Chapter 11
Eric S. Maskin

BIOGRAPHY

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When seeking a solution to a problem it is possible, particularly in a non-specific field such as economics, to come up with several plausible answers. One may stand out as the most likely candidate, but it may also be worth pursuing other options – indeed, this is a central strand of John Nash's game theory, romantically illustrated in the film A Beautiful Mind.

R. M. Solow et al. (eds.), *Economics for the Curious*

Eric Maskin, along with Leonid Hurwicz and Roger Myerson, was awarded the 2007 Nobel Prize in Economics for their related work on mechanism design theory, a mathematical system for analyzing the best way to align incentives between parties. This not only helps when designing contracts between individuals but also when planning effective government regulation.

Maskin's contribution was the development of implementation theory for achieving particular social or economic goals by encouraging conditions under which all equilibria are optimal. Maskin came up with his theory early in his career, after his PhD advisor, Nobel Laureate Kenneth Arrow, introduced him to Leonid Hurwicz. Maskin explains: 'I got caught up in a problem inspired by the work of Leo Hurwicz: under what circumstance is it possible to design a mechanism (that is, a procedure or game) that implements a given social goal, or social choice rule? I finally realized that monotonicity (now sometimes called 'Maskin monotonicity') was the key: if a social choice rule doesn't satisfy monotonicity, then it is not implementable; and if it does satisfy this property it is implementable provided no veto power, a weak requirement, also holds. The proof of the latter finding was constructive, that is, I showed how one can explicitly design an implementing mechanism.'

Admitting his original mechanism was 'fairly cumbersome', he credits a colleague, Karl Vind, with providing a simplification. Maskin explained his theory in his paper 'Nash Equilibrium and Welfare Optimality' during his first term as an assistant professor at MIT but didn't actually publish the paper until 20 years later.

Eric Stark Maskin was born in December 1950 in New York City and grew up in neighboring New Jersey, attending school in Tenafly where he credits good teachers for his interest in mathematics. He graduated in 1968 and went on to study math at Harvard College, where he also joined an economics course, taught by Kenneth Arrow, based in part on Leonid Hurwicz's *work in mechanism design. Maskin says: 'This work was a revelation to me: it had the precision, rigor, and sometimes the beauty of pure mathematics and also addressed problems of real social importance – an irresistible combination.'*

He remained at Harvard to gain his PhD in 1976 in applied mathematics, but his studies incorporated a determined streak of economics, including Truman Bewley's general equilibrium course, where he first met co-laureate Roger Myerson. He went on to a postdoctoral research fellowship at Jesus College, Cambridge, where he also started his Nobel-winning theory.

Returning to the US, Maskin joined the Massachusetts Institute of Technology as an assistant professor. In 1985 he returned to Harvard as the Louis Berkman Professor of Economics, where he remained until 2000 when he moved to the Institute for Advanced Study in Princeton. Despite claiming this was in search of fewer formal duties, Maskin nevertheless also took on the position of director of the Summer School in Economic Theory at the Hebrew University in Jerusalem.

In the spring of 2012, Maskin returned again to Harvard, initially to teach Economics 1052: Game Theory and Economic Applications, and a course in social choice theory. Maskin is married and has two children.

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How Should We Elect Our Leaders?

How should we choose the leader of our country – say, the president or prime minister? The easy answer is to hold an election. But there are many possible election methods – in other words, there are many methods for determining the winner on the basis of citizens' votes. Indeed, citizens in both the United States and France, for example, vote for their presidents, but the two countries determine the winning candidate very differently.[1] Thus we need a way to compare the various methods and identify the best ones.

Let me suggest that a good procedure for doing the comparison is first to figure out a list of *principles* that we think any good election method should adhere to. Then, we can determine which method or methods come closest to satisfying those principles.

To get started, let's look at a simple example. Imagine that there are four candidates: Aisha, Naakesh, Boris, and Wei. Assume that there is a voter named Alice (see Table 1), who happens to prefer Aisha to Naakesh, Naakesh to Boris, and Boris to Wei. There is another voter named Bob who prefers Boris to Naakesh, Naakesh to Wei, and Wei to Aisha (i.e. he has the ranking Boris, Naakesh, Wei, Aisha; see Table 2). Finally, let's suppose, that all voters are either like Alice or like Bob. In fact, imagine that 60 percent share Alice's views, and 40 percent

[1] The USA uses a complicated 'Electoral College' method in which there are, in effect, 50 mini-elections, one for each state. Within a state, the winning candidate (i.e. the candidate who gets the most votes) wins all that state's 'electoral votes' (equal to the number of the state's members of Congress). And the overall winner is the

Alice's ranking
Aisha
Naakesh
Boris
Wei

Table 1

Bob's ranking
Boris
Naakesh
Wei
Aisha

Table 2

60%	40%
Aisha	Boris
Naakesh	Naakesh
Boris	Wei
Wei	Aisha

Table 3

share Bob's views (see Table 3). The question to be answered is: which candidate should be elected in the circumstances of Table 3?

Let me show you first that the candidate who actually *is* elected will depend on the election method being used. In the case of *majority rule* (an election method going back hundreds of years), the candidate who is preferred by a majority of voters (i.e. by more than 50 percent of them) to each other candidate is the winner. Thus, for the example of Table 3, Aisha wins in a landslide because 60 percent of voters prefer her to anybody else.

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candidate with a majority of electoral votes in the country as a whole. France uses a two-round system: if some candidate does not get a majority of votes in the first round, the top two vote-getters face each other in a runoff.

But the winner in this example turns out to be different under *rank-order voting*, another popular election method (it is often used by committees to elect their chairpersons). Rank-order voting works as follows: if there are four candidates for election, each voter assigns four points to his or her favorite candidate, three to the next favorite, two to the next, and one to the least favorite. The points are added up for each candidate, and the winner is the candidate with the biggest total.

I claim that, for the voting population of Table 3, rank-order voting does *not* result in electing Aisha. To see this, notice that if there are a hundred voters in all, then Aisha will get $60 \times 4 = 240$ points from the voters who rank her first. And since 40 voters place her last, she will get an additional 40×1 points from them, for a grand total of 280 points. When we go through the point computations for the other candidates, we find that Boris also gets 280 and Wei gets 140. Strikingly, Naakesh ends up with $100 \times 3 = 300$ points, even though no one places him first. Because he is a consistent second, that is good enough to elect him under rank-order voting.

So, in our example, majority rule and rank-order voting result in sharply different outcomes. Given this contrast, what can we say about which electoral method produces the better outcome?

Well, as I suggested before, we can try to answer this question by going back to basic principles. Notice first that it would be fairly outrageous if an election method produced Wei as the winner. Why? Because all voters prefer Naakesh to Wei, and so everyone would want to see him elected instead. We can summarize this logic in the form of a principle: if all voters prefer candidate A to candidate B, then B should not be elected (call this the *consensus principle*).

Now, the consensus principle by itself does not help us to distinguish between majority rule and rank-order voting. Both election methods clearly satisfy this principle: they would never lead to the election of B if all voters preferred A (indeed, I venture to say that only a very perverse election method would elect B).

So, let us turn to a second basic principle, the idea that all voters should count equally in the voting process. This is sometimes called the 'one-person, one-vote' or *equal-voter principle*. But rank-order voting and majority voting both satisfy this principle too: neither method treats one voter any differently from another. And thus we must go still further to understand the essential difference between the two methods.

A third important principle is the idea that just as all voters should be treated the same, so all *candidates* should compete on an equal footing. The rules ought not to be biased for or against any of them (it should not be the case, for example, that Aisha must get a two-thirds majority to win while everyone else needs only a majority of 51 percent). We will call this the *equal-candidates principle*. However, it is still not enough to drive a wedge between majority rule and rank-order voting; once again, both methods satisfy it.

But, now, we come to a fundamental principle according to which the two election methods *do* differ. The easiest way to introduce this principle is to imagine what would happen if Wei dropped out of the election, leaving the other three candidates in the running. I have already noted that Wei is not a very plausible candidate herself. So it would not make sense for it to matter too much if she dropped out – the outcome of the election should be the same whether she runs or not. Put another way, Wei should not have the opportunity to 'spoil' the prospects of a serious candidate by her decision to drop out.

I will call this line of reasoning the *no-spoilers principle*, the idea that a candidate with no chance of winning herself should not be able to change the outcome of an election by her decision to drop out. And majority rule certainly satisfies this principle: if Wei drops out, Aisha continues to be favored by a majority of voters to the other two candidates, Boris and Naakesh.

But let's see what happens with rank-order voting. With all four candidates in the running, we saw that Naakesh wins. With only three candidates running, the rules for rank-order voting dictate that a voter's favorite candidate will get 3 points, the second favorite 2 points, and the least favorite 1 point. Given the population of voters in Table 3 (and taking Wei out of the picture), Aisha will now have 220 points (3×60 plus 1×40). Similarly, Boris gets 180 points, but Naakesh now has only $100 \times 2 = 200$ points. And so the withdrawal of Wei means that *Aisha* now wins: rank-order voting *fails* to satisfy the no-spoilers principle.

As things stand so far in our comparison, majority rule appears superior to rank-order voting, in the sense that both methods satisfy the consensus, equal-voters, and equal-candidates principles, yet majority rule alone satisfies the no-spoilers principle.

But this is not the end of the story, because it turns out that there is a problem with majority rule, a problem illustrated by another hypothetical example. Let's suppose, in this new example, that 32 percent of voters prefer Aisha to Boris to Naakesh, 33 percent prefer Boris to Naakesh to Aisha, and the remaining 35 percent have the ranking Naakesh, Aisha, Boris (see Table 4). What would happen under majority rule with such population of voters? Notice that 67 percent of voters prefer Aisha to Boris (those in the first and third groups), and so Boris will not be elected; 65 percent prefer Boris to Naakesh (those in the first and second groups), and so Naakesh will not be elected. But 68 percent prefer Naakesh to Aisha (those in the second and third groups), and so Aisha will not be elected either! In this example, there is *no* candidate who wins. In other words, majority fails to satisfy *decisiveness*, the principle that an election method should always produce a clear-cut winner.

32%	33%	35%
Aisha	Boris	Naakesh
Boris	Naakesh	Aisha
Naakesh	Aisha	Boris

Table 4

Rank-order voting by contrast *is* decisive, because there will always be *some* candidate who gets the most points, and that candidate will be elected. So our comparison of majority rule and rank-order voting appears to have resulted in a dead heat: majority rule satisfies all but one principle (decisiveness); rank-order voting also satisfies all but one principle (no-spoilers).

This may prompt us to ask about other election methods. In particular, a natural question to pose is if there is some method that manages to satisfy all five principles: consensus, equal voters, equal candidates, no spoilers, and decisiveness. The answer, unfortunately, is 'no'. That answer was provided by the economist Kenneth Arrow in what is now called the Arrow Impossibility Theorem.

But there is an important sense in which Arrow's theorem conveys too negative a message. The theorem supposes that for an election method to satisfy a given principle, it has to satisfy that principle *regardless* of what voters' preference rankings turn out to be. Yet some rankings might be quite unlikely. Let me suggest, in particular, that there are cases in which the rankings of Table 4 may not all be plausible. This is because a voter's preference ranking normally does not come out of thin air. For example, sometimes it derives from his or her ideological perspective. To be more specific, let's consider the ideological spectrum ranging from left to right, and suppose that Naakesh is the left-wing candidate, Boris is the right-wing candidate, and Aisha is somewhere in between. If ideology is driving voters' views, then any voter who prefers Naakesh to Aisha is also going to prefer Aisha to Boris. Similarly, any voter who prefers Boris to Aisha is going to prefer Aisha to Naakesh. And, in particular, voters cannot have the ranking Boris, Naakesh, Aisha; or at least that ranking seems pretty improbable. But notice that this very ranking was an essential part of the story in showing that majority rule fails to be decisive for the voter population of Table 4. Indeed (and this is the crucial point), it is not difficult to show that if preference rankings are ideologically driven, then majority rule can *never* fail to be decisive.

The preceding argument leads us to conclude that, in comparing election methods, we should take account of the fact that not all preference rankings are necessarily plausible or probable. Instead, the class of plausible rankings will typically be limited. Perhaps it is limited for ideological reasons, perhaps for other reasons. But one way or another it is likely to be limited.

This brings me to some work that I have done myself with the economist Partha Dasgupta. We were interested specifically in comparing election methods under the assumption that individual voters' rankings are not arbitrary but limited to certain classes.

To see how we go about this, let me first introduce the term 'reasonable election method'. Call an election method reasonable if it satisfies the five principles that we have been talking about: consensus, equal voters, equal candidates, no spoilers, and decisiveness. We know from the Arrow theorem that no election method is reasonable when voters' rankings are completely unrestricted. So let's consider election methods that are reasonable for limited classes of rankings. We will call a method *reasonable for a class* of rankings if it satisfies our five principles when voters' rankings are limited to that class. So, for example, majority rule is reasonable for the class of rankings that are ideologically driven.

Our main conclusion, which takes the form of a theorem, is that majority rule is reasonable for more classes of rankings than any other election method. Let me make this more precise. Consider an election method besides majority rule – rank-order voting, for example – and focus on a class of voters' rankings for which this election method is reasonable (so that the method satisfies all five principles when rankings are limited to this class). Dasgupta and I then show that majority rule must be reasonable for that class too. Furthermore, we can always find some *other* class of rankings for which majority rule is reasonable but this other election method is not.

In other words, there is a clear way in which majority rule *dominates* any other possible election method from the standpoint of the principles that we have discussed. Whenever there is a setting for which some other election method is reasonable in the sense of satisfying these principles, then majority rule is reasonable for that setting too. And there will exist other settings for which majority rule is reasonable but for which the other election method is not.

What is the moral of the story? One possible lesson comes from the fact that majority rule is used by virtually every democratic legislature in the world for enacting laws. It is probably no accident that the election method that satisfies our five principles most often is also the method with the greatest popularity. But even if one ignores popularity, I think it is interesting that there is a precise way in which majority rule does a better job than any other electoral method in embodying what we want out of a voting system. So, perhaps the next time your legislature votes in favor of some absurd law, you can take consolation from the idea that although they may not have voted correctly, they at least used the correct method for voting!

For more on this topic see Partha Dasgupta and Eric Maskin, 'The fairest vote of all', in *Scientific American*, February 2004. You may also want to look at Kenneth Arrow's seminal book, *Social Choice and Individual Values* (1951).