



DECEMBER 9, 2024

ADVENTURES IN DEMOCRATIC  
DECISION MAKING

# INSTANT RUNOFF VOTING

Adrian Haret  
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and encourages tactical voting.

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Adding a runoff helps, but does not fix these problems.

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Adding a runoff helps, but does not fix these problems.

So how about adding *more* runoffs?...

This motivates another voting rule.

# INSTANT RUNOFF VOTING (IRV)

Aka *Single Transferable Vote (STV)*, *Ranked-Choice Voting (RCV)*, or *Alternative Vote (AV)*

Voters submit full preference rankings.

					Round <i>i</i>
45	30	25	16	7	
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	
...	...	...	...	<i>d</i>	
<i>e</i>	<i>e</i>	<i>e</i>	<i>e</i>	...	
...	...	...	...	...	

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...	...	...	...	<i>d</i>
<i>e</i>	<i>e</i>	<i>e</i>	<i>e</i>	...
...	...	...	...	...

Round $i + 1$				
45	30	25	16	7
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
...	...	...	...	<i>d</i>
<i>e</i>	<i>e</i>	<i>e</i>	<i>e</i>	...
...	...	...	...	...

\*With tie-breaking (e.g., according to alphabetical order) if needed.

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...	...	...	...	<i>d</i>
<i>e</i>	<i>e</i>	<i>e</i>	<i>e</i>	...
...	...	...	...	...

Round $i + 1$				
45	30	25	16	7
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...	...	...	...	<i>d</i>
<i>e</i>	<i>e</i>	<i>e</i>	<i>e</i>	...
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This process is repeated until only one candidate remains.

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<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
...	...	...	...	<i>d</i>
<i>e</i>	<i>e</i>	<i>e</i>	<i>e</i>	...
...	...	...	...	...

Round $i + 1$				
45	30	25	16	7
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
...	...	...	...	<i>d</i>
<i>e</i>	<i>e</i>	<i>e</i>	<i>e</i>	...
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This candidate's votes are 'transferred' to the next candidate on the ballot.

This process is repeated until only one candidate remains.

Last standing candidate is the winner.

Round $i$				
45	30	25	16	7
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
...	...	...	...	<i>d</i>
<i>e</i>	<i>e</i>	<i>e</i>	<i>e</i>	...
...	...	...	...	...

Round $i + 1$				
45	30	25	16	7
<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>
...	...	...	...	<i>d</i>
<i>e</i>	<i>e</i>	<i>e</i>	<i>e</i>	...
...	...	...	...	...

\*With tie-breaking (e.g., according to alphabetical order) if needed.

# IRV ON AN EXAMPLE

Who gets the boot?

Round 1						
2	1	3	2	1	1	1
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

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Who gets the boot?

In Round 1, *a* gets eliminated.

							Round 1
2	1	3	2	1	1	1	
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>	
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>	
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>	
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>	

# IRV ON AN EXAMPLE

Who gets the boot?

In Round 1, *a* gets eliminated.

In Round 2, *d* gets eliminated.

Round 1						
2	1	3	2	1	1	1
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

Round 2						
2	1	3	2	1	1	1
<b><i>b</i></b>	<b><i>b</i></b>	<b><i>c</i></b>	<b><i>d</i></b>	<b><i>d</i></b>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<b><i>b</i></b>	<b><i>c</i></b>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

# IRV ON AN EXAMPLE

Who gets the boot?

In Round 1, *a* gets eliminated.

In Round 2, *d* gets eliminated.

In Round 3, *b* gets eliminated.

Round 1						
2	1	3	2	1	1	1
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

Round 2						
2	1	3	2	1	1	1
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

Round 3						
2	1	3	2	1	1	1
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

# IRV ON AN EXAMPLE

Who gets the boot?

In Round 1, *a* gets eliminated.

In Round 2, *d* gets eliminated.

In Round 3, *b* gets eliminated.

Only *c* is left standing, hence *c* is the winner.

Round 1						
2	1	3	2	1	1	1
<i><b>b</b></i>	<i><b>b</b></i>	<i><b>c</b></i>	<i><b>d</b></i>	<i><b>d</b></i>	<i><b>a</b></i>	<i><b>a</b></i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

Round 2						
2	1	3	2	1	1	1
<i><b>b</b></i>	<i><b>b</b></i>	<i><b>c</b></i>	<i><b>d</b></i>	<i><b>d</b></i>	<i><b>a</b></i>	<i><b>a</b></i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i><b>b</b></i>	<i><b>c</b></i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

Round 3						
2	1	3	2	1	1	1
<i><b>b</b></i>	<i><b>b</b></i>	<i><b>c</b></i>	<i><b>d</b></i>	<i><b>d</b></i>	<i><b>a</b></i>	<i><b>a</b></i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i><b>b</b></i>	<i><b>c</b></i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i><b>b</b></i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

Round 4						
2	1	3	2	1	1	1
<i><b>b</b></i>	<i><b>b</b></i>	<i><b>c</b></i>	<i><b>d</b></i>	<i><b>d</b></i>	<i><b>a</b></i>	<i><b>a</b></i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i><b>c</b></i>
<i>d</i>	<i><b>c</b></i>	<i>b</i>	<i><b>c</b></i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i><b>c</b></i>	<i><b>c</b></i>	<i>b</i>

# IRV REFINEMENTS

If ballot is incomplete, use as much of it as possible.

							Round 1
2	1	3	2	1	1	1	
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>	
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>	
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>	
	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>	



# IRV REFINEMENTS

If ballot is incomplete, use as much of it as possible.

Tie-breaking can be more sophisticated, e.g., eliminate candidate with fewer second-place votes.

							Round 1
2	1	3	2	1	1	1	
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>	
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>	
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>	
	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>	

In a tie between *a* and *b*, *b* would be eliminated.



ISMAR VOLIĆ

IRV exploits voters' entire preference ranking, and allows candidates to gain an *eventual majority*.

Volić, I. (2024). *Making Democracy Count: How Mathematics Improves Voting, Electoral Maps, and Representation*. Princeton University Press.



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But this is more than plurality, or plurality with runoff, which only look at part of a voter's ballot.



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But this is more than plurality, or plurality with runoff, which only look at part of a voter's ballot.

Plurality is like looking at the galaxy with the naked eye.

Runoff is like the Hubble telescope.

Instant runoff is like the Webb telescope.

Volić, I. (2024). *Making Democracy Count: How Mathematics Improves Voting, Electoral Maps, and Representation*. Princeton University Press.

By transferring votes to next choices,  
IRV tries to ensure that no vote is  
*wasted.*



WILLIAM R. WARE (1832 – 1915)

I devised this rule around 1870, as a professor at MIT.

It is still in use there, to this day.



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SIR THOMAS HARE (1806 – 1891)

Humbug!



Instant-runoff is a special case of *Single Transferable Vote (STV)*, used to elect multiple representatives.

Which I came up in 1857, while being a lawyer and political reformer in Britain.



This idea of transferring votes can be extended to handle elections of *multiple* representatives, e.g., parliaments.

This idea of transferring votes can be extended to handle elections of *multiple* representatives, e.g., parliaments. STV does this.

# IRV/STV IN PRACTICE

1918 House of Representatives in Australia

1937 Presidency of Ireland

1949 Presidency of India

Voted by an electoral college consisting of the elected members of both houses of parliament (MPs), the elected members of the State Legislative Assemblies (Vidhan Sabha) of all States, and the elected members of the legislative assemblies (MLAs) of union territories with legislatures, i.e., National Capital Territory (NCT) of Delhi, Jammu and Kashmir and Puducherry.

1997 - 2006 House of Representatives in Fiji

2003 Parliament elections in Papua New Guinea  
Voters rank only three candidates

2024 Primary election in the 12th district of Budapest

Wikipedia contributors. (2024, November 11). [History and use of instant-runoff voting](#). Wikipedia.

STV ballot from the 2011 Irish general election



# THE HUNGARIAN TWO-TAILED DOG PARTY

Funded in 2006, in Szeged. Officially registered as a party in 2014.

Platform promises eternal life, world peace, a one-day workweek, two sunsets a day (in assorted colors), lower gravity, free beer, and low taxes.

Main political activities consist of protesting, drawing graffiti, and making funny posters.

Got 1.73% of the total vote in the 2018 parliamentary election, but no seats.



"He's so cute, surely he isn't going to steal."

Street art of the party in Budapest, illustrating the four color theorem

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Uses IRV in its elections.



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# IRV IN THE US

1915 Ashtabula, Ohio  
For city council members

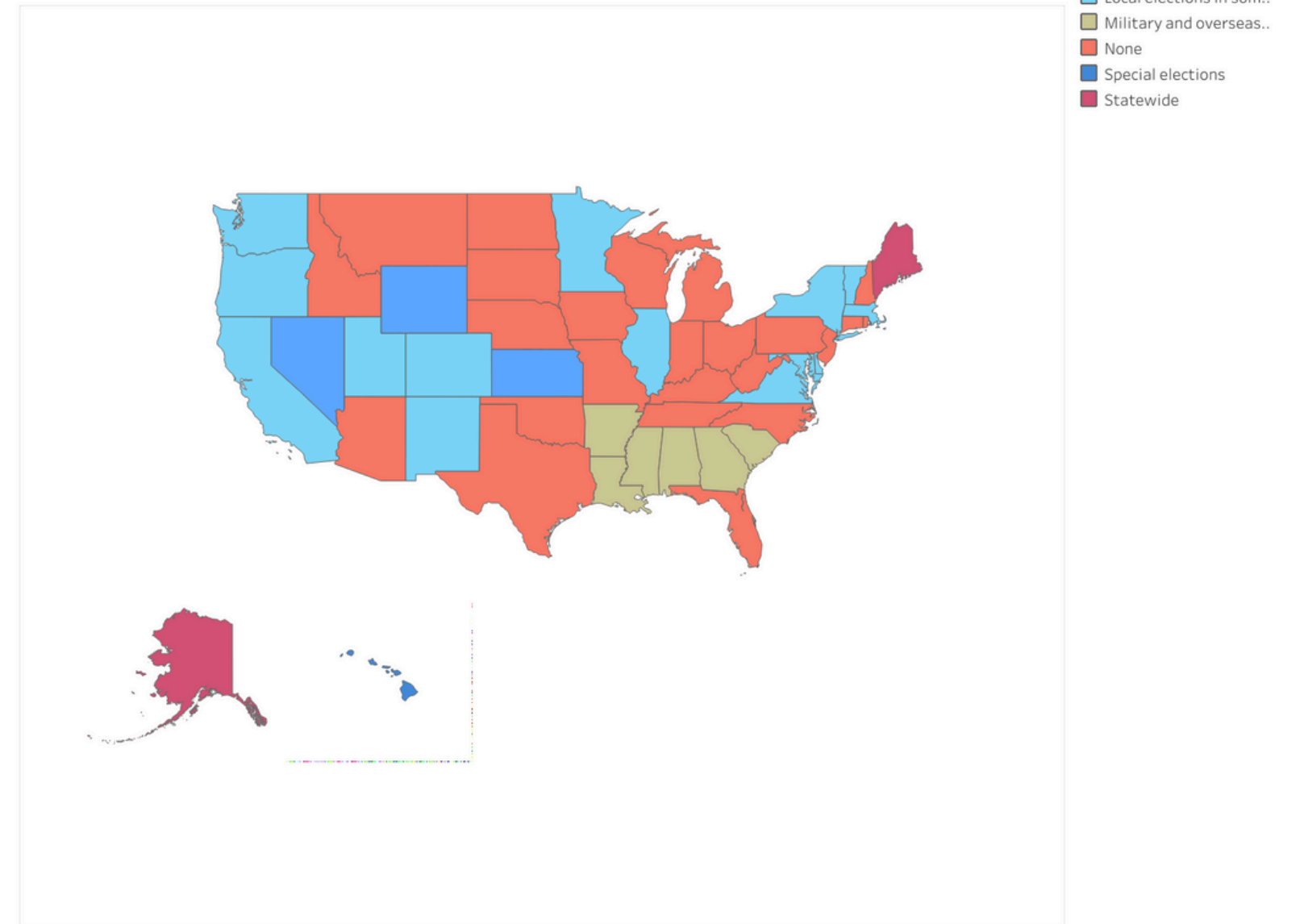
1936 New York City  
For school board and city council elections

currently statewide, in Alaska and Maine

two counties

58 cities

Instant Runoff Voting Usage in the U.S.

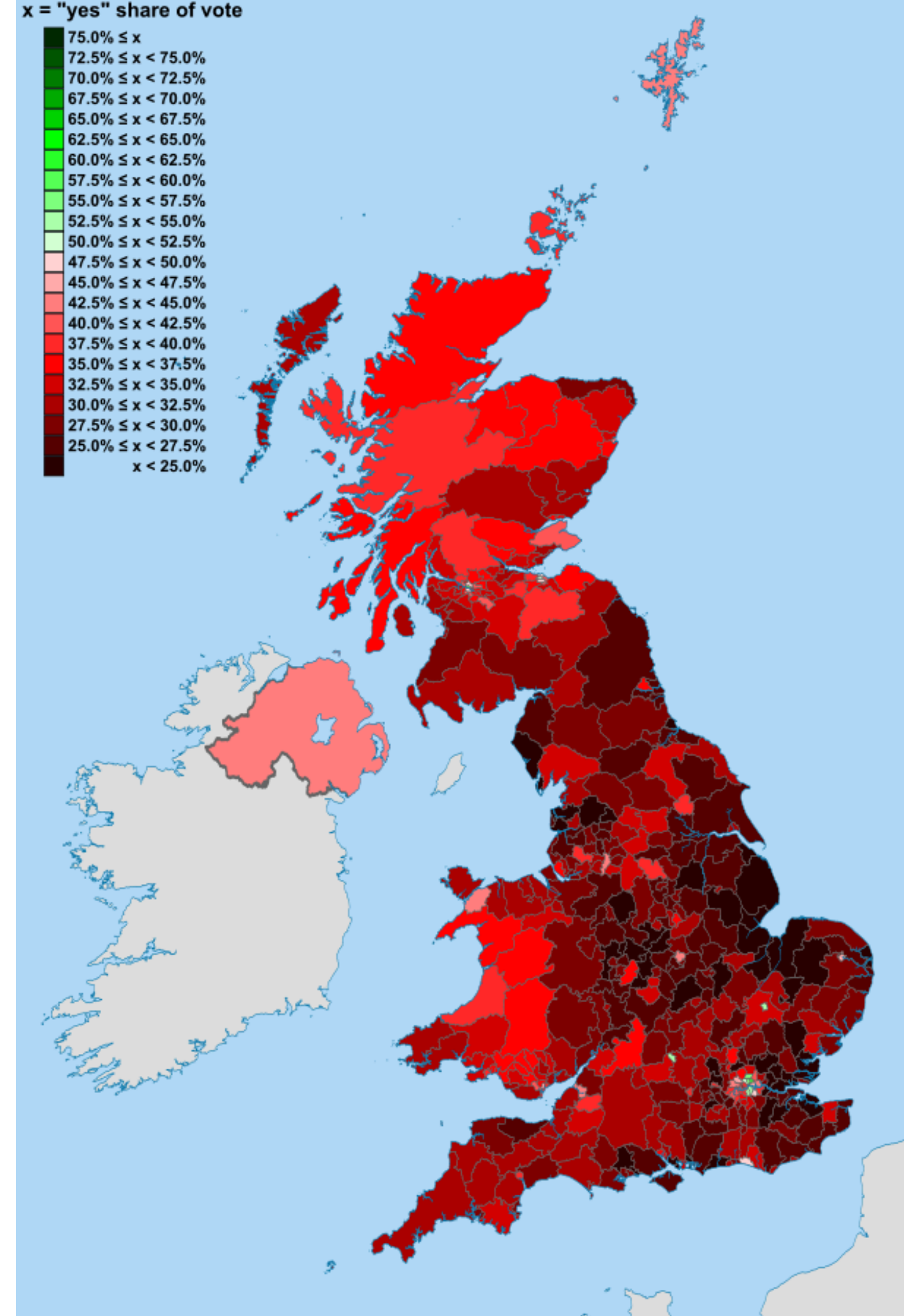


# IN THE UK

In 2011, the UK held a referendum.

The question was whether to replace First-Past-the-Post (plurality) with Alternative Vote (IRV) when electing MPs.

The result was *no* (i.e., keep plurality), with 67.9% of the votes.



Does IRV prevent spoilers?



# IRV AND THE SPOILER EFFECT

In the 2000 US Presidential election, the final decision came down to the (very close) result in Florida.

Bush won by a very narrow margin.

Actual Florida vote count

2,912,790	2,912,253	97,488
<b>Bush</b>	<b>Gore</b>	<b>Nader</b>

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Suppose all Gore and Nader supporters put Bush last.

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<b>Bush</b>	<b>Gore</b>	<b>Nader</b>

Possible Florida preferences

2,912,790	2,912,253	97,488
<b>Bush</b>	<b>Gore</b>	<b>Nader</b>
Gore	Nader	Gore
Nader	Bush	Bush

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Suppose all Gore and Nader supporters put Bush last.

In this case, IRV would have elected Gore.

Actual Florida vote count		
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<b>Bush</b>	<b>Gore</b>	<b>Nader</b>

Possible Florida preferences		
2,912,790	2,912,253	97,488
<b>Bush</b>	<b>Gore</b>	Nader
Gore	Nader	<b>Gore</b>
Nader	Bush	Bush

# NO SPOILERS (WITH IRV)

In 2022, Alaska voted for its one seat in the House of Representatives.

Candidates were Mary Peltola (Democrat), Sarah Palin (Republican) and Nick Begich (Republican).

Alaska had switched to IRV in 2020.

								Round 1
27,053	15,467	11,290	34,049	3,652	21,272	47,407	4,645	23,747
Begich	Begich	Begich	Palin	Palin	Palin	Peltola	Peltola	Peltola
Palin	Peltola		Begich	Peltola		Begich	Palin	
Peltola	Palin		Peltola	Begich		Palin	Begich	

# NO SPOILERS (WITH IRV)

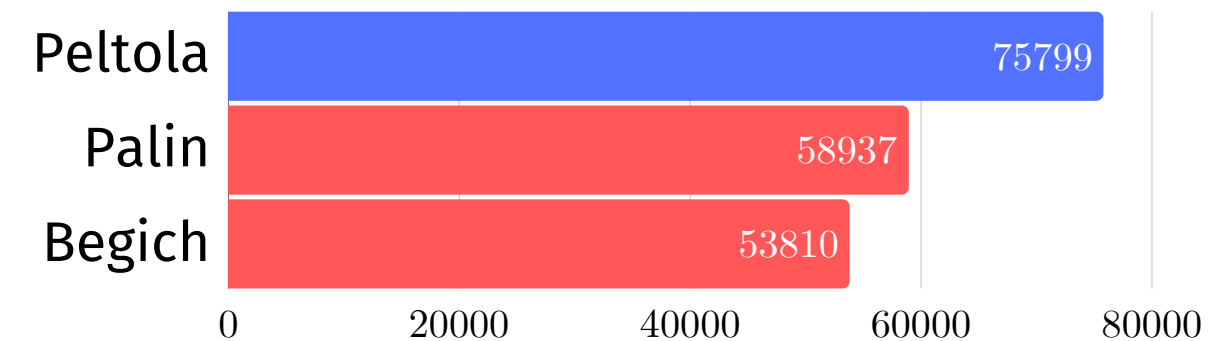
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Alaska had switched to IRV in 2020.

Begich got eliminated in the first round.

								Round 1
27,053	15,467	11,290	34,049	3,652	21,272	47,407	4,645	23,747
Begich	Begich	Begich	Palin	Palin	Palin	Peltola	Peltola	Peltola
Palin	Peltola		Begich	Peltola		Begich	Palin	
Peltola	Palin		Peltola	Begich		Palin	Begich	



# NO SPOILERS (WITH IRV)

In 2022, Alaska voted for its one seat in the House of Representatives.

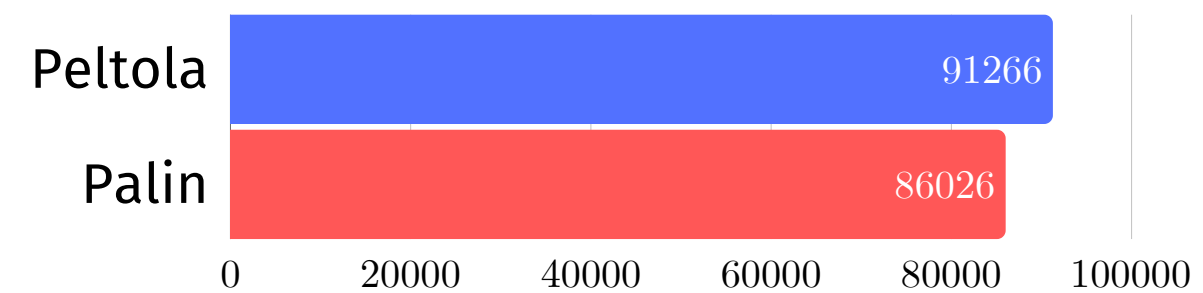
Candidates were Mary Peltola (Democrat), Sarah Palin (Republican) and Nick Begich (Republican).

Alaska had switched to IRV in 2020.

Begich got eliminated in the first round.

But (surprisingly?) Peltola won in the second.

								Round 2
27,053	15,467	11,290	34,049	3,652	21,272	47,407	4,645	23,747
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Peltola	Palin		Peltola	Begich		Palin	Begich	





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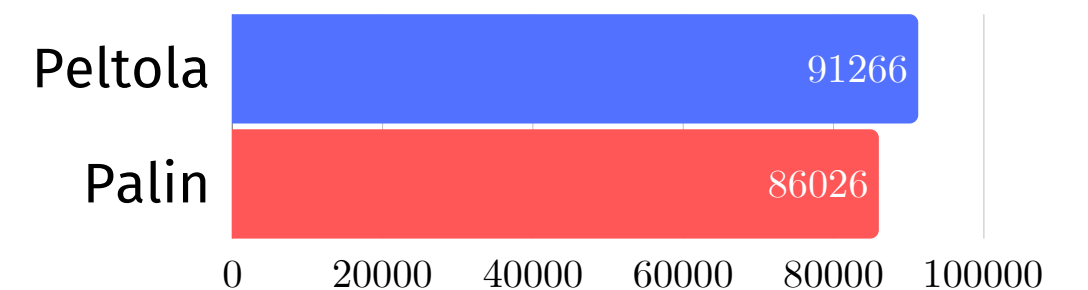
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Suggests that the Republican vote was not split among the two candidates (?).

								Round 2
27,053	15,467	11,290	34,049	3,652	21,272	47,407	4,645	23,747
Begich	Begich	Begich	Palin	Palin	Palin	Peltola	Peltola	Peltola
Palin	Peltola		Begich	Peltola		Begich	Palin	
Peltola	Palin		Peltola	Begich		Palin	Begich	





SARAH PALIN

Ranked-choice voting [i.e., IRV] is corrupt: 60% of Alaskans voted Republican, yet a Democrat won.



SARAH PALIN

Ranked-choice voting [i.e., IRV] is corrupt: 60% of Alaskans voted Republican, yet a Democrat won.

MARK Z. BARABAK

That's a feature, not a bug.



[The purpose of IRV] was to weed out extremists by making it harder for candidates to be elected simply by appealing to the hard-liners of their party's base.

Barabak, M. Z. (2023, July 2). [Column: Think our politics stink? Look north — to Alaska.](#) *Los Angeles Times*.

One of the main selling points of IRV is that it encourages more civil discourse. Why?

One of the main selling points of IRV is that it encourages more civil discourse. Why? Because candidates now have to appeal to a broader segment.

# OAKLAND 2010 MAYORAL ELECTIONS

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The favorite was Don Perata, a conservative Democrat with a lot of money to spend.

Elinson, Z., & Shih, G. (2010, November 12). The Winning Strategy in Oakland: Concentrate on Being 2nd or 3rd Choice. *The New York Times.*



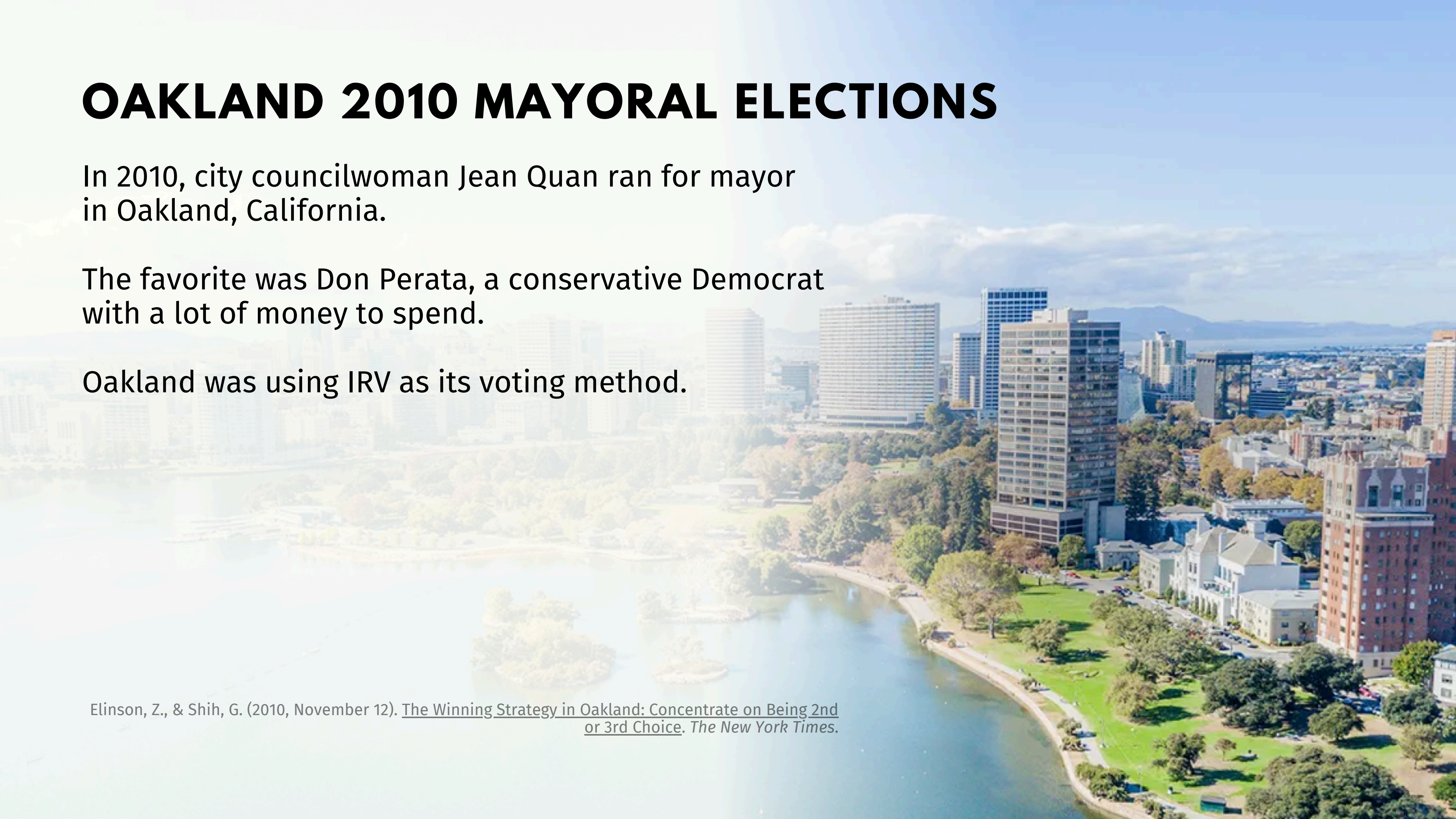
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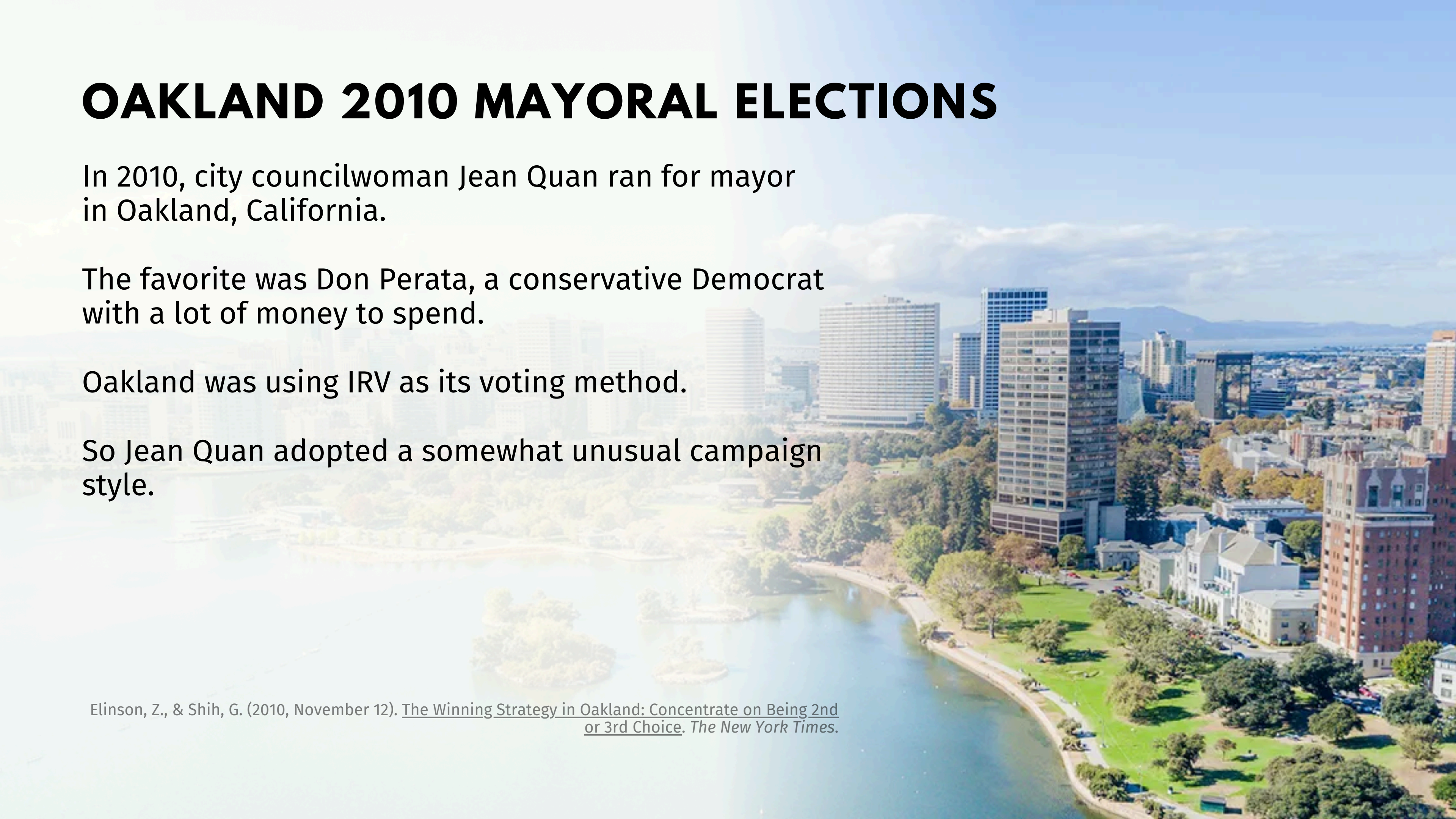
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JEAN QUAN

We talked to everybody, and if you had a sign for [other candidates] Joe Tuman or Rebecca Kaplan or Don Perata, we wanted their No. 2.

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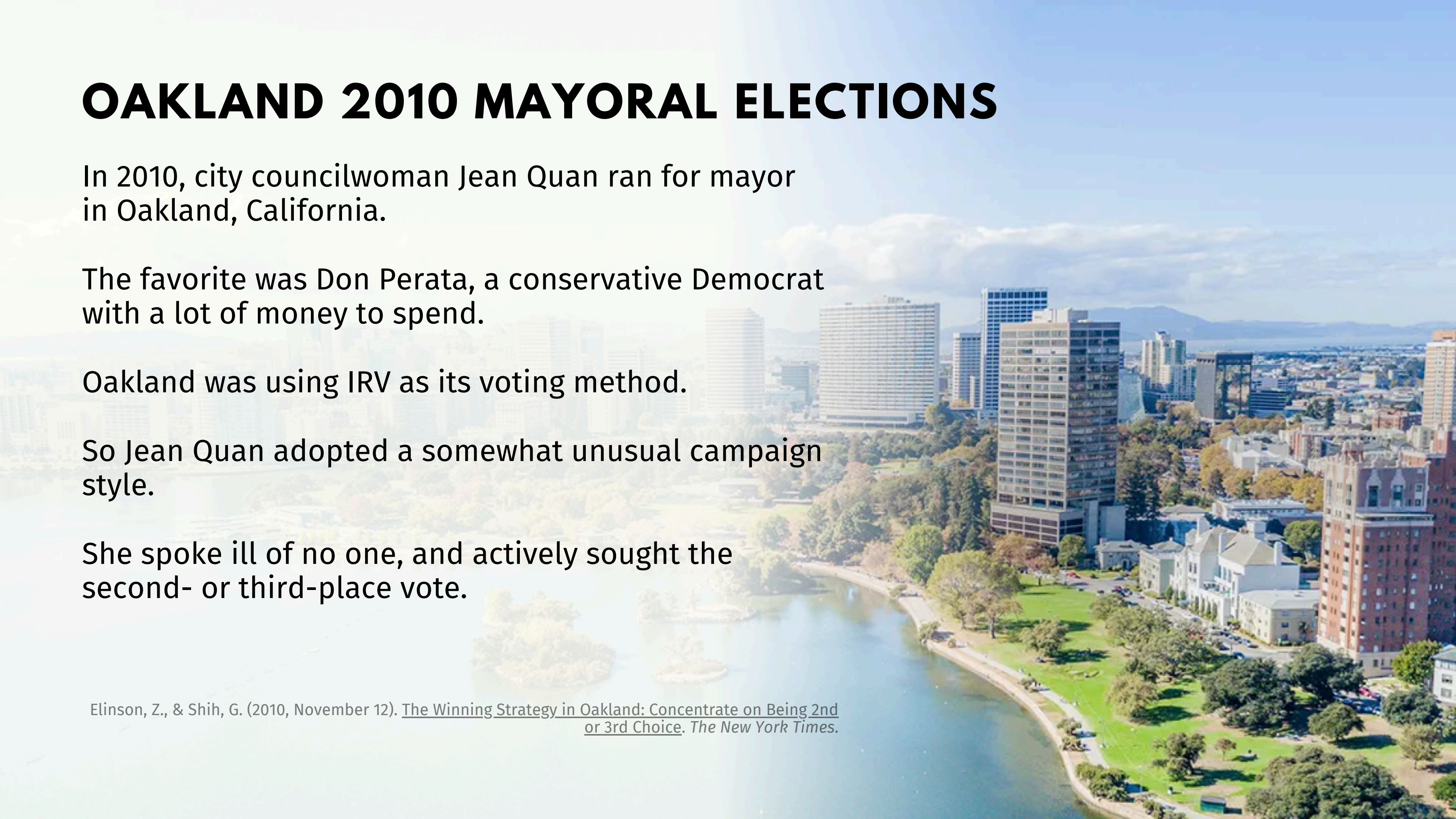
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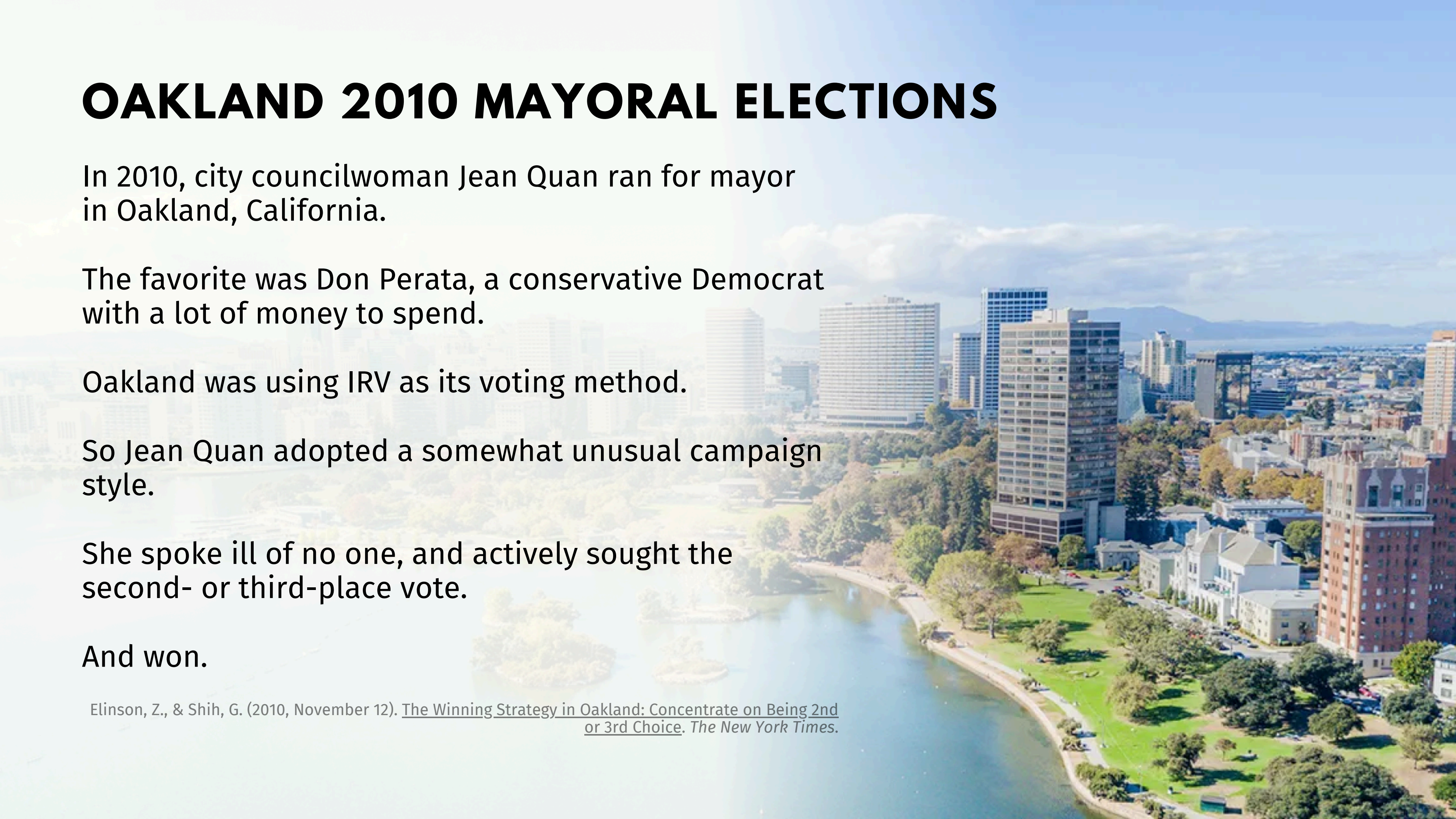
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And won.

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JEAN QUAN

We talked to everybody, and if you had a sign for [other candidates] Joe Tuman or Rebecca Kaplan or Don Perata, we wanted their No. 2.

DON PERATA

If this were a normal election, I would've won in a landslide.



Elinson, Z., & Shih, G. (2010, November 12). The Winning Strategy in Oakland: Concentrate on Being 2nd or 3rd Choice. *The New York Times*.

**Any downsides to IRV?**

One common complaint is that IRV is confusing, and/or too complicated.

# IRV IN MAINE

In a 1998 survey among resident of Maine, IRV produced low levels of voter confidence, voter satisfaction, and ease of use.

Voters thought the process favored their least favorite party.

And it took them longer to fill in their ballot.

Though it did increase 'sincere voting' (here, voting for minor candidates).

Style no. \_\_\_\_\_

**State of maine sample ballot**  
**republican primary election, June 12, 2018**  
**for**

Governor	1st choice	2nd choice	3rd choice	4th choice	5th choice
Fredette, Kenneth Wade Newport	0	0	0	0	0
Mason, Garrett Paul Lisbon	0	0	0	0	0
Mayhew, Mary C. China	0	0	0	0	0
Moody, Shawn H. Gorham	0	0	0	0	0
Write-in	0	0	0	0	0

Rep. to the legislature district 75	1st choice	2nd choice	3rd choice	4th choice
Morris, Joshua K. Turner	0	0	0	0
Pape, John Alexander Turner	0	0	0	0
Terreri, Angelo Turner	0	0	0	0
Write-in	0	0	0	0

**Instructions to voters**  
To vote, fill in the oval like this ●  
To rank your candidate choices, fill in the oval:  
• In the 1st column for your 1st choice candidate.  
• In the 2nd column for your 2nd choice candidate, and so on.  
Continue until you have ranked as many or as few candidates as you like.  
**Fill in no more than one oval for each candidate or column.**  
To rank a write-in candidate, write the person's name in the write-in space and fill in the oval for the ranking of your choice.

**Turn over for additional contests**

11 14 21 40 42 44 48 54 61

Maine Republican primary ranked ballot, 2018

Sometimes, IRV is described as unfair.



Sometimes, IRV is described as unfair. But the reasoning can be unclear.



DAVID CAMERON

There's an inherent unfairness under AV [i.e., IRV].

Supporters of unpopular parties end up having their votes counted a number of times... potentially deciding the outcome of an election... while people who back more popular parties only get one vote.

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Wintour, P. (2011, February 18). [AV reform is "inherently unfair", says David Cameron](#). *The Guardian*.

TIMOTHY GOWERS

This is a misrepresentation of how AV works.



Gowers, T. (2011, April 20). [Is AV better than FPTP?](#). Gowers's Weblog.

More serious is the fact that a plurality winner can lose.

# BURLINGTON 2010 MAYORAL ELECTIONS

In 2010 there were elections for mayor in Burlington, Vermont.

Kurt Wright (Republican) lost the election to Bob Kiss (Progressive) under IRV.

Wright lost even though he was the plurality winner.

As part of the backlash, Burlington repealed IRV.

Nonetheless, IRV *can* produce odd results.

# IRV WINNER CAN LOSE HEAD-TO-HEAD CONTESTS

In our original example, *c* is the IRV winner.

Round 1

2	1	3	2	1	1	1
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

Round 2

2	1	3	2	1	1	1
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

Round 3

2	1	3	2	1	1	1
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

Round 4

2	1	3	2	1	1	1
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>



# IRV WINNER CAN LOSE HEAD-TO-HEAD CONTESTS

In our original example, *c* is the IRV winner.

But in a direct vote between *a* and *c*, *a* wins.

Round 1							Round 2						
2	1	3	2	1	1	1	2	1	3	2	1	1	1
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

Round 3							Round 4						
2	1	3	2	1	1	1	2	1	3	2	1	1	1
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

# IRV WINNER CAN LOSE HEAD-TO-HEAD CONTESTS

In our original example, *c* is the IRV winner.

But in a direct vote between *a* and *c*, *a* wins.

In fact *a*, the first candidate to get eliminated, wins in a head-to-head contest against *everyone*.

Round 1							Round 2						
2	1	3	2	1	1	1	2	1	3	2	1	1	1
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>

Round 3							Round 4						
2	1	3	2	1	1	1	2	1	3	2	1	1	1
<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>a</i>	<i>a</i>
<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>a</i>	<i>b</i>	<i>c</i>
<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>	<i>d</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>b</i>	<i>d</i>	<i>d</i>
<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>d</i>	<i>b</i>	<i>c</i>	<i>c</i>	<i>b</i>



CONDORCET  
Hmmm...

# CENTER SQUEEZE

With IRV, Center gets eliminated first, leaving Left as the winner.

Round 1

36	34	16	14
<b>Left</b>	<b>Right</b>	<b>Center</b>	<b>Center</b>
Center	Center	Left	Right
Right	Left	Right	Left

Round 2

36	34	16	14
<b>Left</b>	<b>Right</b>	Center	Center
Center	Center	<b>Left</b>	<b>Right</b>
Right	Left	Right	Left

Round 3

36	34	16	14
<b>Left</b>	Right	Center	Center
Center	Center	<b>Left</b>	Right
Right	<b>Left</b>	Right	<b>Left</b>

# CENTER SQUEEZE

With IRV, Center gets eliminated first, leaving Left as the winner.

Even though Center is preferred to both Left and Right by a majority of voters.

Round 1

36	34	16	14
<b>Left</b>	<b>Right</b>	<b>Center</b>	<b>Center</b>
Center	Center	Left	Right
Right	Left	Right	Left

Round 2

36	34	16	14
<b>Left</b>	<b>Right</b>	Center	Center
Center	Center	<b>Left</b>	<b>Right</b>
Right	Left	Right	Left

Round 3

36	34	16	14
<b>Left</b>	Right	Center	Center
Center	Center	<b>Left</b>	Right
Right	<b>Left</b>	Right	<b>Left</b>

# CENTER SQUEEZE

With IRV, Center gets eliminated first, leaving Left as the winner.

Even though Center is preferred to both Left and Right by a majority of voters.

Centrist candidates get squeezed out by more extreme candidates.

Round 1

36	34	16	14
<b>Left</b>	<b>Right</b>	<b>Center</b>	<b>Center</b>
Center	Center	Left	Right
Right	Left	Right	Left

Round 2

36	34	16	14
<b>Left</b>	<b>Right</b>	Center	Center
Center	Center	<b>Left</b>	<b>Right</b>
Right	Left	Right	Left

Round 3

36	34	16	14
<b>Left</b>	Right	Center	Center
Center	Center	<b>Left</b>	Right
Right	<b>Left</b>	Right	<b>Left</b>

And then, something even stranger.

# INCREASING SUPPORT

With IRV, *c* gets eliminated in the first round and *a* ends up winning.

Round 1

6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

Round 2

6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

Round 3

6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>



# INCREASING SUPPORT

With IRV, *c* gets eliminated in the first round and *a* ends up winning.

Suppose, however, that three of the  $b > a > c$  voters change to  $a > b > c$ .

Round 1						Round 1				
6	6	6	4	3	2	6 + 3			1	
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>			<i>b</i>	
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>			<i>a</i>	
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>			<i>c</i>	

Round 2					
6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

Round 3					
6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

# INCREASING SUPPORT

With IRV, *c* gets eliminated in the first round and *a* ends up winning.

Suppose, however, that three of the  $b > a > c$  voters change to  $a > b > c$ .

And the two  $c > b > a$  voters change to  $c > a > b$ .

Round 1						Round 1				
6	6	6	4	3	2	9	6 + 2		1	
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>		<i>b</i>	
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>		<i>a</i>	
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>		<i>c</i>	

Round 2					
6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

Round 3					
6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

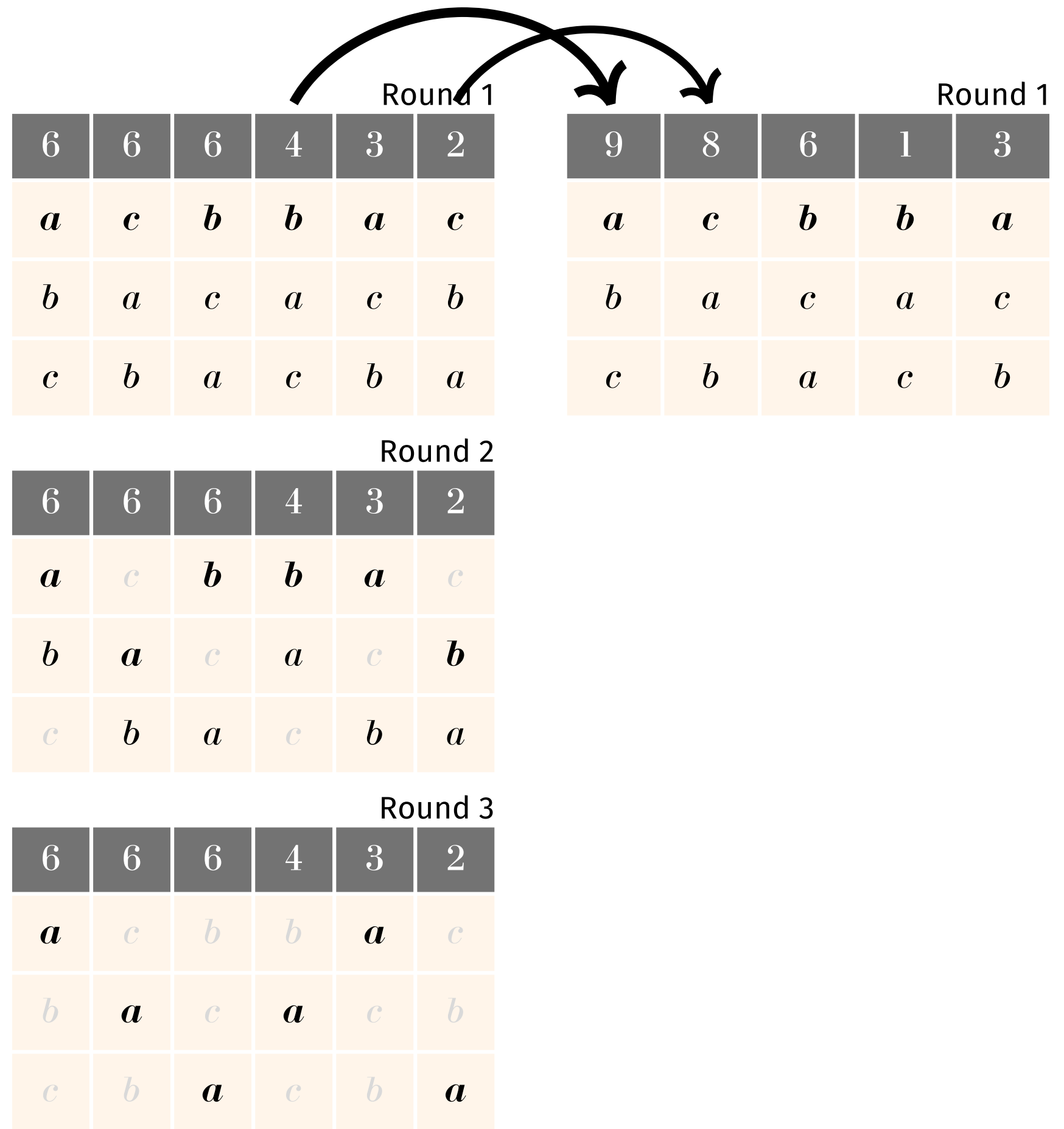
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The diagram illustrates two scenarios of IRV rounds. The left scenario shows the original state, and the right scenario shows the state after support changes. Arrows indicate the flow of support from the first scenario to the second.

Round 1					
6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

Round 1				
9	8	6	1	3
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>

Round 2					
6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

Round 2				
9	8	6	1	3
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>

Round 3					
6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

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And the two  $c > b > a$  voters change to  $c > a > b$ .

In essence, *a* wins more support.

But now *c* comes out as winner.

The diagram illustrates two scenarios of an Instant Runoff Voting (IRV) process across three rounds. Arrows at the top indicate that three voters in the second scenario have changed their preferences from  $b > a > c$  to  $a > b > c$ , and two voters have changed from  $c > b > a$  to  $c > a > b$ .

Round 1					
6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

Round 2					
6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

Round 3					
6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

Round 1					
9	8	6	1	3	
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	

Round 2					
9	8	6	1	3	
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	

Round 3					
9	8	6	1	3	
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	

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And the two  $c > b > a$  voters change to  $c > a > b$ .

In essence, *a* wins more support.

But now *c* comes out as winner.

The increased support for *a* knocks it out of the race!

The diagram illustrates two scenarios of IRV rounds. Arrows at the top point from the first scenario to the second, indicating a change in voter preferences.

Round 1					
6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

Round 2					
6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

Round 3					
6	6	6	4	3	2
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	<i>c</i>
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	<i>b</i>
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	<i>a</i>

Round 1					
9	8	6	1	3	
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	

Round 2					
9	8	6	1	3	
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	

Round 3					
9	8	6	1	3	
<i>a</i>	<i>c</i>	<i>b</i>	<i>b</i>	<i>a</i>	
<i>b</i>	<i>a</i>	<i>c</i>	<i>a</i>	<i>c</i>	
<i>c</i>	<i>b</i>	<i>a</i>	<i>c</i>	<i>b</i>	

This is a failure of *monotonicity*.

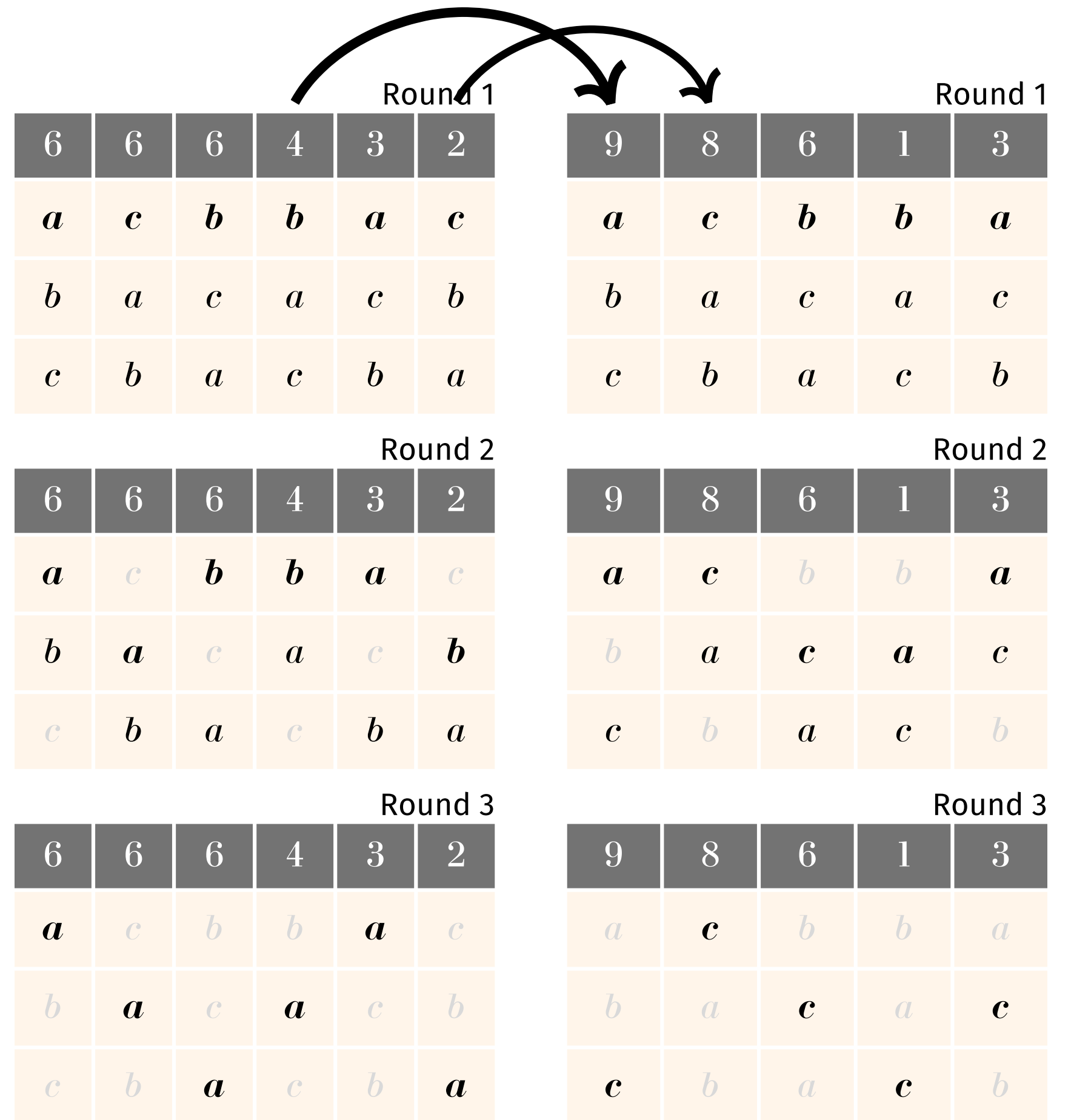
This is a failure of *monotonicity*.  
When increased support for an  
alternative ends up hurting it in the  
outcome.



# MANIPULATING IRV

The failure of monotonicity also shows that IRV can be manipulated.

Supporters of *c* can insure *c* wins by placing *a* above *b*.



# BURLINGTON 2010 MAYORAL ELECTIONS

A street scene in Burlington, Vermont, featuring historic brick buildings, a church steeple in the distance, and a paved walkway with benches and trees.

The 2010 elections also exhibited a failure of monotonicity.

Wikipedia contributors. (2024, November 5). [2009 Burlington mayoral election](#). Wikipedia.