compute pools in $\mathcal{O}(C_s)$. We divide the algorithm in two parts. And the second part in two cases (the second one, the most general and complex, is explained in the Appendix).

Algorithm:

1. **Ordering committees**

   1.1 Compute the position of N: $\Lambda(N) = \sum_{i=1}^{n} \frac{\alpha_i}{n}$

   1.2 Obtain the set of all possible committees of size s, C_s

   Note that there are exactly $m = \binom{n}{s} = \frac{n!}{(n-s)!\,s!}$ committees of size s

   1.3 For each committee $c \in C_s$, compute its position: $\Lambda(c) = \sum_{i \in c} \frac{\alpha_i}{s}$

   1.4 For each committee, compute the distance to N: $d(c, N) = |\Lambda(N) - \Lambda(c)|$

   1.5 Order the committees from low to high according to its distance to N (ties can be ordered as desired). Then, write C_s in that order (from nearest to farthest):

   $$C = \left\{c^1, c^2, \ldots, c^m\right\}$$

   After these steps, we obtain an ordered list of the m committees that can be grouped in the following way:

   - First, we obtain the set of committees that are at the smallest distance from the entire body. We denote this set by M_1, and m_1 denotes the number of committees in M_1. All these committees are at a distance $d_1 = d(c, N)$, $c \in M_1$.
   - Next we obtain a set M_2, with m_2 committees, that are at the next smallest distance $d_2 = d(c, N)$, $c \in M_2$.
   - ...
   - Finally, we obtain the set M_t, composed by m_t committees, at the maximum distance from N, $d_t = d(c, N)$, $c \in M_t$.

   These sets fulfill:

   $$i < j \Rightarrow d_i < d_j \text{ and } m_1 + m_2 + \ldots + m_t = m$$

2. **Selecting a pool of committees**

   Now, we are going to select committees beginning from the closest to N (the one with lowest distance $d(c, N)$). Since the first objective is that all members must appear the same number of times, we only need to check pools of committees that contain k committees, where k is chosen such that ks is a multiple of n.

   Selecting a pool of committees case 1: no ties in distance from N *(for all $i, m_i = 1$)*

   2.1 Find the first integer number $k \in \mathbb{N}$ such that ks is a multiple of n

   2.2 Set $p = 1$

   2.3 Compute the sum of the first $r = pk$ vectors (committees):

$$K(1 \text{ to } r) = \sum_{j=1}^{r} c^j = c^1 + c^2 + \ldots + c^r$$

   2.4 Check if all components in $K(1 \text{ to } r)$ are identical. That means that all members appear the same number of times.

   - If the answer is "yes," we have the optimal pool.

$$P^* = \{c^1, c^2, \ldots, c^r\}$$

   - If the answer is "no," then set $p = p + 1$ and return to step 2.3.

Theorem 1. *The set of committees obtained with the previous method is an optimal pool in $O(C_s)$; that is, P^* is a pool providing EOM, CR and ε-R for ε as small as possible.*

Proof. Let P^* be the pool obtained with the previous algorithm. And let $c^r \in P^*$ be the last committee selected and $d_r = d(c^r, N)$ its distance to N. Obviously, by construction, P^* provides EOM and CR and ε-R for an ε as small as possible, in this case $\varepsilon = d_r$. Suppose that P^* is not an optimal pool of committees, $P^* \notin O(C_s)$. Then there is a pool $P^0 \in O(C_s)$ and a committee $c^j \in P^0$ such that $c^j \notin P^*$. In that case, for any $d^* \geqslant d(c^j, N) > d(c^r, N) = d_r$, a contradiction with the definition of optimal pool. So, P^* is an optimal pool. ■

Remark 1. *The previous result is always true, independently if there are ties or not. Observe that when all the committees have a different distance to N (no ties), only one pool can be obtained by applying the previous algorithm, so the uniqueness of an optimal pool P^0 is deduced. This uniqueness is not guaranteed in the general case shown in the Appendix, where the existence of several optimal pools is possible.*

8. An Example

Example 1. *Let $N = \{$Adams, Brown, Cooper, Dickens, Evans, Fox, Graham$\}$ be the set of members. We want to obtain a pool of 3-member committees from which we will select randomly one of them in order to represent the whole set N. Then $n = 7$, and $s = 3$. There are 35 possible* *committees and more than* 34 *billion possible pools of committees. Table 2 shows the characteristic of each member.*

MEMBER	*Adams*	*Brown*	*Cooper*	*Dickens*	*Evans*	*Fox*	*Graham*
LABEL	A	B	C	D	E	F	G
CHARACTERISTIC	3.2	3.9	5.1	7.9	10	13	14.1

Table 2: Members' Characteristics in Example 1

Then, the position (the average characteristic) of the group is $\Lambda(N) = 8.17$. *We compute the position of each* 3*-committee, its difference from the group position, and order them from nearest to farthest positions. Table 3 shows the result.*

ORDER	COMMITTEE	VECTOR c	POSITION $\Lambda(c)$	DISTANCE $d(c, N)$
1	BDF	$(0,1,0,1,0,1,0)$	8.27	0.10
2	ADF	$(1,0,0,1,0,1,0)$	8.03	0.14
3	ADG	$(1,0,0,1,0,0,1)$	8.40	0.23
4	BDG	$(0,1,0,1,0,0,1)$	8.63	0.46
5	BCG	$(0,1,1,0,0,0,1)$	7.70	0.47
6	CDF	$(0,0,1,1,0,1,0)$	8.67	0.49
7	CDE	$(0,0,1,1,1,0,0)$	7.67	0.50
$K(1-7)$		$(2,3,3,6,1,3,3)$		
8	AEF	$(1,0,0,0,1,1,0)$	8.73	0.56
9	ACG	$(1,0,1,0,0,0,1)$	7.47	0.70
10	BEF	$(0,1,0,0,1,1,0)$	8.97	0.80
11	BCF	$(0,1,1,0,0,1,0)$	7.33	0.84
12	CDG	$(0,0,1,1,0,0,1)$	9.03	0.86
13	BDE	$(0,1,0,1,1,0,0)$	7.27	0.90
14	AEG	$(1,0,0,0,1,0,1)$	9.10	0.93
$K(1-14)$		$(5,6,6,8,5,6,6)$		
15	ACF	$(1,0,1,0,0,1,0)$	7.10	1.07
16	ABG	$(1,1,0,0,0,0,1)$	7.07	1.10
17	ADE	$(1,0,0,1,1,0,0)$	7.03	1.14
18	BEG	$(0,1,0,0,1,0,1)$	9.33	1.16
19	CEF	$(0,0,1,0,1,1,0)$	9.37	1.20
20	ABF	$(1,1,0,0,0,1,0)$	6.70	1.47
21	CEG	$(0,0,1,0,1,0,1)$	9.73	1.56
$K(1-21)$		$(9,9,9,9,9,9,9)$		
22	BCE	$(0,1,1,0,1,0,0)$	6.33	1.84
23	AFG	$(1,0,0,0,0,1,1)$	10.10	1.93
24	ACE	$(1,0,1,0,1,0,0)$	6.10	2.07
25	DEF	$(0,0,0,1,1,1,0)$	10.30	2.13
26	BFG	$(0,1,0,0,0,1,1)$	10.33	2.16
27	ABE	$(1,1,0,0,1,0,0)$	5.70	2.47
28	DEG	$(0,0,0,1,1,0,1)$	10.67	2.50
29	BCD	$(0,1,1,1,0,0,0)$	5.63	2.54
30	CFG	$(0,0,1,0,0,1,1)$	10.73	2.56
31	ACD	$(1,0,1,1,0,0,0)$	5.40	2.77
32	ABD	$(1,1,0,1,0,0,0)$	5.00	3.17
33	DFG	$(0,0,0,1,0,1,1)$	11.67	3.50
34	ABC	$(1,1,1,0,0,0,0)$	4.07	4.10
35	EFG	$(0,0,0,0,1,1,1)$	12.37	4.20

Table 3: Committees Ordered by Their Distance to N in Example 1

After the first 7 committees, the members appearances are:

MEMBER	*Adams*	*Brown*	*Cooper*	*Dickens*	*Evans*	*Fox*	*Graham*
APPEARANCES	2	3	3	6	1	3	3

so this pool is not valid. After checking the first 14 *committees, the members appearances are:*

MEMBER	*Adams*	*Brown*	*Cooper*	*Dickens*	*Evans*	*Fox*	*Graham*
APPEARANCES	5	6	6	8	5	6	6

so this pool is also not valid. After checking the first 21 *committees, all the members appear* 9 *times, and this is the optimal pool. This pool has* 21 *committees and when we randomly choose a committee within this pool, all members have the same probability to be in the selected committee. Moreover, the position of the committee differs, in the worst case, by* 19% *with respect to the entire group position (by only* 1% *in the best case). The expected difference in position is* 9.7%. *This is the best that we can do if we want all members to have equal opportunities.*

If the 3-member committee is randomly selected (that is, we consider the pool with all (35) possible 3-member committees), the expected difference with respect to the entire group position is 19.1%, *nearly twice the difference of our proposal. In this case, the worst possible case differs by* 51.34%. *Note that the worst committee in our proposed pool nearly equals the median difference in the random case.*

Remark 2. *Sometimes it is not possible to find a set of committees different from the one formed by all the committees guaranteeing equal opportunities for all members. This would be the case, for example, of the situation with 3 members and 2-member committees, regardless of their characteristics.*

In future research, an alternative method could be formulated in such circumstances (i.e., where $k = m$), such that the equal opportunity constraint is relaxed somewhat in order to achieve greater representativeness.

9. Comparison of RSRC to the Bucket Method

In a recent paper Huang et al. (2020) provide an alternative and intuitive way of selecting a subset of individuals (judges), which they call *Bucket*. They defend this method in terms of computational efficiency, apart from the desirable properties it fulfills. RSRC has similar properties and in some respects works better than the Bucket method, as the following comparison demonstrates.

1. **Equal Opportunity for the Members:** Both RSRC and the Bucket method provide each member with the same chance to serve on any particular committee.

2. **Representativeness:** Some "bad" committees can be selected with the Bucket method. For instance, in Example 1, the subset of judges $c = \{$*Adams, Cooper, Evans*$\}$ is a possible committee by using the Bucket method (if either *Fox* or *Graham* are randomly eliminated at the first step of their algorithm). The distance of this committee to the entire set of judges is greater than 0.25. In the optimal pool using RSRC, the furthest distance is 0.19.

3. **Coherence in Representativeness:** Using RSRC, a lack of coherence cannot occur. In contrast, by using the Bucket method, some configurations of committees are not possible, even in the case that these committees are more representative than selected committees with the Bucket method, as the following example shows.

   Example 2. *From a set of* 6 *judges* $\{$*Adams, Brown, Cooper, Dickens, Evans, Fox*$\}$*, with respective positions* 1*,* 5*,* 5.1*,* 5.2*,* 5.3*, and* 5.4*, we want to select a* 2*-member committee. The average position is* 4.5*. The 'best' choice is* $c = \{$*Brown, Cooper*$\}$*, with position* 5.05*, but this committee cannot be obtained with the Bucket method. Nevertheless, the committee* $c' = \{$*Adams, Dickens*$\}$*, with average position* 3.1*, is a possible proposal with the Bucket method.*

4. **Computational Efficiency:** When looking for an algorithm that works for large numbers, computational efficiency is a must. Usually, when computation time is long, it is interesting to define polynomial time algorithms that are considered efficient. In RSRC, we are dealing with sets of individuals (judges) with low cardinality, from which we select a subset. Therefore, calculations are quite easy. Nevertheless, if we just want to select a committee, the Bucket method needs less than 1 second, while RSRC needs more than 3 hours (Huang et al., 2020). The complexity of the Bucket method is $O(s^2)$, whereas the complexity of finding an optimal pool using RSRC is $O(n^s)$. On the other hand, if we want to select more than one committee, we need to define our *optimal pool* only once (if the set of judges and their characteristics remain unchanged). After we have obtained an optimal pool, each committee is selected at random, and the complexity is $O(1)$, lower than the complexity of the Bucket method.

5. **Selection for Large Committees:** When the number of committee members is more than half of the full set of members, the Bucket method is, in fact, a random selection. To demonstrate this fact, suppose that the members in a committee is $s > \frac{n}{2}$. Then, to apply the Bucket method the first step is to (randomly) eliminate individuals until obtaining a multiple of s. But, in this case, we need to eliminate $n - s$ individuals, which is equivalent to randomly selecting the s members of the committee. In the next example we show that this does not happen with RSRC. So, in these cases RSRC performs better than the Bucket method, as RSRC is always better than random selection, regarding representativeness.

   Example 3. *We have an entire set of* 5 *judges* $\{$*Adams, Brown, Cooper, Dickens, Evans*$\}$*, from which we want to select a* 3*-member committee. Table 4 shows the result of applying RSRC.*

ORDER	COMMITTEE	VECTOR c	POSITION $\Lambda(c)$	DISTANCE $d(c, N)$
1	ABD	$(1, 1, 0, 1, 0)$	1.27	0.12
2	BCE	$(0, 1, 1, 0, 1)$	1.33	0.18
3	CDE	$(0, 0, 1, 1, 1)$	0.95	0.20
4	ADE	$(1, 0, 0, 1, 1)$	1.40	0.25
5	ABC	$(1, 1, 1, 0, 0)$	1.42	0.27
$K(1-5)$		$(3, 3, 3, 3, 3)$		
6	ABE	$(1, 1, 0, 0, 1)$	0.87	0.28
7	ACD	$(1, 0, 1, 1, 0)$	0.86	0.29
8	ACE	$(1, 0, 1, 0, 1)$	1.75	0.60
9	BCD	$(0, 1, 1, 1, 0)$	1.77	0.62
10	BDE	$(0, 1, 0, 1, 1)$	1.87	0.72
$K(1-10)$		$(6, 6, 6, 6, 6)$		

Table 4: Committees Ordered by Their Distance to N in Example 3

The optimal pool contains the first 5 *committees and the expected distance to the entire body is* 0.204*, while the expected distance when selecting at random (or, in this case, with the Bucket method) is* 0.353*, that is, more than* 1.7 *times larger.*

6. **Gini Inequality Index:** Table 3 in Huang et al. (2020) presents the *Gini* inequality index (Gini, 1912) of the committees obtained by using different selection methods. This index is widely used to measure the degree of inequality in a distribution, with a lower index denoting a more homogeneous distribution. So, if we have to select a committee within a subset of committees, a lower Gini index signifies that the position of the possible selected committees have greater similarity. As shown in Huang et al. (2020), only in one of the examples does the Bucket method provide a lower index value, whereas in two of the examples RSRC provides a lower Gini index value (in the other cases, both values coincide).

10. Final Remarks

A reader might wonder whether a new selection method such as RSRC is really necessary, given that the current selection methods, for whatever their faults, are simple and time-tested. However, the past acceptance of direct and random selection took place at a time of less polarization and less public focus on court decisions. As widely noted, democratic societies across the world are becoming more polarized, i.e., the ideological differences between the major national parties are getting larger (Carothers and O'Donohue, 2019). This growing divide will inevitably increase the polarization on the national judicial systems, as has been observed, for example, in the Ninth Circuit Court of Appeals, where an influx of very conservative Trump-appointed judges has joined a previously liberal court (Yeatman, 2020). In such circumstances, particularly where many of the court's cases are politically charged, random selection may threaten the legitimacy of the court because it becomes "too easy" to predict the outcome of cases based solely on the composition of the panels.

Moreover, direct selection might be publicly acceptable where it is assumed that the Selector is forming panels based on representativeness, expertise, or scheduling convenience. However, the "trust" needed for this public assumption is likewise undermined by hyper-polarization. Additionally, scholars now have sophisticated empirical tools to ferret out the "true" reasons for the selections, and once revealed, this method is difficult to defend if there are indications of strategic manipulation. Case in point: after Givati and Rosenberg (2020) circulated a draft of their paper showing strategic manipulation on the part of the Chief Justice of the Supreme Court of Israel for its three-justice panels, the Supreme Court of Israel announced that it was changing its selection method for these panels from direct selection to (effectively) random selection (Hovel, 2018).

As a result of these changing dynamics, the shelf life of the current methods may be short, and the question may become not whether the current methods should remain, but what should replace them. We believe that this paper offers a compelling answer.

Acknowledgments: We thank Alan Miller for his very helpful comments and suggestions. This work was carried out, in part, while Begoña Subiza and Josep E. Peris were visiting the University of New South Wales (UNSW) in Sydney. These authors appreciate the hospitality received from Carlos Pimienta and Haris Aziz. Josep E. Peris acknowledges financial support from the Spanish Ministerio de Educación, Cultura y Deporte to visit the UNSW in Sydney.

References

Abramowicz, M., 2000. En banc revisited. Columbia Law Review 100, 1600–1642.

Alarie, B., Green, A., 2017. Commitment and cooperation on high courts: A cross-country examination of institutional constraints on judges. Oxford University Press, New York.

Alarie, B., Green, A., Iacobucci, E.M., 2015. Panel selection on high courts. University of Toronto Law Journal 65, 335–381.

Austen-Smith, D., Banks, J.S., 1996. Information aggregation, rationality, and the Condorcet jury theorem. American Political Science Review 90, 34–45.

Barrow, D., Walker, T., 1988. A Court Divided: The Fifth Circuit Court of Appeals and the Politics of Judicial Reform. Yale University Press, New Haven.

Bartrum, I., Nyman, K., Otto, P., 2018. Justice As Fair Division. Pepperdine Law Review 45, 531–545.

Battista, J.C., 2004. Re-Examining Legislative Committee Representativeness in the States. State Politics & Policy Quarterly 4, 161–180.

Baum, L., 2006. Judges and Their Audiences: A Perspective on Judicial Behavior. Princeton University Press.

Beim, D., Clark, T.S., Lauderdale, B.E., 2018. How consistently are death penalty appeals decided? Working Paper.

Beim, D., Clark, T.S., Lauderdale, B.E., 2020. Republican-Majority Appellate Panels Increase Execution Rates for Capital Defendants. The Journal of Politics.

Benda, S.R., 1996. Committees in Legislatures: A Division of Labor. National Democratic Institute for International Affairs. Legislative Research Series 2.

Black, R.C., Owens, R.J., 2016. Courting the President: How Circuit Court Judges Alter Their Behavior for Promotion to the Supreme Court. American Journal of Political Science 60, 30–43.

Boyd, C.L., Epstein, L., Martin, A.D., 2010. Untangling the Causal Effects of Sex on Judging. American Journal of Political Science 54, 389–411.

Broadwater, L., Fandos, N., 2021. Pelosi Bars Trump Loyalists From Jan. 6 Inquiry, Prompting a G.O.P. Boycott. N.Y. Times, newspaper (United States), https://www.nytimes.com/2021/07/21/us/politics/pelosi-republican-boycott-capitol-riot.html.

Brown, J.R., Lee, A.H., 2000. Neutral Assignment of Judges at the Court of Appeals. Texas Law Review 78, 1037–1116.

Budziak, J., 2015. The Strategic Designation of Visiting Judges in the U.S. Courts of Appeals. Justice System Journal 36, 233–253.

Carothers, T., O'Donohue, A. (Eds.), 2019. Democracies divided: The global challenge of political polarization. Brookings Institution Press.

Coenen, M., Davis, S., 2021. Percolation's Value. Stanford Law Review 73.

Condorcet, M.D., 1785. Essay on the application of analysis to the probability of majority decisions. Imprimerie Royale, Paris.

Congressional Oversight Manual, 2020. Congressional Research Service, RL30240.

Copus, R.W., 2017. Machine Learning and the Reliability of Adjudication. PhD diss., University of Califormia, Berkeley.

Copus, R.W., 2020. Statistical Precedent: Allocating Judicial Attention. Vanderbilt Law Review 73.

Damgaard, E., 1995. How parties control committee members, in: Doring, H. (Ed.), Parliaments and majority rule in western Europe. St. Martin's Press, New York, pp. 308–325.

Delaware Judiciary, 2020. Judicial officers, https://courts.delaware.gov/supreme/justices.aspx.

Engelstad, F., 1989. The assignment of political office by lot. Social Science Information 28, 23–50.

Epps, D., Sitaraman, G., 2019. How to Save the Supreme Court. The Yale Law Journal 129, 148–206.

Feinstein, B.D., 2013. Congressional government rebooted: Randomized committee assignments & legislative capacity. Harvard Law and Policy Review 7, 139–172.

Feinstein, B.D., Hemel, D., 2017. Partisan balance requirements from Carter to Obama (and Trump). Yale Journal on Regulation Blog.

Flanigan, B., Gölz, P., Gupta, A., Hennig, B., Procaccia, A.D., 2021. Fair algorithms for selecting citizens' assemblies. Nature 596 (7873), 548–552.

Furman v. Georgia, 1972. 408 U.S. 238.

Giles, M.W., Hettinger, V.A., Peppers, T., 2001. Picking federal judges: A note on policy and partisan selection agendas. Political Research Quaterly 54, 623–641.

Gini, C., 1912. Variabilità e mutabilità. Reprinted in Memorie di metodologica statistica. Pizetti E., Salvemini, T. (Eds.), Libreria Eredi Virgilio Veschi, Roma.

Ginsburg, D.H., Falk, D., 1991. The Court En Banc: 1981-1990. George Washington Law Review 59, 1008–1091.

Givati, Y., Rosenberg, I., 2020. How would judges compose judicial pannels? Theory and evidence from the Supreme Court of Israel. Journal of Empirical Legal Studies 17, 317–341.

Gregg v. Georgia, 1976. 429 U.S. 1301.

Hasday, M., 2000. Ending the Reign of Slot Machine Justice. N.Y.U. Annual Survey of American Law 57, 291–321.

Hasday, M.J., 2017. The Rank-Order Method Appellate Subset Selection. Notre Dame Law Review Online 93, 17–34.

Hasday, M.J., 2019. Divide and conquer: How the democrats can maintain control of the ninth circuit. Harvard Law and Policy Review Blog.

Hausegger, L., Haynie, S., 2003. Judicial Decisionmaking and the Use of Panels in the Canadian Supreme Court and the South African Appellate Division. Law & Society Review 37, 635–657.

Hedlund, R.D., Coombs, K., Martorano, N., Hamm, K.E., 2009. Partisan Stacking on Legislative Committees. Legislative Studies Quarterly 34, 175–191.

Hessick, F.A., Jordan, S.P., 2009. Setting the size of the Supreme Court. Arizona State Law Journal 645.

Hessick, F.A., McLaughlin, J.P., 2014. Judicial Logrolling. Florida Law Review 443.

Hovel, R., 2018. The Chief Justice: Supreme Court Justices will not be able to choose who will sit with them on panel when rejecting cases. Haaretz, newspaper (Israel), https://www.haaretz.co.il/news/law/1.6695320.

Huang, L., Wei, J., Celis, E., 2020. Towards just, fair and interpretable methods for judicial subset selection, in: Proceedings of the AAAI/ACM Conference on AI, Ethics, and Society, Association for Computing Machinery, New York, NY, USA. pp. 293–299.

Ifill, S.A., 2000. Racial diversity on the bench: Beyond role models and public confidence. Washington and Lee Law Review 57.

Jordan, S.P., 2007. Early panel announcement, settlement, and adjudication. BYU Law Review 2007, 55–107.

Kao, A.B., Couzin, I.D., 2014. Decision accurancy in complex environments is often maximized by small groups sizes. Proceedings of the Royal Society B: Biological Sciences 281.

Katz, D.M., Bommarito, M.J.I., Blackman, J., 2017. A general approach for predicting the behavior of the Supreme Court of the United States. Plos One 12.

Krishnamurthi, G., 2020. For Judicial Majoritarianism. Journal of Constitutional Law 22, 1201–1270.

Ladha, K.K., 1992. The Condorcet jury theorem, free speech, and correlated votes. American Journal of Political Science 36, 617–634.

Lauderdale, B.E., Clark, T.S., 2012. The Supreme Court's many median justices. American Journal of Political Science 106, 617–634.

Levy, M.K., 2017. Panel assignment in the federal courts of appeals. Cornell Law Review 103, 65–116.

Martin, A.D., Quinn, K.M., 2002. Dynamic ideal point estimation via Markov chain Monte Carlo for the US Supreme Court. Political Analysis 10, 134–153.

McElroy, G., 2006. Committee Representation in the European Parliament. European Union Politics 7, 5–29.

Peppers, T.C., Vigilante, K., Zorn, C., 2012. Random Chance or Loaded Dice: The Politics of Judicial Designation. The University of New Hampshire Law Review 10, 69–96.

Posner, R.A., 2008. How judges think. Harvard University Press.

Samaha, A.M., 2009. Randomization in Adjudication. William & Mary Law Review 51, 1–86.

Schneider, J., 2006. Committee Assignment Process in the U.S. Senate: Democratic and Republican Party Procedures. Congressional Research Service Report RL30743.

Shor, B., McCarty, N., 2011. The ideological mapping of American legislatures. American Political Science Review 105, 530–551.

State of Michigan, 2020. Frequently Asked Questions, Independent Citizens Redistricting Process, https://www.michigan.gov/sos/0,4670,7-127-1633_91141-488602–,00.html.

Stone, P., 2016. Sortition, voting, and democratic equality. Critical Review of International Social and Political Philosophy 19, 339–356.

Sunstein, C.R., 2005. Group judgments: Statistical means, deliberation, and information markets. NYU Law Review 80, 962–1049.

Sunstein, C.R., Schkade, D., Ellman, L.M., Sawicki, A., 2006. Are judges political?: An empirical analysis of the federal judiciary. Brookings Institution Press.

Tiller, E.H., Cross, F.B., 1999. A Modest Proposal for Improving American Justice. Columbia Law Review 99, 215–234.

Wald, P.M., 1999. A response to Tiller and Cross. Columbia Law Review 99, 235–261.

Wijtvliet, W., Dyevre, A., 2019. Measuring Judicial Ideology in Economic Cases: An Expert Crowdsourcing Design. SSRN Electronic Journal doi:10.2139/ssrn.3332943.

Yeatman, W., 2020. Ninth circuit review-reviewed: CA9 is broken. Yale Journal on Regulation Blog.

Appendix

Selecting a pool of committees case 2: the general case

If there are some ties in the distance from the position of different committees, the process is a bit more elaborate, although it shares the same idea. Remember how we have ordered the committees after the first part of the process.

Find the first natural number $k \in \mathbb{N}$ such that ks is a multiple of n. We distinguish two cases:

1. $m_1 < k$

    1.1 Set $p = 1$

1.2 Let $r = pk$

1.3 If $m_1 + m_2 + \ldots + m_{t_p} < r \leqslant m_1 + m_2 + \ldots + m_{t_p} + m_{t_p+1}$
Sum all vectors in $M_1 \cup M_2 \cup \ldots \cup M_{t_p}$ and add subsets of vectors in M_{t_p+1} such that the total number of vectors (committees) is r.

1.4 Check if all components in any of the above sums have all components identical. If so, this is an optimal pool.
If this is not possible, set $p = p + 1$ and return to step 1.2.

2. $m_1 \geqslant k$

2.1 Let $q^* \in \mathbb{N}$ such that $q^*k \leqslant m_1 < (q^* + 1)k$

2.2 Check if there is a subset of M_1 with exactly q^*k vectors such that the sum has all components identical. In this case, this is an optimal pool. If it is not possible, try with $(q^* - 1)k$ vectors, and so on with all the positive integers lower than q^*. If it is not possible to find a pool in M_1 satisfying equal opportunities for all members (EOM), then go to the following step.

2.3 Set $p = q^*$

2.4 Let $r = pk$

2.5 If $m_1 + m_2 + \ldots + m_{t_p} < r \leqslant m_1 + m_2 + \ldots + m_{t_p} + m_{t_p+1}$
Sum all vectors in $M_1 \cup M_2 \cup \ldots \cup M_{t_p}$ and add subsets of vectors in M_{t_p+1} such that the total number of vectors (committees) is r.

2.6 Check if all components in any of the above sums has all components identical. If so, this is the optimal pool.
If this is not possible, set $p = p + 1$ and return to step 2.4.

We illustrate the above algorithm with a slight modification of our Example 1.

Example 4. *Consider N = {Adams, Brown, Cooper, Dickens, Evans, Fox, Graham}. As before, we want to obtain a pool of 3-member committees, from which we will select randomly one of them in order to represent the whole set N, but the characteristics have changed. Table 5 shows the new characteristic of each member.*

MEMBER	*Adams*	*Brown*	*Cooper*	*Dickens*	*Evans*	*Fox*	*Graham*
LABEL	A	B	C	D	E	F	G
CHARACTERISTIC	3	4	5	8	10	13	14

Table 5: Members' Characteristics in Example 4

The position (the average characteristic) of the group is now $\Lambda(N) = 8.14$. We compute the position of each 3-member committee, its difference from the group position, and order them from nearest to farthest positions. Table 6 shows the result. As can be observed, unlike Example 1, there are several ties in the distance of some committees to the entire group and we cannot apply the simplified algorithm.

ORDER	COMMITTEE	VECTOR c	POSITION $\Lambda(c)$	DISTANCE $d(c,N)$
1	ADF	$(1,0,0,1,0,1,0)$	8	0.14
2	BDF	$(0,1,0,1,0,1,0)$	8.33	0.19
3	ADG	$(1,0,0,1,0,0,1)$	8.33	0.19
4	CDE	$(0,0,1,1,1,0,0)$	7.67	0.48
5	BCG	$(0,1,1,0,0,0,1)$	7.60	0.48
6	CDF	$(0,0,1,1,0,1,0)$	8.67	0.52
7	BDG	$(0,1,0,1,0,0,1)$	8.67	0.52
8	AEF	$(1,0,0,0,1,1,0)$	8.67	0.52
9	BDE	$(0,1,0,1,1,0,0)$	7.33	0.81
10	BCF	$(0,1,1,0,0,1,0)$	7.33	0.81
11	ACG	$(1,0,1,0,0,0,1)$	7.33	0.81
12	CDG	$(0,0,1,1,0,0,1)$	9	0.86
13	BEF	$(0,1,0,0,1,1,0)$	9	0.86
14	AEG	$(1,0,0,0,1,0,1)$	9	0.86
15	ADE	$(1,0,0,1,1,0,0)$	7	1.14
16	ACF	$(1,0,1,0,0,1,0)$	7	1.14
17	ABG	$(1,1,0,0,0,0,1)$	7	1.14
18	BEG	$(0,1,0,0,1,0,1)$	9.33	1.19
19	CEF	$(0,0,1,0,1,1,0)$	9.33	1.19
20	ABF	$(1,1,0,0,0,1,0)$	6.67	1.48
21	CEG	$(0,0,1,0,1,0,1)$	9.67	1.52
22	BCE	$(0,1,1,0,1,0,0)$	6.33	1.81
23	AFG	$(1,0,0,0,0,1,1)$	10	1.86
24	ACE	$(1,0,1,0,1,0,0)$	6	2.14
25	DEF	$(0,0,0,1,1,1,0)$	10.33	2.19
26	BFG	$(0,1,0,0,0,1,1)$	10.33	2.19
27	BCD	$(0,1,1,1,0,0,0)$	5.67	2.48
28	ABE	$(1,1,0,0,1,0,0)$	5.67	2.48
29	DEG	$(0,0,0,1,1,0,1)$	10.67	2.52
30	CFG	$(0,0,1,0,0,1,1)$	10.67	2.52
31	ACD	$(1,0,1,1,0,0,0)$	5.33	2.81
32	ABD	$(1,1,0,1,0,0,0)$	5.00	3.14
33	DFG	$(0,0,0,1,0,1,1)$	11.67	3.52
34	ABC	$(1,1,1,0,0,0,0)$	4	4.14
35	EFG	$(0,0,0,0,1,1,1)$	12.33	4.19

Table 6: Committees Ordered by Their Distance to N in Example 4

We observe that committees 6, 7 *and* 8 *have the same distance to the entire group. As we need to check for a pool with exactly seven committees, we need to check* $K(P)$ *for the following cases:*

$$\begin{array}{ll} P^1 = \left\{c^1,c^2,c^3,c^4,c^5,c^6,c^7\right\} & K\left(P^1\right) = (3,3,2,5,2,3,3) \\ P^2 = \left\{c^1,c^2,c^3,c^4,c^5,c^6,c^8\right\} & K\left(P^2\right) = (3,3,2,5,2,4,2) \\ P^3 = \left\{c^1,c^2,c^3,c^4,c^5,c^7,c^8\right\} & K\left(P^3\right) = (3,3,2,6,1,3,3) \end{array}$$

So, in any case we obtain a pool that is not valid.

After checking the first 14 *committees, the pool is also not valid. Now, if we check the first* 21 *committees, all the members appear* 9 *times, and this is the optimal pool. The optimal pool contains* 21 *committees and when we randomly choose a committee within this pool, all members have the same probability to be in the selected committee. Moreover, the position of the committee differs, in the worst case, by* 18.7% *with respect to the entire group position (by only* 2.3% *in the best case).*

The expected difference in position is 9.8%. *This is the best that we can do if we want all members to have equal opportunities.*

If the 3-member committee is randomly selected (that is, we consider the pool with all (35) possible 3-member committees), the expected difference with respect to the entire group position is 19.2%, *nearly twice the difference of our proposal. In this case, the worst possible case differs by* 51.5%. *Note that the worst committee in our proposed pool is better than the average in the random case.*