

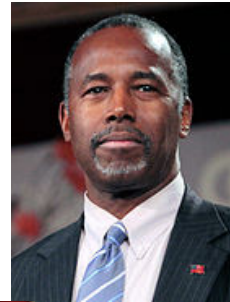


Primarily About Primaries

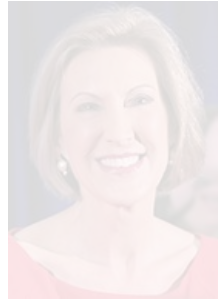
Allan Borodin, Omer Lev, Nisarg Shah, Tyrone Strangway

AAAI 2019
Honolulu, Hawaii

Republican primary 2016



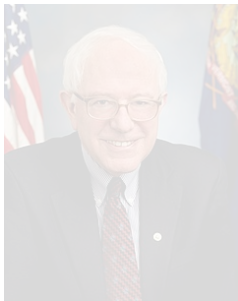
Republican primary 2016



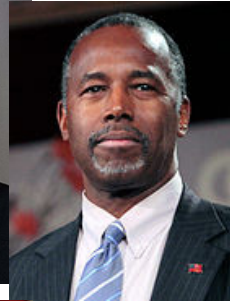
Democratic primary 2016



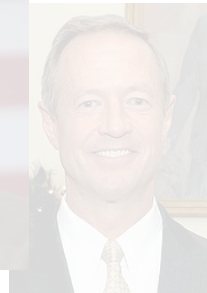
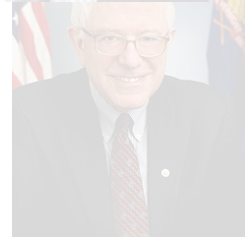
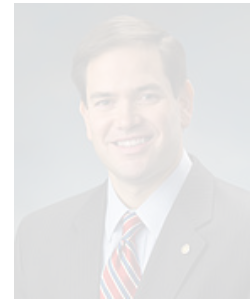
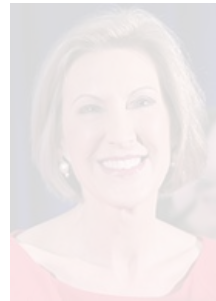
Democratic primary 2016



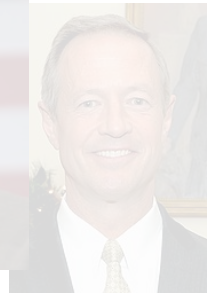
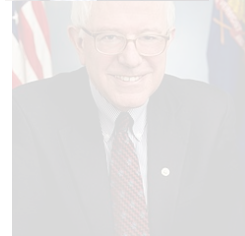
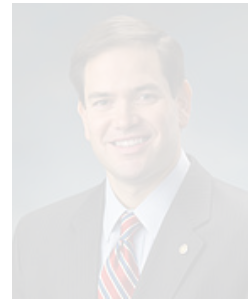
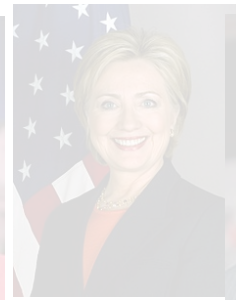
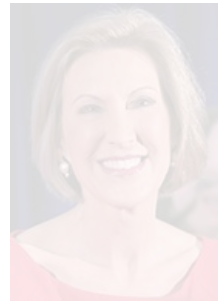
General elections 2016



General elections 2016



General elections 2016



2-stage election

A set V of voters, of size n ; A set C of candidates
Both are located in a metric space.

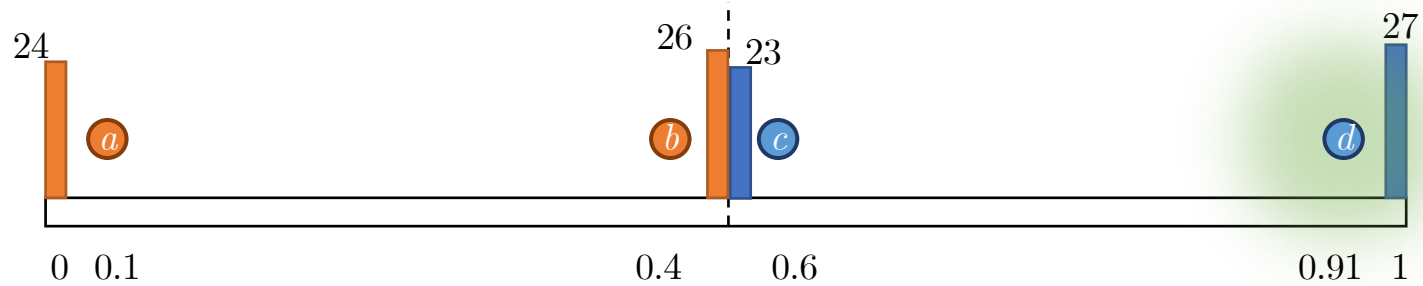
Sets $V_1, V_2 \subseteq V$; $C_1, C_2 \subseteq C$

Voters V_1 use voting rule f_1 to select a single candidate x from C_1 .

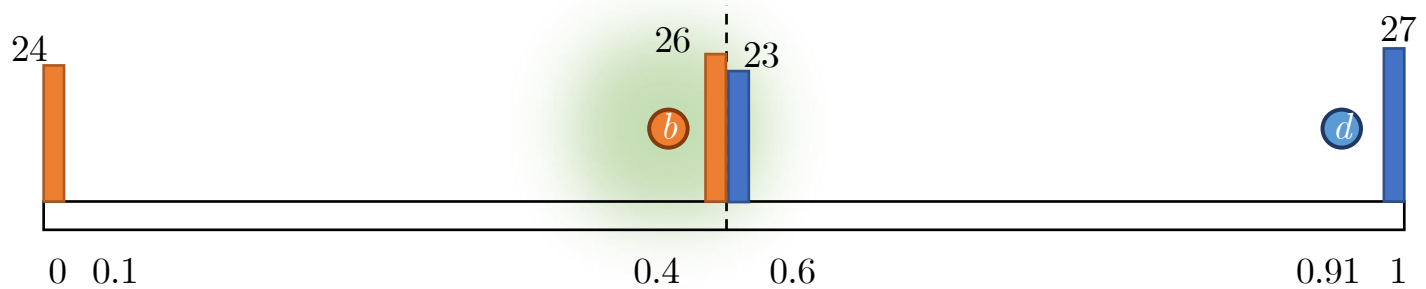
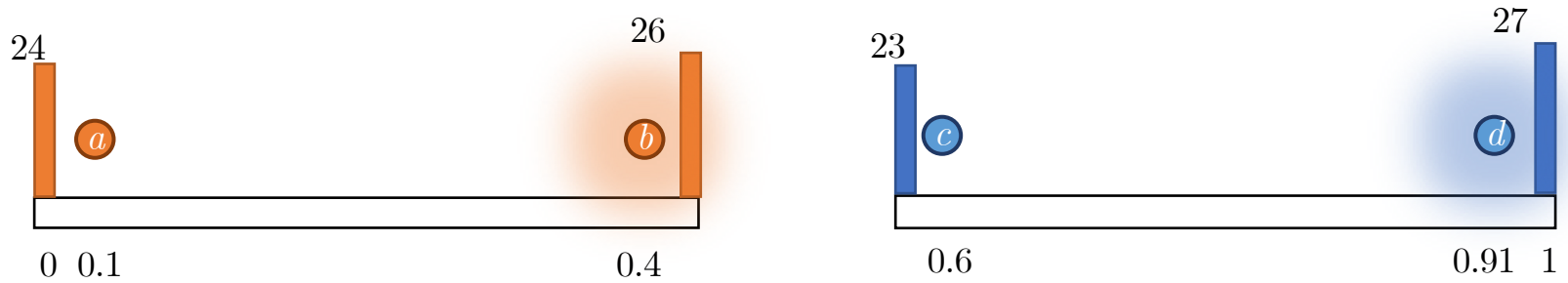
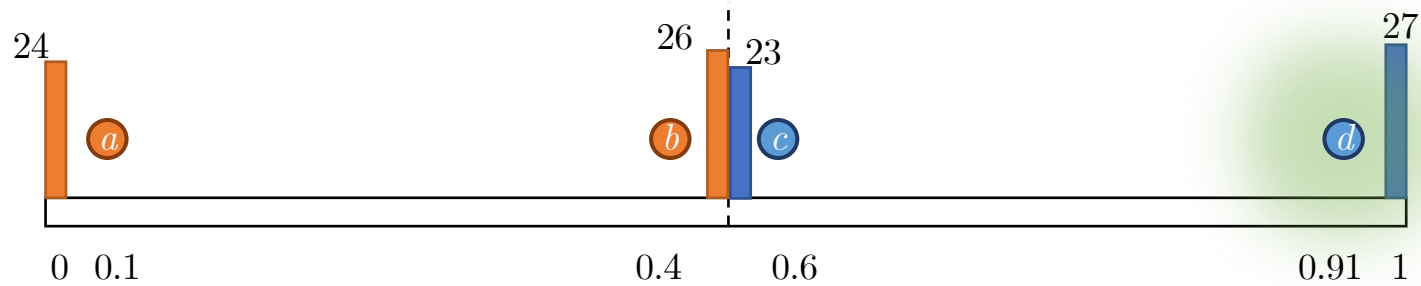
Voters V_2 use voting rule f_2 to select a single candidate y from C_2 .

Voters V use **majority** to select between x and y

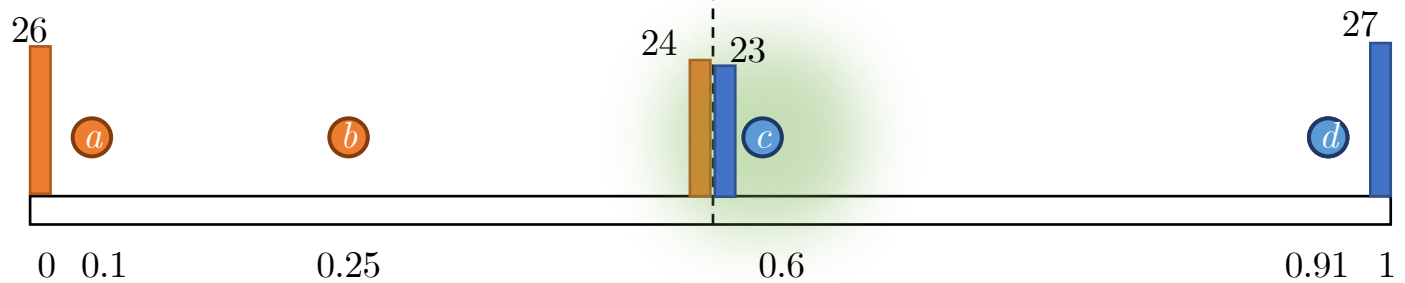
Primaries can be good!



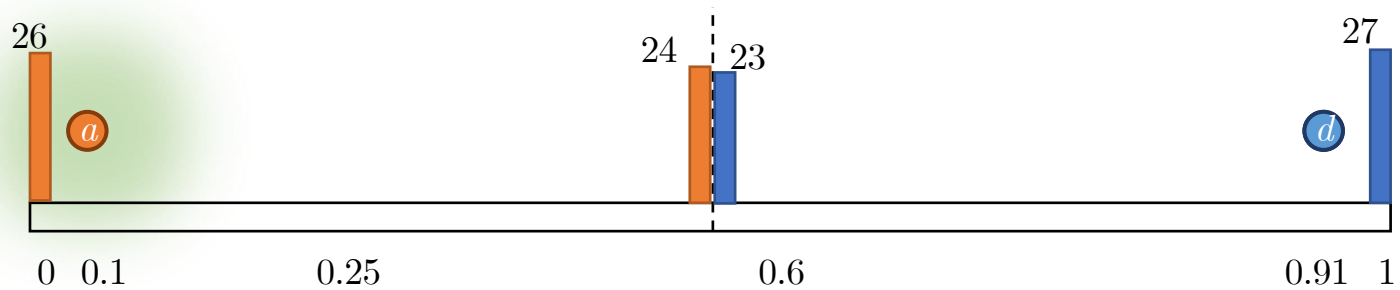
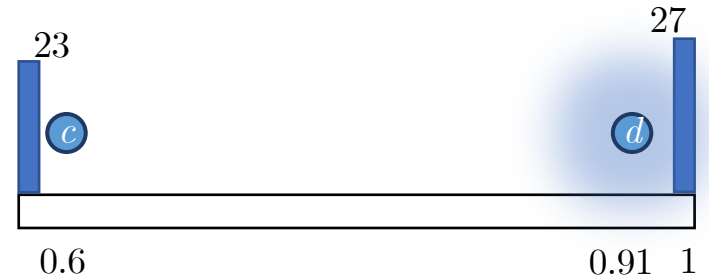
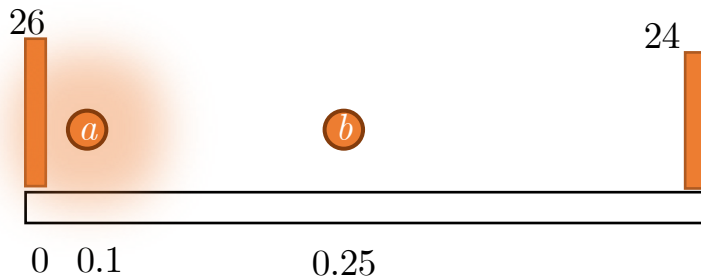
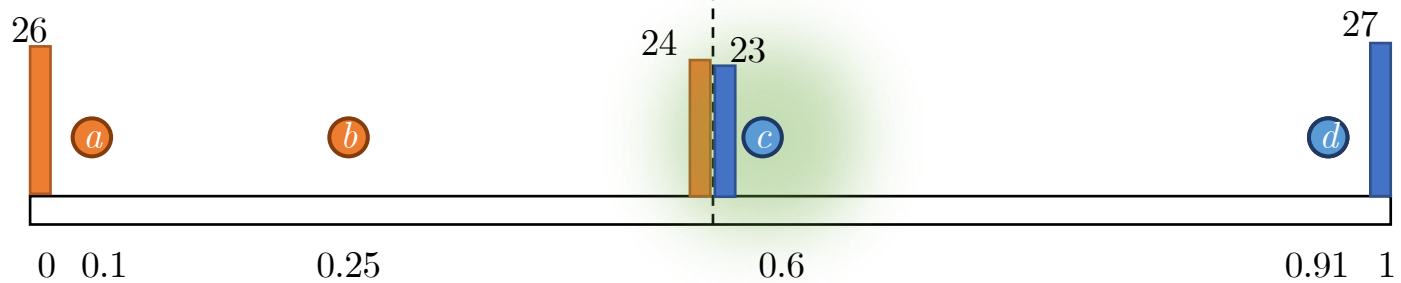
Primaries can be good!



Primaries can be bad!



Primaries can be bad!



Distortion

$\max_{i \in C}$ The social welfare to voters provided by candidate i

The social welfare to voters provided by the candidate winning the election

Social welfare is calculated thanks to voters (and candidates) being in metric space. So, for candidate i , social welfare is $\sum_{v \in V} d(v, i)$

Distortion known results

Plurality: $2m-1$

Borda: $2m-1$

k-approval: $2n-1$

Veto: $2n-1$

n: number of voters ($|V|$)

m: number of candidates ($|C|$)

Copeland: 5

Distortion primary vs. direct

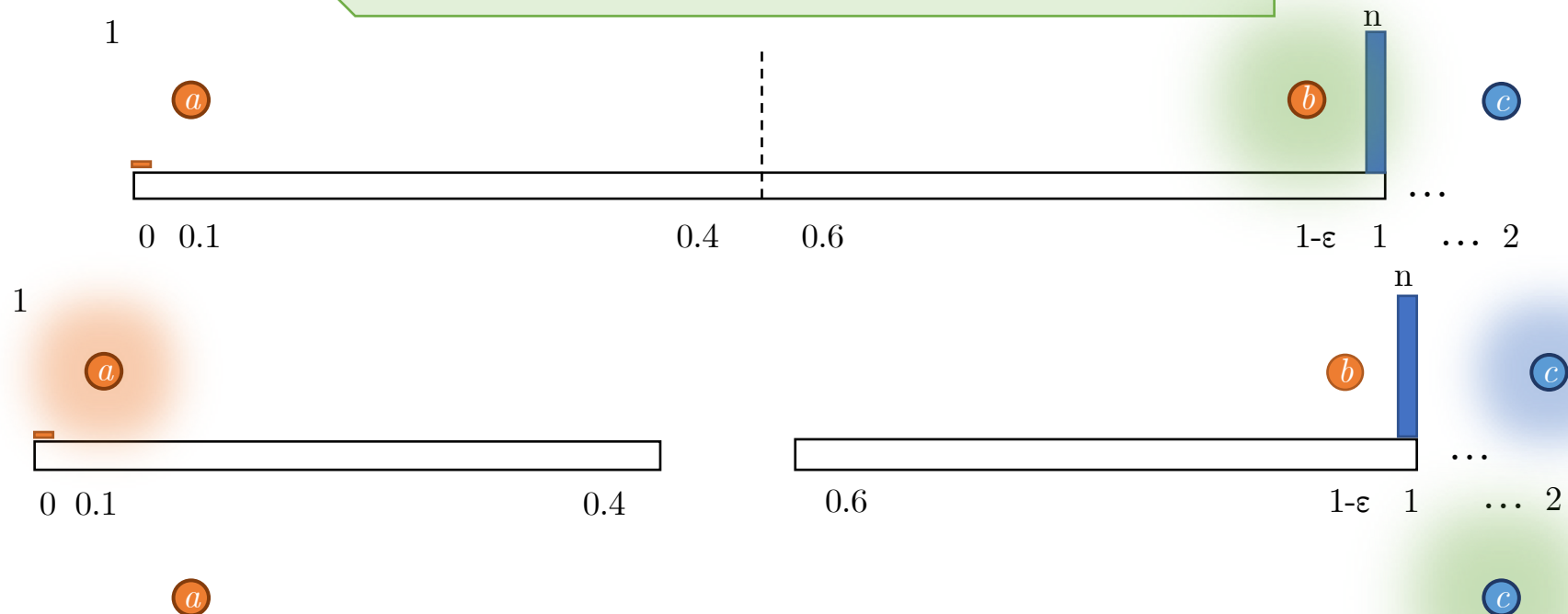
If $|V_1|, |V_2|$ have arbitrary size

Primary distortion: ∞

Distortion primary vs. direct

If $|V_1|, |V_2|$ have arbitrary size

Primary distortion: ∞



Distortion primary vs. direct

If $|V_1|, |V_2| \geq \alpha n$,

Primary distortion \leq

$$3 \frac{1-\alpha}{\alpha} (\max(\text{distortion of } f_1, \text{distortion of } f_2))$$

Distortion primary vs. direct

If $|V_1|, |V_2| \geq \alpha n$, and each party is using the voting rule f

Primary distortion \leq

$$3 \frac{1-\alpha}{\alpha} (\text{direct election distortion for } f)$$

Distortion primary vs. direct

If $|V_1|, |V_2| \geq \alpha n$, and each party is using the voting rule f

Primary distortion \leq

$$3 \frac{1-\alpha}{\alpha} (\text{direct election distortion for } f)$$

Maximal distortion between the 2 primary winners

Distortion primary vs. direct

If $|V_1|, |V_2| \geq \alpha n$, and each party is using the voting rule f

Primary distortion \leq

$$3 \frac{1-\alpha}{\alpha} (\text{direct election distortion for } f)$$

Maximal distortion
between the 2
primary winners

Distortion between primary winner
and any other party candidate

Distortion

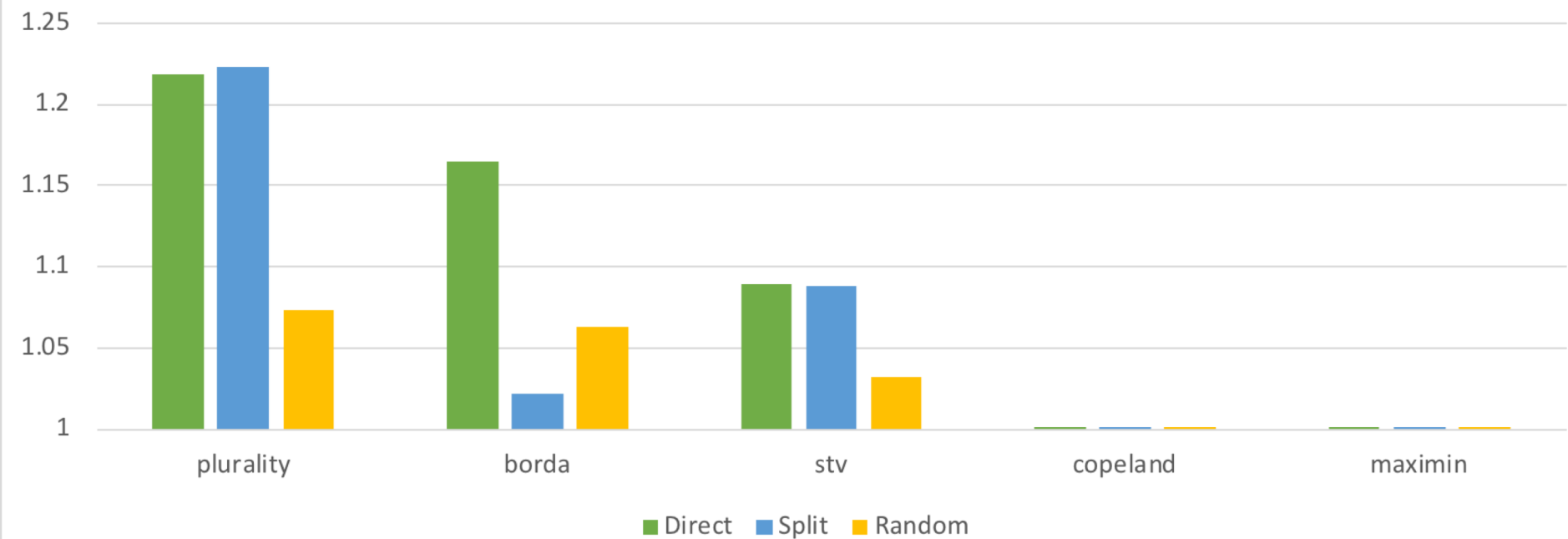
direct vs. primary

There is a voting rule such that when parties are separable from each other

direct election distortion is unbounded
primary distortion bounded by constant

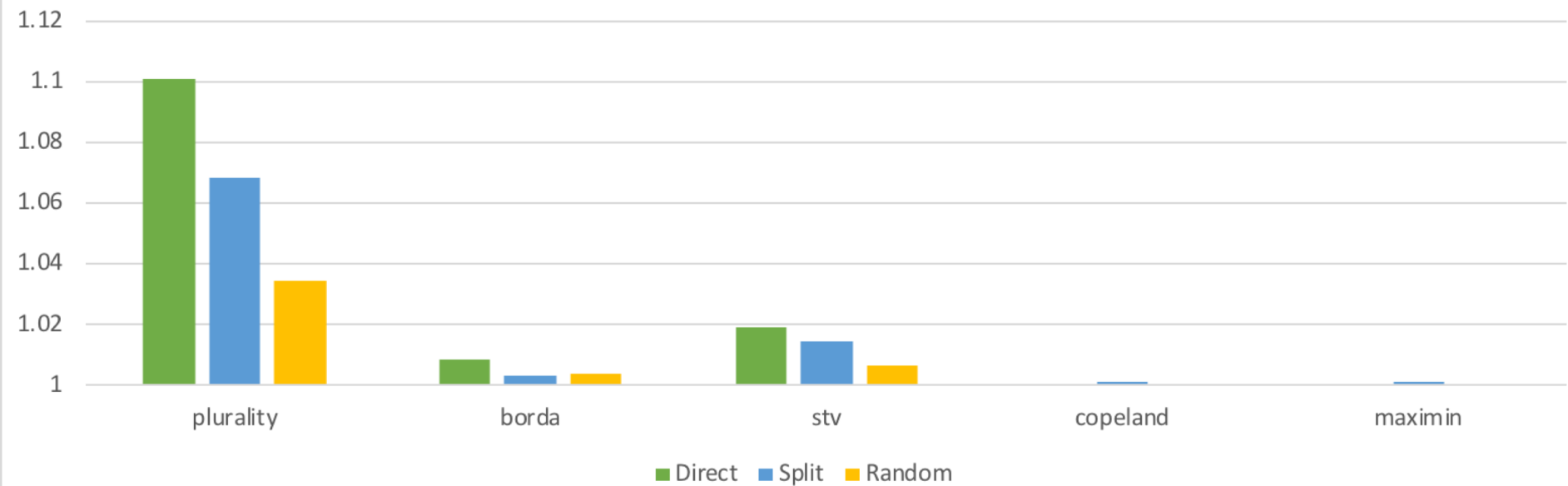
Simulations

When all voters/candidates reside on the single axis line



Simulations \mathbb{R}^3

When all voters/candidates reside in the 3-dimensional space





Future directions

Voter **distribution** and its effects

More election **stages**

More than 2 parties (which also means general election voting rule)

Candidates **strategic** concerns

Simulations where parties use **different voting rules**

Thanks for listening

