Sadie Witkowski: 00:00 --> 00:32
(Background string music)
I'm Sadie Witkowski, and you are listening to Carry the Two, a podcast from the Institute for Mathematical and Statistical Innovation, aka IMSI. That is right. We are back. And while this is still the podcast where we talk about the real-world applications of mathematical and Statistical Research, I am now joined by a new co-host, Sam Hansen.

Sam Hansen: 00:32 --> 00:53
Hello, everyone. I'm so happy to be joining Sadie to talk math with y'all. It was a dream to have the opportunity to become IMSI's new Director of Communications and Engagement, and come on board,
carry the two, a dream that's made even sweeter when it worked out that I would be able to co-host
it with Sadie. I can't think of anyone else I would rather be on the mic with.

Sadie Witkowski: 00:53 --> 01:06
(laughs) Thanks. I am so happy to be able to stay a part of Carry the Two.
Though today I do find myself in an unfamiliar role, as I'm not entirely sure what we're going to be discussing today.

Sam Hansen: 01:07 --> 01:19
Well, as I'm sure you know, we here in the States have an election coming up.
So I thought there's no better time to investigate the intersection of math and democracy.

Sadie Witkowski:
You got a point there.
01:19 --> 01:20

Sam Hansen: 01:20 -->01:34
Which is why for my first season of Carry the Two as co-host, I thought that should be our focus.
And for the first episode, I knew exactly who I had to talk to.

Ismar Volić: 01:34 --> 01:36
So the name is Ismar Volic.

Sam Hansen: 01:36 --> 01:48
Ismar is a professor and chair of the mathematics department at Wellesley College, as well as the director of the Institute for Mathematics and Democracy.
And most importantly for us today.

01:48 --> 02:01

Ismar Volić: I'm the author of Making Democracy Count: How Mathematics Improves Voting, Electoral Maps, and Representation. I think I got that right, but yes that that came out just this past April.

Sam Hansen: 02:02 --> 02:13
He did indeed get that right. But today, we're going to focus only on the first part of that subtitle, voting. And to do that, we're going to have to start with what, Sadie?

Sadie Witkowski: 02:13 --> 02:18
Well, since we're dealing with math, I'm going to guess a definition.

Sam Hansen: 02:19 --> 02:20
You got it in one.

A voting system is any mechanism by which preferences of individuals are aggregated into some choice.

Ismar Volić: 02:20 --> 02:34
A voting system is any mechanism by which preferences of individuals are aggregated into some choice, in this case a choice of a candidate, right, or a number of candidates if we're talking about multi-winner elections.

Sam Hansen: 02:34--> 02:56
Simple enough, right? And voting systems are part of a bigger world of things called social choice functions, which are the many different ways groups decide on things. And it is why the study of voting falls under social choice theory.
But let's not get too bogged down with the general and stay on the specifics of voting. Does that sound good?

Sadie Witkowski: 02:56 --> 02:57
That sounds perfect.

Sam Hansen: 02:58 --> 03:05
Great. With that settled, what's the first thing that pops into your head when you hear Ismar define voting systems?

Sadie Witkowski: 03:05 --> 03:09
I guess, what voting system we end up using here in the U.S.?

Sam Hansen: 03:10 --> 03:13

Well, lucky for you, I had that exact question.

Sam Hansen (From Interview Tape): 03:14 --> 03:36
We have these social choice functions, these voting functions, will of the people and all that. How does the United States in most cases try to capture that through our voting system?

Ismar Volić: 03:27 --> 04:01
Well, it chooses the worst social choice function because it's at the same time the easiest. So easy is good, right, people understand it, but it's really terrible at capturing this will of the people. And that is relative majority or plurality voting or first past the post, or winner take all, it has all these names because it's so widely used, not just in the United States, but in most democracies in the world to some extent. Although we, we and a couple other countries use it the most and therefore we have the worst voting system.

Sadie Witkowski: 04:01 --> 04:04
Oh man, he doesn't mince his words, does he?

Sam Hansen: 04:04 --> 04:13
Nope, not one bit. But let's have Ismar flesh out the specifics of plurality a little bit more.

Ismar Volić: 04:13 --> 04:25
When you say voting, this is what most people imagine. You just pick one of the candidates and that's it. And then you move on and the candidate with most votes wins. So that's the plurality winner.

Sadie Witkowski: 04:21 --> 04:31
Okay. Yeah, this sounds familiar. Why does Ismar say this is the worst?

Sam Hansen: 04:29 --> 04:35
Well, he did end up wanting to expand that a little bit. And I should qualify

Ismar Volić: 04:35 --> 04:48
And I should qualify the worst. When I say the worst voting system, I mean the voting system that's actually used out there.

Sam Hansen: 04:49 --> 05:02
One you've heard of, dictatorship. In social choice theory, dictatorship is defined as a voting system where only the dictator's vote matters and who or whatever they vote for wins.

Sadie Witkowski: 05:02 --> 05:05
For sure. Definitely sounds worse than plurality.

Sam Hansen: 05:05 --> 05:08
It isn't my favorite of the worst systems, though.

Sadie Witkowski: 05:08 --> 05:11
You have a favorite worst voting system, Sam?

Sam Hansen: 05:12 --> 05:15
Yes. Yes, I do. And it's called parity.

Sadie Witkowski: 05:15 --> 05:29
Okay. We're just going to have to skip past having a favorite worst voting system because I don't think we have enough time to really dig into the psychology of that. So I guess I'll just ask what parity is instead.

Sam Hansen: 05:29 --> 05:48
Well, thank you for that question.
Parity is a voting system Ismar wrote about in Making Democracy Count, where you have two candidates, A and B.
And the winning condition for candidate A is that the total number of votes is even.
And if the total number of votes is odd, B wins.

05:48 --> 05:52
That's ridiculous.

05:53 --> 06:02
I know. That's why it's my favorite. Anyway, back to plurality and why it's the worst of the best.

Ismar Volić: 06:02 --> 06:18
With three or more candidates, most votes does not mean a majority of the votes. And this is where the social choice theory opens up into a wonderful and frustrating field of mathematics and economics and political science and so on.

Sadie Witkowski: 06:18 --> 06:27
Ah, that makes sense. I can remember a number of very important elections where the winner had less than 50% of the vote.

Sam Hansen: 06:28 --> 06:51
Exactly. On the national stage, no candidate got above 50% of the vote in four out of the last eight presidential elections.
And those are elections where there really are only two candidates with a chance of winning and maybe a third candidate that can pull a few percent.
It gets even worse when you start thinking about elections where there are even more candidates that could win, like primaries.

Sadie Witkowski: 06:51 --> 07:06

Yeah, if I remember correctly, the last competitive Senate primary in Illinois had seven candidates who all got over 5% and the winner only got 30.2% of the vote.

That doesn't really scream will of the people.
07:04 --> 07:06

Sam Hansen: 07:07 --> 07:41
No, it doesn't, does it? And social choice theory has names for some of the problems with plurality. The first two you've probably heard of, and that's the idea of wasted votes or not wanting to vote for the candidate you most want to win because you're afraid they have no reasonable chance of winning.
And thus your vote would be wasted.
And spoilers, or a candidate, let's call them C, that peels off enough votes from candidate A so that they lose to candidate B, even though the people who voted for C would have preferred A to B.

Sadie Witkowski: 07:42 --> 07:45
Those definitely sound familiar.

Sam Hansen: 07:45 --> 07:50
The issue Ismar spoke the most about with me, though, was vote splitting.

Ismar Volić: 07:50 --> 08:01
Vote splitting is when kind of similar candidates divide the votes, allowing another candidate to kind of rise to the top and win with very few votes.

Sadie Witkowski: 08:02 --> 08:07
Ah, this is probably what happened in the 2020 Republican Senate primary in Illinois.

Sam Hansen: 08:07 --> 08:13
It's very likely that it was. And in the worst cases, it can get quite ridiculous.

Ismar Volić: 08:14 --> 09:21
So there was a mayor in Fall River, Massachusetts who was a pretty corrupt.
It was clear that he was you know, taking money from donors and spending it on lavish lifestyles and fancy cars, etc. So federal charges were brought against him and a vote was brought to Fall River to oust him as a mayor. And that happened. But on the same ballot where people were supposed to, you know, declare their preference whether they want to kick this guy out or not. The next question was, well, who do you want to be the mayor in case this guy is, you know, kicked out? Well, nothing in the system actually prevented the same guy to be on the ballot to be the mayor, you see where this is going, obviously. So he gets kicked out by a majority of the votes. I forget exactly what 60 something, but then he gets reelected mayor with you know, like 30% of the vote or something because of vote splitting and plurality voting. It really is, it's kind of

a hilarious and terrible example of how these voting systems fails. He later got convicted and I think he's in jail now or something.

you know, taking money from donors and spending it on like lavish lifestyles and fancy cars,

Sadie Witkowski: 09:21 --> 09:26
Recalled and then reelected on the same ballot.

Sam Hansen: 09:26 --> 09:43
Yeah, specifically
recalled by 61.45% of voters and then reelected by 35.4% of voters. And while this may be an extreme example, Ismar says there are plenty more. So when I give talks on this stuff in various

Ismar Volić: 09:43 --> 10:05
So when I give talks on this stuff in various parts of the country, I will adjust my presentation to make it as local as possible. It literally takes me like a minute to Google some elections right there where I'm giving the talk and find something that potentially was, you know, about splitting or spoiler or some of these other other bad effects.

Sam Hansen: 10:05 --> 10:17
And it's not only not always meaningfully representing the will of the people you can blame on plurality, it also encourages polarization and negative campaigning. So it encourages you to

Ismar Volić: 10:18 --> 10:44
So it encourages you to create a gung-ho base that you can rely on that will maybe push you over the plurality bar, encourages a negative campaigning as well because a vote that I can take away from you is a vote for me, right? So, you know, hurling poop at you is a strategy that pays off. So, all these things do encourage polarization.

Sadie Witkowski: 10:44 --> 10:49
Yeah. I mean, I am convinced that plurality is bad, but like, how can math help?

Sam Hansen: 10:50 --> 11:00
Well, in order for math to help, we're first going to need some more definitions.
Specifically, we need to mathematically define what criteria we're looking for in a voting system.

Sadie Witkowski: 11:01 --> 11:02
Right. Makes sense.

Sam Hansen: 11:02 --> 11:37
Thankfully, that's exactly what social choice theorists have been doing for decades.
And while there are multiple sets of criteria used depending on what area of social choice theory experts are studying, there are a core set that are typically used for evaluating voting systems.

One is the Condorcet criterion, which Ismar will talk more about later.
Another is the majority criterion, which means if any candidate gets more than 50% of the votes, they should win. Next is the anonymity criteria.

Ismar Volić: 11:38 --> 11:46
If we were to switch ballots, the result of the election wouldn't change, right? That's a way of saying that then no voters preferred over another. Everybody's equal.

Sam Hansen: 11:46 --> 11:48
The neutrality criteria.

Ismar Volić: 11:48 --> 11:58
So if A, candidate A was the winner and B was a loser and we all change our preference from A to B or B to A, now B should be the winner as well.

Sam Hansen: 11:58 --> 12:00
The monotonicity criteria.

Ismar Volić: 12:01 --> 12:06
So if somebody is winning and they get more votes, they should still be winning.

Sam Hansen: 12:07 --> 12:15
And finally, Ismar defined the independence of a relevant alternatives criteria, or IIA.

Ismar Volić: 12:15 --> 12:44
Suppose a candidate is a winner according to some tallying method and we have these ranked ballots. If you sort of switch things around but do not mess with the position of the winner or any of the ballots, you might change some other things around, that shouldn't change the outcome. This should still be the winner. If you fail that then you fail IIA, namely you're not independent of irrelevant alternatives, you're depending on something that should be irrelevant.

If you sort of switch things around, but do not mess with the position of the winner on any of the ballots, you might change some other things around.
12:21 --> 12:30

Sadie Witkowski: 12:45 --> 13:00
Sure, all those make sense.
But it seems a little silly that we should have to check them.
I mean, a winner getting more votes causing them to lose
or messing around with the ordering of candidates below a winner shouldn't impact anything.

Sam Hansen: 13:00 --> 13:03
Ismar agrees, kind of.

Ismar Volić: 13:03 --> 13:27
I mean, it sounds dumb, of course, right? But it turns out not all voting systems actually satisfy this. So it's very, again, it's from an academic point of view, this is very cool, very exciting. There's something there that we want to, you know, dig into and figure out what's going on. But if you're trying to implement this in, like, an actual democracy, you are just pissed.

Sam Hansen: 13:31 --> 13:41
And these issues really do show up in the real world. For example, IIA failed in the 1995 figure skating world championships.

Ismar Volić: 13:14 --> 14:06
So there was a, you know, women's World Figure Skate Championship and Michelle Kwan, I think, was like the US superstar at the time. She was a teen, she was young, 14 or something. And before she skated, there were these three other women who were placed first, second and third. And then Michelle Kwan skated, came in fourth, but also the second and the third place flipped.

Sadie Witkowski: 14:06 --> 14:06
What?

Sam Hansen: 14:07 --> 14:39
That's what can happen if you don't choose your voting system carefully.
I will say figure skating did change their voting system after that.
But Michelle Kwan was again involved in an IIA issue in 2002, when she was in first ahead of Sarah Hughes until Irina Slutskaya skated. After which, Hughes jumped up to first, Sluskaya got second, and Kwan tumbled to third.
Skating again had to change their voting system after that.

Sadie Witkowski: 14:40 --> 14:48
Well, across all of these, it's clearly hard to find a perfect voting system.
So again, I ask, how can math help?

Sam Hansen: 14:48 --> 14:57
Well, mathematics has proven that there is a best voting system (whispered)for a very specific context.(end whisper)

Sadie Witkowski: 14:57 --> 14:59
Oh, I'm sorry. What was that?

Sam Hansen: 15:00 --> 15:08
There is a best voting system for a very specific context.

Sadie Witkowski: 15:09 --> 15:11

And what is that context?

Sam Hansen: 15:12 --> 15:14
When there's only two candidates.

Sadie Witkowski: 15:15 --> 15:18
Oh, that is rather specific.

Sam Hansen: 15:18 --> 15:27
We have to take what we can get.
That there is a best possible voting system for two candidates was proven in 1952 by Kenneth May. And the result is known as May's theorem.

Ismar Volić: 15:27 --> 15:57
May's Theorem says the majority, the absolute majority voting is it will satisfy these three and it's the only system that will satisfy these three. So it is kind of an unequivocal kind of case closed situation where this is the voting system we should use. We shouldn't use dictatorship or parity. Of course, we know all these things, but to have a theorem that says, yes, this is the one to use, that's great.

Sadie Witkowski: 15:57 --> 16:00
What about when there are more than two candidates?

Sam Hansen: 16:01 --> 16:13
Okay. Okay. I'm just, I'm going to tell you, but I wanted to let Ismar share what he really thinks the big issue of plurality voting stems from.

Ismar Volić: 16:13 --> 16:30
The main issue is that plurality just doesn't know enough about our preferences. We are saying so little that there is really little that math can do.
And therefore, math can make a mistake, right? In sort of in the sense of capturing, representing us faithfully.

Sam Hansen: 16:30 --> 16:32
And there are a couple of ways of gathering that information.

Ismar Volić: 16:33 --> 17:12
One is these preferential, ordinal systems or cardinal systems.
So ordinal systems ask you to rank the candidates, right? So typically in a plurality election, you say who your top choice is, but here you would say that, plus you would say who's your second choice, third, etc. And then math can do various things with that. And there are cardinal voting systems where you evaluate each candidate separately somehow. You don't pit them against each other, but you provide some information about each of them independent of the other. So

you might rank each candidate on a scale from one to ten or something like that. And math can do a lot more with that as well.
Sam Hansen: 17:13 --> 17:19
I needed to share that because for the rest of our conversation, we're going to be talking about ordinal voting.

Sadie Witkowski: 17:20 --> 17:21
Why not cardinal?

Sam Hansen: 17:21 --> 17:39
For a couple of reasons. One, because plurality alternatives or preferential voting systems are much more commonly used in democracies, and therefore there's more data around their usage. And two, because Ismar feels rankings are just more instinctive.

Ismar Volić: 17:39 --> 18:10
I think it's more natural for us to sort of rank things. You're rarely thinking, if, you know, if you look at a menu in a restaurant, you're not giving salmon a score from one to ten, and like the pork chop a score from one to ten. You're like, I like salmon better than pork chop. Your brain is, I think our brain more naturally goes to comparisons than individual isolated evaluations of each, of each alternative.

Sadie Witkowski: 18:10 --> 18:29
Well, I personally think salmon is a five and pork chops are an eight, but I understand his reasoning. And now I'm going to ask you one final time for preferential voting systems with more than two candidates. How can math help?

Sam Hansen: 18:29 --> 18:31
Well...

Ismar Volić: 18:31 --> 18:40
And there's a theorem, famous theorem by Kenneth Arrow from 1952 I want to say, that says, no rank choice voting system will satisfy them all.

Sadie Witkowski: 18:41 --> 18:48
What the hell, Sam? Are you telling me we went through all of that to tell me that math says no voting systems are good?

Sam Hansen: 18:48 --> 19:18
Hold on. Arrow's theorem didn't say that they were all bad, just that none could be perfect. Remember what Ismar said earlier about plurality not having enough data.
If we are instead in this world where we're getting ballots with rankings back, we have more data. And any system that takes more information in is typically going to be a better system.

Sadie Witkowski: 19:18 --> 19:21

OK, what are some of these other systems?

Sam Hansen: 19:22 --> 19:30
I thought you would never ask.
The one you may have heard of is commonly called ranked choice voting or instant runoff.

Sadie Witkowski: 19:30 --> 19:34
Oh, yeah, I've heard of that. It's used in, like, Maine, right?

Sam Hansen: 19:34 --> 19:39
Yeah. Maine, as well as Alaska, New York City, many other municipalities.

Sadie Witkowski: 19:40 --> 19:42
So how exactly does it work?

Sam Hansen: 19:42 --> 19:45
Well, instead of me, I'm just going to let Ismar explain.

Ismar Volić: 19:45 --> 19:54
So instant runoff proceeds like this. If there's a, if someone gets the majority of first place votes right at the beginning, that's the winner. So there's this agreement that if someone has the majority support, they should be the winner. So let's start with that, with that kind of assumption. If not, then you look at the person with the least number of first place votes. And basically, you eliminate them, you erase them from all the ballots. And then you retabulate. So what does that mean? So anyone who voted for the person who is now eliminated, their vote goes to the next person on their ballot. And now there's a shift, right? Some other people have gotten more first place votes because of this transfer. Now you, now you count again. Does anyone now have a majority of first place votes? If yes, you're done. And if not, you repeat.

Sadie Witkowski: 20:40 --> 20:43
Yeah, I mean, that makes sense.
What are some others?

Sam Hansen: 20:44 --> 20:45
Well, there's Borda Count.

Ismar Volić: 20:45 --> 21:08
Borda count is actually, maybe more natural for people to understand. You basically assign points, right, so any time a candidate is ranked in the first place they get the top number of points. If there are five candidates they get four points for first place, three for second, two, one, zero. And then you basically add up all the points and the person with the most points wins.

Sadie Witkowski: 21:09 --> 21:11
Is there a case where this is, like, actually used?

Sam Hansen: 21:11 --> 21:13
Do you know Eurovision?

Sadie Witkowski: 21:13 --> 21:14
Oh, yeah.

Sam Hansen: 21:15 --> 21:31
Well, Eurovision utilizes a board account system for voting,
with professional and televoting from each country getting their own ballots,
where their top 10 songs get 12 points, 10 points, 8 points, down to 1 for the 10th place.

Sadie Witkowski: 21:32 --> 21:38
Oh god, I'm just imagining Eurovision with plurality voting. What a mess that would be.

Sam Hansen: 21:38 --> 21:51
Right? Though I did check and it wouldn't have moved Nemo out of first place this year.
Probably a good thing because if it would have moved Bambi Thug into first place,
I may have just become a plurality apologist.

Sadie Witkowski: 21:52 --> 21:54
Wouldn't want that.

Sam Hansen: 21:54 --> 21:57
Not at all, especially when Condorcet is out there.

Sadie Witkowski: 21:58 --> 22:00
Condorcet. I don't remember seeing them in Eurovision.

22:01 --> 22:10
A bit before his time, but I would have loved to see what he came up with.
Condorcet was a mathematician who had a lot to say about voting.

Ismar Volić: 22:10 --> 22:14
Condorcet, Condorcet is cool from a mathematical point of view, because what it does is it asks, it considers pairs of candidates, and it just looks at how that pair did compared to one another. How many people have candidate A ranked over B versus B over A? And if more people have A over B, then A is the winner of that particular pairwise contest.
Now you do that for all possible pairs, right? And if there's a candidate who wins all those head-to-head contests, they are the overall winner.

Sadie Witkowski: 22:49 --> 22:56

Oh, wait. Didn't you mention Condorcet earlier when we were talking about the criteria for best voting systems?

Sam Hansen: 22:56 --> 23:07
I did. And what the Condorcet criteria says is that if there is a Condorcet winner, then a voting system should identify that candidate as a winner.

Sadie Witkowski: 23:08 --> 23:23
Condorcet sounds really great, especially since it breaks everything down to two-person elections.
And then we know from May's theorem the best way to run those elections.
But I know you're going to spoil it somehow.
So just tell me what's wrong with it.

Sam Hansen: 23:23 --> 23:44
Wrong with it?
I wouldn't go that far, but it does have some issues.
A couple are more minor, such as not always generating a winner or that it's computationally hard to compute.
especially for elections with large numbers of candidates but the real sticking point are the cycles

Ismar Volić: 23:44 --> 23:50
So there may not be this candidate who beats all other candidates.
In fact, something worse can happen and it can happen with, you know, frequently enough that it becomes a problem. You could have what's called a condorcet cycle, which is really, for someone whose brain is not used to this kind of mathematical sort of seemingly paradoxical behavior, just the brain explodes. So what you could have is, you could have three candidates, A, B, and C, so that in a head to head contest, A beats B, B beats C, but then C beats A.

Sadie Witkowski: 24:25 --> 24:30
Oh, man, my brain is just doing some rock, paper, scissors weirdness.
I need a better explanation than that.

Ismar Volić: 24:30 --> 25:08
The reason why we have a hard time processing that is because we default to ourselves. We're rational individuals. If I like chocolate ice cream better than strawberry, strawberry better than vanilla, then by transitivity, right, you would expect that I like whatever I said first, I forget, chocolate to whatever I said last, vanilla. You expect that. But groups as entities are not rational in this sense of the word. Again, this is something that's academically very cool, interesting, but very frustrating in practice.

Sam Hansen: 25:08 --> 25:14

Sadie, can you remember the names of the problems that we identified with plurality voting earlier?

Yeah, I'm up for the challenge.
25:15 --> 25:16

Sadie Witkowski: 25:16 --> 25:27
Um, we had wasted votes, vote splitting, spoilers, polarization, and negative campaigning.

Sam Hansen: 25:27 --> 25:47
That's right. And while Arrow proved that none of the ordinal voting systems we just discussed can meet all the mathematical criteria, they do all help with those issues.
For example, let's think about polarization, vote splitting, and spoilers in the context of instant runoff.

Ismar Volić: 25:47 --> 25:51
So what happens for highly polarizing extreme candidates, you'll have the gung-ho base that will put them on top of ranked ballots, but then everybody else will put them at the bottom. And once this iterative process of elimination and shifts in votes happens, they're on the bottom for most ballots. They don't really advance up to the top. Somebody else is bubbling up to the top, eventually overtaking the base that's voted for them. So this is how, this is why the system eliminates spoilers, eliminates vote splitting.

Sadie Witkowski: 26:22 --> 26:24
And is this true for the other ranked systems as well?

Sam Hansen: 26:25 --> 26:41
It is. For Borda, while a strong base gets you a bunch of max point ballots, if you are polarizing, many of the rest may give you no points at all.
And in Condorcet, being on top of a small amount of ballots does you no good if you're in the bottom half of the rest.

Sadie Witkowski: 26:41 --> 26:25
Well, that's great.I mean, these systems aren't perfect, but I can see why they're much better than what we're currently using.
So, how are you going to ruin this now?

Sam Hansen: 26:52 --> 26:56
What do you mean?
Why do you think I'm going to ruin this?

Sadie Witkowski: 26:57 --> 26:57

Hmm.

26:58 --> 27:09
Well, okay.
Sure, you're right.
I do have one other thing to bring up.
So far, we have been making a huge assumption.

Sadie Witkowski: 27:10 --> 27:11
What is that?

27:12 --> 27:18
That voters are being honest.
And that's just not something we should assume.

Ismar Volić: 27:18 --> 27:30
Strategic voting just means or dishonest voting just means you are not voting your true preference. You have some end goal in mind and you're marking something different than your true opinion.

Sam Hansen: 27:30 --> 27:42
In a way, we've already talked about strategic voting, such as when a voter doesn't vote for their true preference in a plurality system because of fear of a wasted vote.
That's strategic voting.

Sadie Witkowski: 27:43 --> 27:50
Okay. And I really, really did not want to ask this again, but how can math help?

Sam Hansen: 27:51 --> 27:52
Um.

Sadie Witkowski: 27:53 --> 27:57
Oh, no. We've got some impossibility theorem, don't we?

Sam Hansen: 27:58 --> 27:58
Yep.

Ismar Volić: 27:58 --> 28:03
This is the Gibbard-Satterthwaite theorem, which says that, again we're talking about ranked voting system, there is no strategy proof ranked voting system. All the ranked voting system are susceptible to strategic voting. And experts who really understand the guts of this theorem, I'm not one of them, say this is the really, truly the kind of the deepest, the hardest theorem in social choice theory. Arrow's theorem is what people know, but Gibbard-Satterthwaite is what people who know say is that that's the real stuff.

Sadie Witkowski: 28:33 --> 28:38
Great. So there are no perfect or strategy-proof voting systems.

Sam Hansen: 28:39 --> 28:42
Nope. But there is a bright side.

Ismar Volić: 28:42 --> 29:10
It's not as much danger with large voting systems. When we vote for president, 150 million people voting, and if we did say ranked choice, if I strategically try to flip two candidates this way, that way, it's not gonna make. It would have to be a concerted effort of a few million of us doing exactly the right thing to influence the outcome of the election.

Sadie Witkowski: 29:10 --> 29:12
OK, that's good to hear.

Sam Hansen: 29:12 --> 29:24
Right? But do watch out if the chair of a small committee you're on changes the election system right before a vote. They could be trying to strategically influence the result.

Sadie Witkowski: 29:24 --> 29:27
Oh, I'll be sure to keep my eye out for that.

Sam Hansen: 29:27 --> 29:36
Good, good. And now, I think we finally have the background we need to ask our final question.

Sadie Witkowski: 29:37 --> 29:38
And what is that question?

Sam Hansen: 29:38 --> 29:47
You know what? I think I'm just going to let Ismar ask it for us.

Ismar Volić: 29:47 --> 30:17
You are stuck with this knowledge, with this impossibility of a perfect preferential voting system. And that's fine. So now we have to work within the confines of this mathematical truth, right? And the question becomes, which system sort of fails these criteria the least? Like, what's the least bad system? And that is a question that has been living in the academic world for 70 years and is still very much alive.

Sadie Witkowski: 30:17 --> 30:25
So that's it. You're just going to leave us with this still open question ending.

Sam Hansen: 30:25 --> 30:27
Just wait. Ismar had more to say.

Ismar Volić: 30:27 --> 30:42
What we do have now that we didn't 50, 60, 70 years ago is evidence from lots of elections about the frequency of failure of some of these criteria as they apply to these different voting systems.

Sam Hansen: 30:42 --> 30:48
And that evidence is quite positive for the existing implementations of instant runoff.

Ismar Volić: 30:49 --> 31:20
Lately we have a bunch of evidence from lots of instant runoff elections. That it's actually pretty good. It doesn't fail stuff. It doesn't produce unusual or kind of paradoxical results very often. So probability is very low that you will see something weird happening in an instant runoff election. So that's given us a little bit of a boost, sort of new wings to unify, to unite behind the instant runoff voting.

Sadie Witkowski: 31:21 --> 31:25
So is Ismar advocating instant runoff as to like where we should move?

Sam Hansen: 31:26 --> 31:38
He is. And he makes it very clear in his book that instant runoff is his preferred system.
And among the theorists, we may even be approaching a sense of unanimity on this question.

Ismar Volić: 31:38 --> 32:41
What the math community seems to have decided in the last five, ten years is to get behind instant runoff, put our own differences behind. And it's not that we're lying to the world. Instant runoff is as good as any of these other systems. In addition, we have empirical evidence that it doesn't screw up really, very rarely, negligibly often. And it's already out there in the real world. So there's a new kind of a unity that, I was actually just talking to one of the biggest proponents of Condorcet voting, Harvard professor and Nobel laureate Eric Maskin, who is a student of Kenneth Arrow who proved that impossibility theorem. And Eric likes Condorcet voting, but he says like, yeah, sure, I like it, but you know what, let's just get behind the IRV. It's good, it's great. Anything's better than plurality at this point, and this is a perfectly good system.

Sadie Witkowski: 32:41 --> 32:49
I can understand that. After all of this, anything that's not plurality does seem like the best way forward.

Sam Hansen: 32:49 --> 32:52
As long as it isn't parity.

Sadie Witkowski: 32:52 --> 32:53
Fair.

(Music)
Sam Hansen: 32:53 --> 33:22
If you're enjoying the discussions we're having on this show, there's another University of Chicago Podcast Network show you should check out. It's called Big Brains. Big Brains brings you the stories behind the pivotal scientific breakthroughs in research that are reshaping our world. Change how you see the world and keep up with the latest academic thinking with Big Brains. Part of the University of Chicago Podcast Network. network.

SH 33:27 --> 33:35
Up to this point, we've only been talking about electing people. And there's another type of election that I want to talk to you about.

Sadie Witkowski: 33:31 --> 33:36
Okay, what's that?

Victoria Mooers: 33:36 --> 33:49
Direct democracy is where for every single issue that comes up, every policy we want to make a decision on, every single person gets to cast a vote in it. So you're having a referendum on every issue.

Sadie Witkowski: 33:49 --> 33:51
All right. So who was that?

Sam Hansen: 33:51 --> 33:53
I'll let her introduce herself.

Victoria Mooers: 33:53 --> 33:59
My name is Victoria Mooers and I'm a PhD student in economics at Columbia University.

Sadie Witkowski: 34:00 --> 34:06
So direct democracy are ballot measures, like the proposals we're always hearing about from California.

Sam Hansen: 34:06 --> 34:28
Ballot measures or referendums are a type of direct democracy where for very specific, important topics, it's put to the whole electorate.
There are those who believe that for a government to be truly democratic, in the will of the people sense, then the people should be the ones voting on the laws like they did in ancient Athens.

Sadie Witkowski: 34:28 --> 34:33
Yeah, like a classic thumbs up, thumbs down majority vote for every law.

Sam Hansen: 34:33 --> 34:45

Yeah, with or without the ability for people to abstain depending on who you ask.
And when you think about it, this makes some sense, at least from a mathematical sense.

Sadie Witkowski: 34:45 --> 34:55
I mean, it does take away the question of voting systems.
With just yes or no choices, we know thanks to May's theorem that the majority vote is the way to go.

Sam Hansen: 34:55 --> 34:59
Not only that, our old friend Condorcet gives us another reason.

Victoria Mooers: 34:59 --> 35:31
The Condorcet jury theorem says that in a common interest environment, which means we all want the same outcome, there's a right and the wrong state of the world, and we all want to choose the right state of the world. We just don't know what it is. In that environment, as long as everyone's information is at least as good as random, then as the number of voters grows large, the probability that we choose the right state of the world when we vote with majority voting approaches one.

Sadie Witkowski: 35:31 --> 35:36
Okay, I think I'm going to need you to break this down a little bit for me.

Sam Hansen: 35:36 --> 36:09
Yeah, there's a lot there.
First, in the case of the jury theorem, it's important to know that Condorcet was thinking about situations with a true, false, or right, wrong binary choice.
So with that said, what the theorem is really saying is that as long as people have more than a 50% chance of choosing the right answer to a question, getting a lot of people into a room and taking their majority answer on the question gives you a really, really good chance of getting it right.

Sadie Witkowski: 36:09 --> 36:20
Okay, I think I get it. Let me give it a try. Using the word jury from the title, a jury with more people is likely to reach the correct guilty verdict.

Sam Hansen: 36:21 --> 36:23
Exactly. And when it comes to voting.

Victoria Mooers: 36:23 --> 36:41
What Condorcet's jury theorem really gives us is that direct democracy or majority voting is very, very strong. It's very effective at choosing the right outcome. And it means that as you get towards a large electorate, it becomes very, very difficult to do better than majority voting.

Sam Hansen: 36:41 --> 36:57

This is, of course, assuming a lot of things that we can't know are true, such as there being a capital C correct way to vote on a law and everyone having enough information to be better than a coin flip on voting the correct way.

Sadie Witkowski: 36:57 --> 37:04
Yeah, those are kind of big assumptions, especially the idea that there's a correct choice on a political vote.

Sam Hansen: 37:05 --> 37:27
Can't deny that this is a sticking point.
The way I like to think about it is that the capital C correct way for a political vote on a law to go is if it faithfully represents the will of the people voting for it if everyone had perfect information about the content and potential impacts of the law.

Sadie Witkowski: 37:27 --> 37:40
Okay, so like for the political votes, instead of the information from the theory representing the chance of a voter being correct on the truth, it's really much more about how they understand the law and its impacts.

Sam Hansen: 37:40 --> 37:46
Exactly. It's all about how well they're able to determine if it matches their will.

Sadie Witkowski: 37:46 --> 37:50
Okay, but this still is a lot of assumptions.

Sam Hansen: 37:51 --> 37:53
Yeah, but what other path is there?

Sadie Witkowski: 37:53 --> 38:05
Okay, that's a trap. That sounds like a leading question, but I'm going to bite anyway. What about limiting the vote to just those who think we have the best information?

Sam Hansen: 38:06 --> 38:14
Have you been reading ahead? Because that's exactly what some people have suggested. It's a method called liquid democracy.

Victoria Mooers: 38:14 --> 38:35
So liquid democracy, it's trying to be the golden medium between direct democracy and representative democracy. Everybody has the chance to vote on every issue. But now people also have the chance to delegate their vote on a given issue to a person of their choice.

Sam Hansen: 38:35 --> 38:44
Meaning, if you think your information is not up to snuff, you can assign your vote to someone who you think has more or better info.

Sadie Witkowski: 38:44 --> 38:48
I mean, it does sound really great, but has anyone tried it out?

38:49 --> 39:00
They have. It's been tried out in a bunch of places, especially as an internal decision-making system in the pirate parties in Europe.
Not to mention one of the biggest companies in the world.

Victoria Mooers: 39:00 --> 39:10
Google implemented an experiment where they tried to use liquid democracy to make some internal choices about things like what snacks to have and things like this.

Sadie Witkowski: 39:11 --> 39:14
Okay, having worked in those offices, this is fascinating.

Sam Hansen: 39:15 --> 39:21
Right? Though using liquid democracy for a vote on snacks might not be the best usage.

Victoria Mooers: 39:21 --> 39:43
When you see their results, it's really highlighted because they had, I think it was like under 5% of votes were actually delegated. And they had a huge amount of participation. Thousands of employees voted, but very few actually delegated. And that's not so surprising given that most of us know what snack we want.

Sadie Witkowski: 39:43 --> 39:46
Of course, if the question isn't one where the voters are likely to have a wide array of quality of information, then the delegation isn't too helpful.

39:47 --> 40:01
Exactly. Not to mention that this was not a vote with only two choices. So it also ran into Arrow's theorem issues.

40:01 --> 40:04
That pesky Arrow, always getting in the way.

40:04 --> 40:20
I know, what a jerk of a theorem. But going back to our ideal world, where there are only two choices and a correct answer, Victoria and her collaborators were able to show that liquid democracy can be better than a full electorate direct vote.

Victoria Mooers: 40:20 --> 40:27
In this world, there does exist an equilibrium in which delegation does better than majority voting.

Sam Hansen: 40:27 --> 40:58
When Victoria says in this world, she means in the model she and her collaborators created. And as it said, all models are wrong, but some are useful. And what this useful model says is that if you know how likely the information that voters have is right, then there is a threshold value where people whose information is worse than that threshold value should delegate to an expert with better information.

Sam Hansen: 40:58 --> 41:16
So say I exist in this world of the model and I somehow know that my information is only like 65 percent likely to be right.
And the threshold value for a specific election is 75 percent.
then I should delegate.

Sam Hansen: 41:16 --> 41:19
Right. Except those thresholds are probably too high.

Victoria Mooers: 41:19 --> 41:32
We find that the threshold is kind of surprisingly low, at least by our intuition. And it means that in order for delegation to improve over majority voting, it's important that people don't delegate too much.

Sadie Witkowski: 41:32 --> 41:43
But why? To me, it would seem that the more people who delegate to high information voters, the more likely the vote would come out correct.

Sam Hansen: 41:38 --> 41:46
That's my intuition too. So I asked Victoria about it.

Victoria Mooers: 41:46 --> 42:10
Many of those people say, oh, my signal had a pretty low chance of being right.
Let me give it to this expert. That expert's only pulling one signal, but suddenly they have all this voting weight from everyone that delegated to them. So you're putting a lot of weight on this one signal that isn't actually as likely to be right as the combined everyone else's signals.

Sadie Witkowski: 42:12 --> 42:39
Still not sure I'm there, but let me try. So if you were going to ask just one person,
either the expert would say 75% chance of being right, or a random person from a pool of people who all have a 60% chance of being right, you would choose the one person. But if that pool of people was big enough, you should instead choose the pool's majority choice.

Sam Hansen: 42:39 --> 43:07
You're there.

Really, it comes down to how probability and large numbers interact. The more independent voters who are over 50% likely to be correct, the closer to 100% you get that the majority will be correct. In fact, for the example you just shared, it only takes a group of 11 voters with a 60% chance of being correct to be better than a single voter with a 75% chance.

Sadie Witkowski: 43:08 --> 43:11
Only 11? That is much fewer than I expected.

Sam Hansen: 43:11 --> 43:18
Me too, which is exactly why it's important for people not to delegate too much in liquid democracy.

Sadie Witkowski: 43:18 --> 43:23
I mean, for sure. But do we know anything about delegation rates for liquid democracy?

Sam Hansen: 43:23 --> 43:29
We do, thanks to Victoria and her collaborators who recently conducted research where they could study this.

Victoria Mooers: 43:29 --> 43:36
We ran two different experiments. One was a very classic lab experiment and one was an online experiment.

Sam Hansen: 43:37 --> 44:00
The lab experiment had a straightforward setup. There were two boxes, one with a prize, and the participants had to vote on which had the prize. Before they voted, they were all given information about which box had the prize as well as how reliable that information was.
as well as how reliable the information of the expert that they could delegate to was.
And they found...

Victoria Mooers: 44:00 --> 44:06
So in this experiment, we find that people really have a tendency to delegate too often.

Sam Hansen: 44:06 --> 44:11
It's like the reverse of Dunning-Kruger.
They probably had the same intuition that I had earlier.

Sam Hansen: 44:11 --> 44:32
Most likely.
But what's really interesting is that the pattern didn't hold when it came to people abstaining from voting, which is similar to delegating, except instead of giving your whole vote to one person, you are really giving each other voter a tiny bit extra weight.

Victoria Mooers: 44:32 --> 44:46

And what's interesting there is that people abstain the theoretically correct amount. If you consider in the equilibrium where majority voting with abstention does best, they abstain that amount on average.

Sam Hansen: 44:46 --> 44:47
Which means?

Victoria Mooers: 44:47 --> 44:59
Liquid democracy does poorly if you compare it to majority voting in terms of how frequently we get the correct outcome in the lab due to this over delegation.

Sadie Witkowski: 45:00 --> 45:01
That's too bad.

Sam Hansen: 45:01 --> 45:13
It really is. But those results were from the lab.
And we both know that results from the lab do not always translate to more real world scenarios.

Victoria Mooers: 45:13 --> 45:41
But one concern we had was that because of the really precise environment of the lab, where you know your own precision, you know the expert's precision all very precisely, that this might be distorting behavior. Because it might be driving people to really focus on the contrast between how likely their own signal is to be correct and how likely it is for the expert's signal to be correct.

Sam Hansen: 45:41 --> 45:44
Which is why they did a second experiment.

Victoria Mooers: 45:44 --> 45:50
And what we wanted to do in this online experiment was to make the precision of the signals very ambiguous.

Sadie Witkowski: 45:51 --> 45:55
Yeah, okay. That makes sense.
So what did the experiment actually look like?

Sam Hansen: 45:55 --> 46:34
In order to make the numbers ambiguous, they used a test from psychology that's based on perception.
Essentially, there were a lot of moving dots on a screen.
Most are darting about randomly, but some are moving as a group to the left or to the right.
Everyone gets a quick look about one second, and then they have to vote on the direction. So no one knows exactly how accurate their sense of the direction is. And while again, they can all

delegate, this time, instead of knowing how precise the information the person who they're delegating to has, they just know that they were among the top 20% of correctness among the participants in prior rounds.

Sadie Witkowski: 46:34 --> 46:39
And how did the delegation look in this new experiment?

Sam Hansen: 46:39 --> 47:40
Well…

Victoria Mooers: 46:40 --> 47:06
Even in this environment, where nobody knows any numbers at all, we still get that people delegate in some sense too often. They delegate more often than they abstain. And it leads to liquid democracy doing worse than they would have done if they had just done majority voting and gone with what they each reported as left or right in each task.

Sadie Witkowski: 47:06 --> 47:13
Great. So should we just be writing liquid democracy off then? I mean, I only just learned about it, so I can erase it pretty quickly.

Sam Hansen: 47:13 --> 47:42
I don't think we're quite at that point yet. It definitely raises some concerns about delegation and the non-intuitive nature of when to do it that proponents of liquid democracy will have to address.
It is important to note that these experiments were precisely set up, which makes for good science, but does mean that they can't test everything, which is why Victoria says,

Victoria Mooers: 47:42 --> 47:45
I think there's certainly more research that needs to be done.

Sam Hansen: 47:45 --> 47:59
It's also important to remember that in politics, there is not always a right or wrong answer. And the way people actually picture liquid democracy is quite different from the way they tested it.

Victoria Mooers: 47:59 --> 48:07
You know a lot of people talk about, "Oh what I want is to be able to delegate basically on this one issue I delegate to the politician I agree with on environmental issues, and they vote on all environmental issues for me." The idea is people want to pick for a given issue, someonethat matches their preferences, but then has more information.
A lot of people talk about, oh, what I want is to be able to delegate basically on this one issue.
.
Sam Hansen (during interview): 48:19 --> 48:25
Yeah, it almost feels like a fluid house of representatives instead of...

Victoria Mooers: 48:25 --> 48:28
Yes, I think that's how a lot of people would envision it.

Sadie Witkowski: 48:28 --> 48:43
Yeah, exactly. That's just the sort of thing I was picturing. I could vote on the bills that I thought were so vital that I had read and researched them. But for the rest, I could choose a delegate depending on who I trusted for that topic.

Sam Hansen: 48:43 --> 49:06
Me too. I even sort of imagine in a liquid democracy that there would be people who end up as a new profession who sort of serve as professional delegates who read all the bills and have known ideologies, except instead of electing them and they get to have our vote delegated to them for the length of their term, we can give and take it freely.

Sadie Witkowski: 49:06 --> 49:10
Yeah, I mean, that sounds quite good, except for one thing.

Sam Hansen: 49:10 --> 49:11
What's that?

Sadie Witkowski: 49:11 --> 49:13
Yeah. How are they getting paid?

Sam Hansen: 49:15 --> 49:52
I'll get back to you on that. All of that said, I won't hide that I find liquid democracy to be a very intriguing possible path for how governments could be run in the future.
The arguments from its proponents that it could increase public participation in the democratic process, as well as responsibility and cooperation with respect to public works are quite convincing to me. But I really hope that the research Victoria says is needed happens, because the results she helped find have made me a lot less bullish than I used to be.

Victoria Mooers: 49:52 --> 50:06
There's many other reasons people might argue for liquid democracy, but the informational grounds that are often one of the first reasons it's pushed, we have reason to be a little concerned about that.

Sadie Witkowski: 50:06 --> 50:11
Yeah, hopefully that research that Victoria needs actually happens and it can provide more clarity.

Sam Hansen: 50:12 --> 50:16
Definitely. There is one thing that I'm clear on, though.

Sadie Witkowski: 50:16 --> 50:16
What's that?

Sam Hansen: 50:17 --> 50:18
It would still be better than plurality.

Sadie Witkowski: 50:18 --> 50:24
Oh, of course. We have plenty of clarity on that.

Sam Hansen: 50:24 --> 50:31
And if you are not as clear on that as we are, Ismar has a kind offer.

Ismar Volić: 50:31 --> 50:38
Yes. If they're not, they need to email me and I can talk to them some more.

(Music)

Sam Hansen: 50:40 --> 50:48
Don’t forget to check out our show notes in the podcast description for more Ismar and Victoria, including links to their work we discussed on this episode

Sadie Witkowski: 50:48 --> 51:01
And if you like the show, give us a review on apple podcast or spotify or wherever you listen. By rating and reviewing the show, you really help us spread the word about Carry the Two so that other listeners can discover us.

Sam Hansen: 51:01 --> 51:17
And for more on the math research being shared at IMSI, be sure to check us out online at our homepage: IMSI dot institute. We’re also on twitter at IMSI underscore institute, as well as instagram at IMSI dot institute! That’s IMSI, spelled I M S I.

Sadie Witkowski: 51:16 --> 51:32
And do you have a burning math question? Maybe you have an idea for a story on how mathematics and statistics connect with the world around us. Send us an email with your idea!

Sam Hansen: 51:32 --> 51:41
You can send your feedback, ideas, and more to sam AT IMSI dot institute. That’s H A N S E M at I M S I dot institute.

Sadie Witkowski: 51:41 --> 51:47
We’d also like to thank Blue Dot Sessions for the music we use in Carry the Two.

Sam Hansen: 51:48 --> 51:52

Lastly, Carry the Two is made possible by the Institute for Mathematical and Statistical Innovation, located on the gorgeous campus of the University of Chicago. We are supported by the National Science Foundation and the University of Chicago.

Sam Hansen: 52:09 --> 52:14
Another is the majoria.
Majoria.
Majoria.

Sadie Witkowski: 52:15 --> 52:17
Masks of majoria criteria. (laughs)
Sorry, I'm done.

Sadie Witkowski: 52:26 --> 52:38
I can understand that.
After all of this, anything that is not pure.
Anything that is not plura. (laughs)
I can't say that word.
Save me, Jesus.
Okay.