

Regular Single Transferable Vote example

Joe Sutherland for the Wikimedia Foundation
July 2023

Example

- Suppose seven candidates for three seats:

- Aardvark

- Bobcat

- Cheetah

- Dingo

- Eagle

- Fox

- Goldfish



Image credits on last slide



Votes

- The votes are cast like this:

1st preference	Aardvark	Bobcat	Cheetah	Dingo	Eagle	Fox	Goldfish
2nd preference	Bobcat	Cheetah	Dingo	Eagle	Dingo		Fox
3rd preference		Dingo	Bobcat	Cheetah	Fox		
Number of ballots	4	7	1	3	1	4	3



Tallying: Regular STV

Step	Votes for each option						
	Aardvark	Bobcat	Cheetah	Dingo	Eagle	Fox	Goldfish
Setting the quota	<p>The quota is 6: total votes / (options to choose + 1) + 1, rounded down = 23 / (3 + 1) + 1, rounded down = 6.75, rounded down = 6</p>						
Step 1	4	7 ELECTED (1 surplus vote)	1	3	1	4	3



Tallying: Regular STV

Step	Votes for each option						
	Aardvark	Bobcat	Cheetah	Dingo	Eagle	Fox	Goldfish
Step 2	4	ELECTED	1	3	1	4	3
Step 3	4	ELECTED	2	$3 + 1 = 4$	<i>eliminated</i>	4	3
Step 4	4	ELECTED	<i>eliminated</i>	$4 + 2 = 6$ ELECTED (0 surplus votes)	<i>eliminated</i>	4	3
Step 5	4	ELECTED	<i>eliminated</i>	ELECTED	<i>eliminated</i>	$4 + 2 = 6$ ELECTED (0 surplus votes)	<i>eliminated</i>



Meek (or "Scottish") STV example

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Meek (or "Scottish") STV

- Meek STV introduces a "keep factor" and fractional transfers of surplus votes from elected candidates
- This is performed algorithmically



Votes

The votes are cast like this:

1st preference	Aardvark	Bobcat	Cheetah	Dingo	Eagle	Fox	Goldfish
2nd preference	Bobcat	Aardvark	Dingo	Eagle	Dingo	Goldfish	Fox
3rd preference		Dingo	Bobcat	Cheetah	Fox	Bobcat	
Number of ballots	201	198	171	189	182	176	149



Tallying: Meek STV

The quota is 317:

$$\begin{aligned} & \text{total votes} / (\text{options to choose} + 1) + 1, \text{ rounded down} \\ &= 1,266 / (3 + 1) + 1, \text{ rounded down} \\ &= 317.25, \text{ rounded down} \\ &= 317 \end{aligned}$$



Tallying: Meek STV

Nobody meets the quota, so we must first eliminate a candidate as normal.

Fox meets the quota and is elected.

Step	Votes for each option						
	Aardvark	Bobcat	Cheetah	Dingo	Eagle	Fox	Goldfish
Step 1 Quota: 317	201	198	171	189	182	176	149
Step 2 Quota: 317	201	198	171	189	182	176 + 149 = 325 ELECTED	<i>eliminated</i> (149)



Votes after Step 2

The ballots currently look like this:

1st preference	Aardvark	Bobcat	Cheetah	Dingo	Eagle	Fox	Goldfish
2nd preference	Bobcat	Aardvark	Dingo	Eagle	Dingo	Goldfish	Fox
3rd preference		Dingo	Bobcat	Cheetah	Fox	Bobcat	
Number of ballots	201	198	171	189	182	176	149 (exhausted)

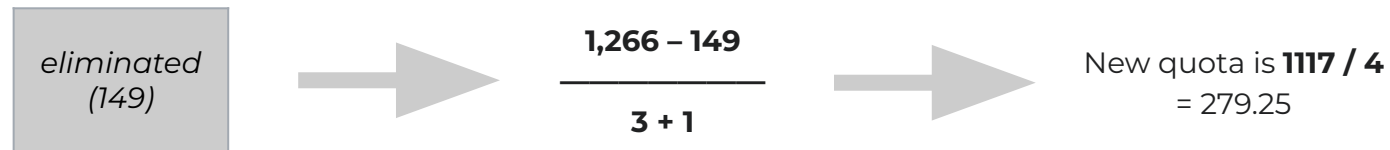


Quota change

When ballots become **exhausted**, the quota changes according to the formula:

$$\frac{\text{Total votes} - \text{Excess votes}}{\text{Seats} + 1}$$

In our example, **Goldfish** was eliminated, leaving **149 exhausted ballots**:



Therefore, the new quota is 279.25. This is calculated after every step.



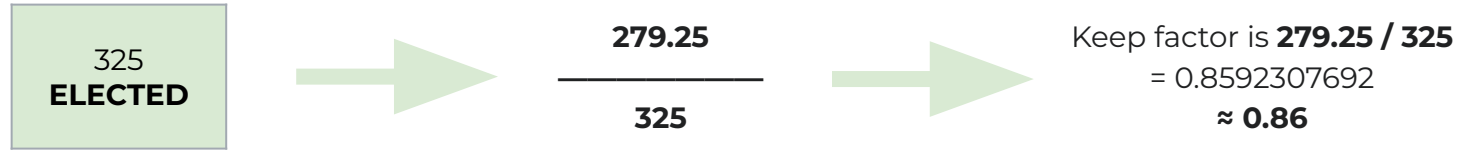
Surplus votes

When a candidate is **elected**, surplus votes are transferred using a formula:

$$\frac{\text{Winning quota}}{\text{Votes for that candidate}}$$

This number is **different for every elected candidate**. It is known as the "keep factor".

In our example, **Fox** was elected with **325 votes**:



Therefore, **Fox** can "keep" \approx **0.86 of their votes** and still be at the winning quota.



Tallying: Meek STV

So, let's transfer **Fox**'s surplus votes to the next choices on their first-preference ballots.

These are transferred using the formula **(1 - keep factor) * total votes**.

This can in theory include transfers to other elected candidates, but in this case it does not.

Bobcat 's initial vote total	+	1 - Fox 's keep factor	*	Fox 's total votes	=	Bobcat's new total
198	+	(1 - 0.86)	*	325	=	243.5



Tallying: Meek STV

Step	Votes for each option						
	Aardvark	Bobcat	Cheetah	Dingo	Eagle	Fox	Goldfish
Keep factor	1	1	1	1	1	0.86	—
Step 3 Quota: 279.25	201	$198 + (1 - 0.86) * 325$ $= \mathbf{243.5}$	171	189	182	$= 325 * 0.86$ $= \mathbf{279.5}$	<i>eliminated</i>



Tallying: Meek STV

Nobody meets quota, so we eliminate the candidate with the least votes (**Cheetah**) and distribute to their next-preferences.

Dingo meets the quota and is elected.

Step	Votes for each option						
	Aardvark	Bobcat	Cheetah	Dingo	Eagle	Fox	Goldfish
Keep factor	1	1	1	1	1	0.86	—
Step 4 Quota: 279.25	201	243.5	<i>eliminated</i> (171)	= 189 + 171 = 360 ELECTED	182	279.5	<i>eliminated</i>

Note that the quota remains the same, since these actions do not exhaust any ballots.



Votes after Step 4

The ballots currently look like this:

1st preference	Aardvark	Bobcat	Cheetah	Dingo	Eagle	Fox	Goldfish
2nd preference	Bobcat	Aardvark	Dingo	Eagle	Dingo	Goldfish	Fox
3rd preference		Dingo	Bobcat	Cheetah	Fox	Bobcat	
Number of ballots	201	198	171	189	182	176	149 (exhausted)



Tallying: Meek STV

We work out a new keep factor for **Dingo** and transfer their votes.

In the next round, we eliminate **Aardvark** and transfer their votes as normal.

Bobcat now meets the quota and is elected.

Step	Votes for each option						
	Aardvark	Bobcat	Cheetah	Dingo	Eagle	Fox	Goldfish
Keep factor	1	1	1	0.78	1	0.86	—
Step 5 Quota: 279.25	201	243.5	<i>eliminated</i>	= 360 * 0.78 = 280.8	= 182 + (1 - 0.78) * 360 = 261.2	279.5	<i>eliminated</i>
Step 6 Quota: 279.25	<i>eliminated</i> (201)	= 243.5 + 201 = 444.5 ELECTED	<i>eliminated</i>	280.8	261.2	279.5	<i>eliminated</i>

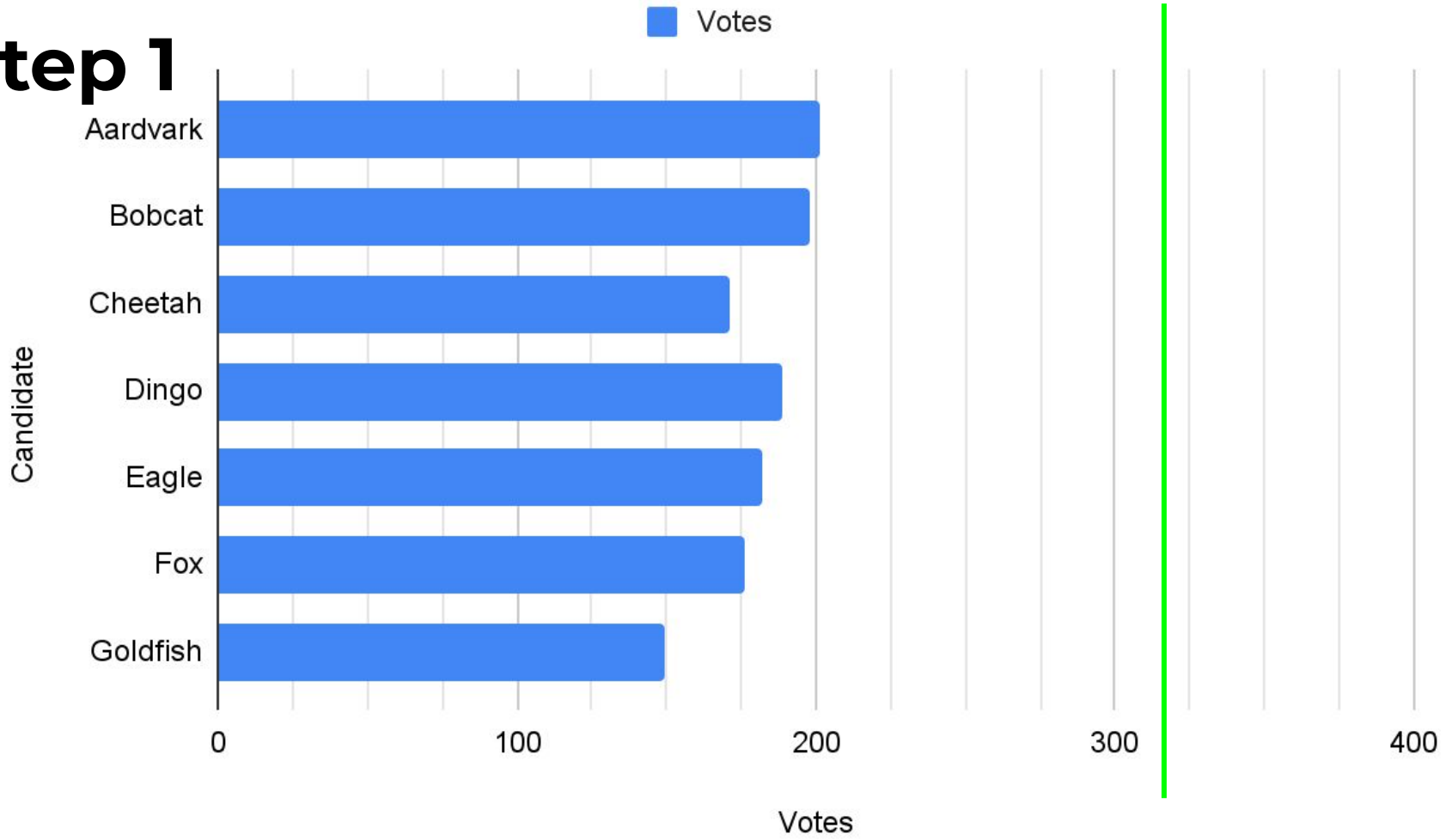


Results as charts

The following slides depict the same information as charts, showing visually where the surplus votes were transferred.

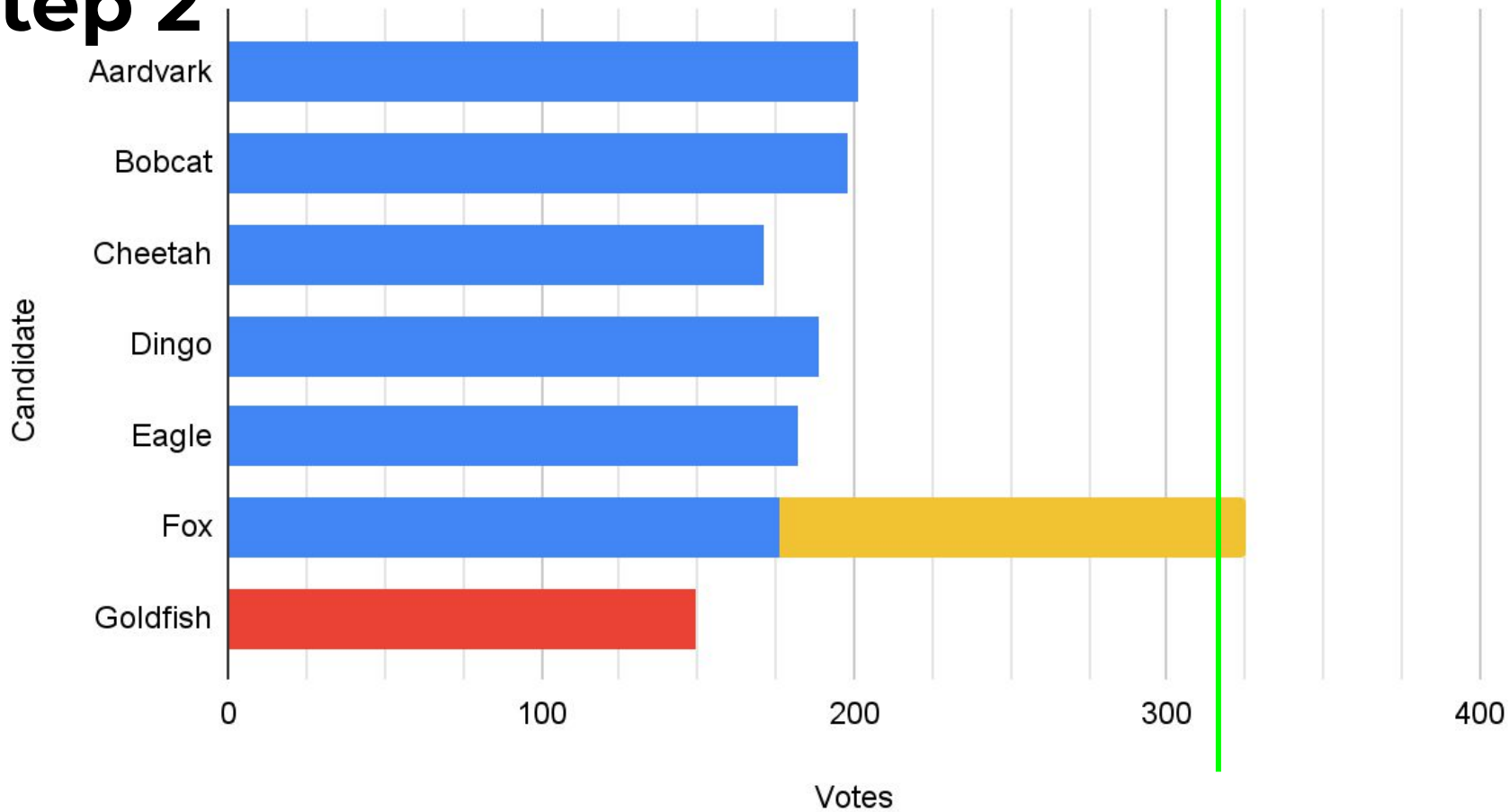


Step 1



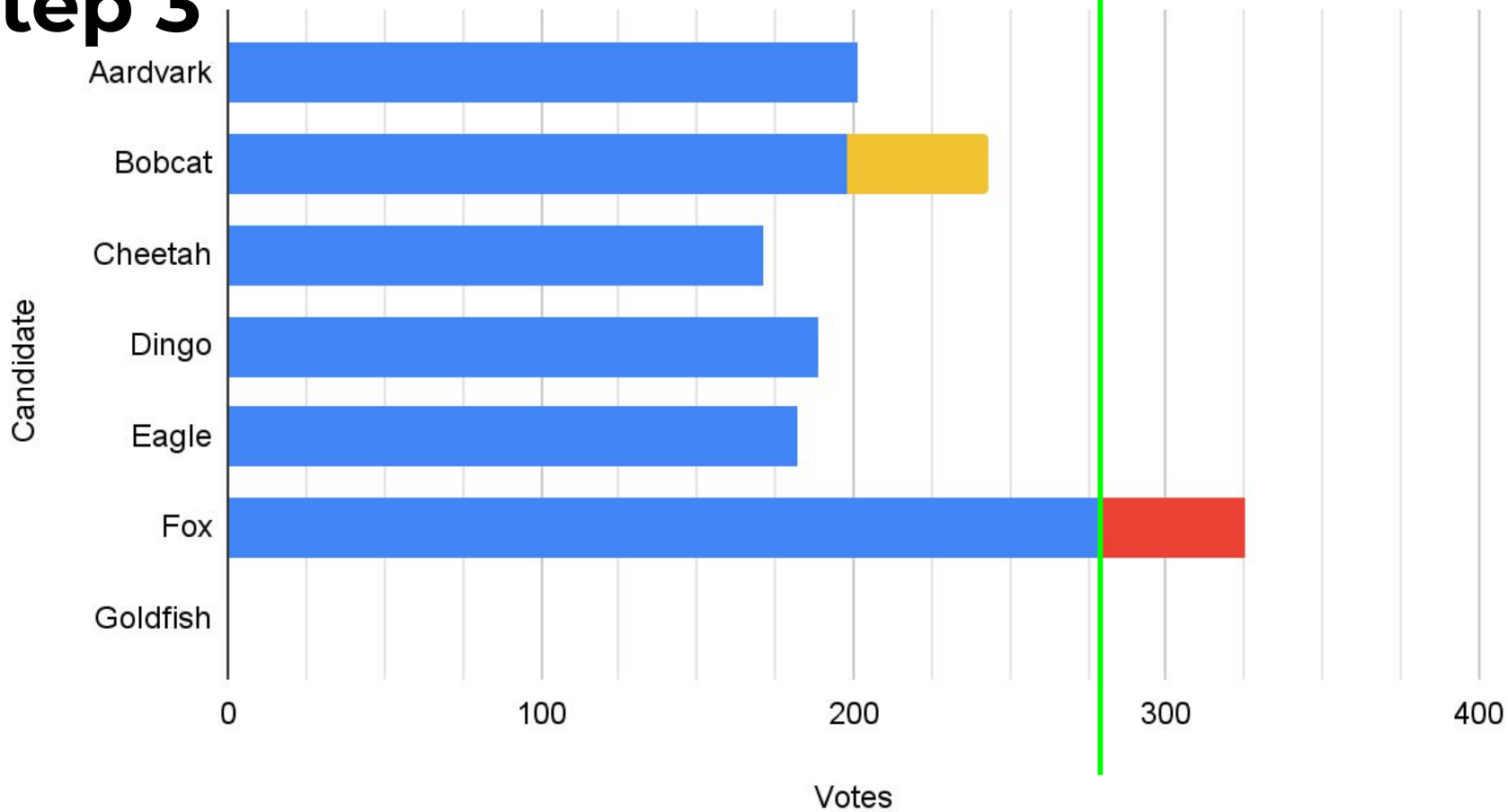
Step 2

■ Votes ■ Loss ■ Surplus

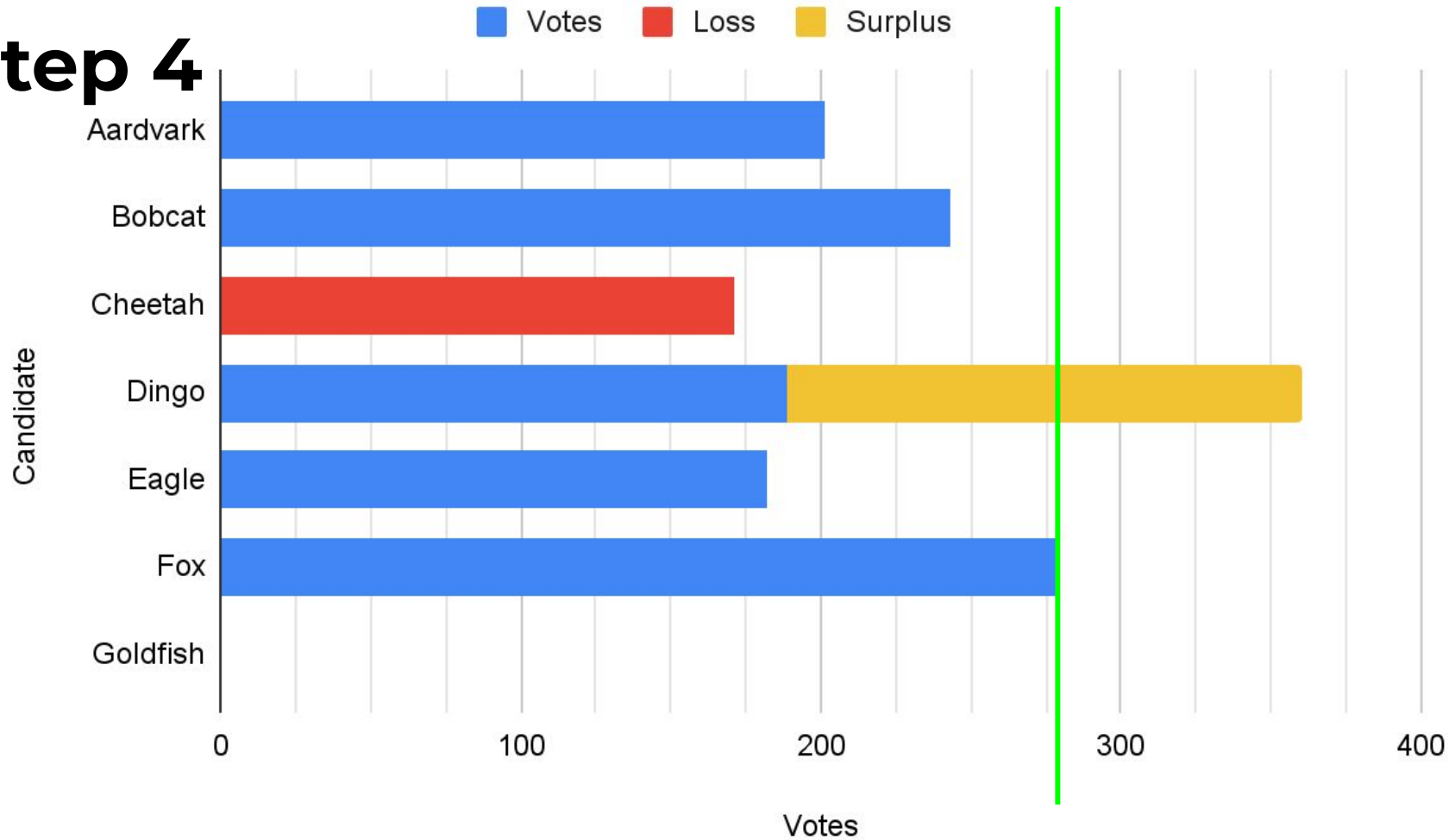


Step 3

■ Votes ■ Loss ■ Surplus

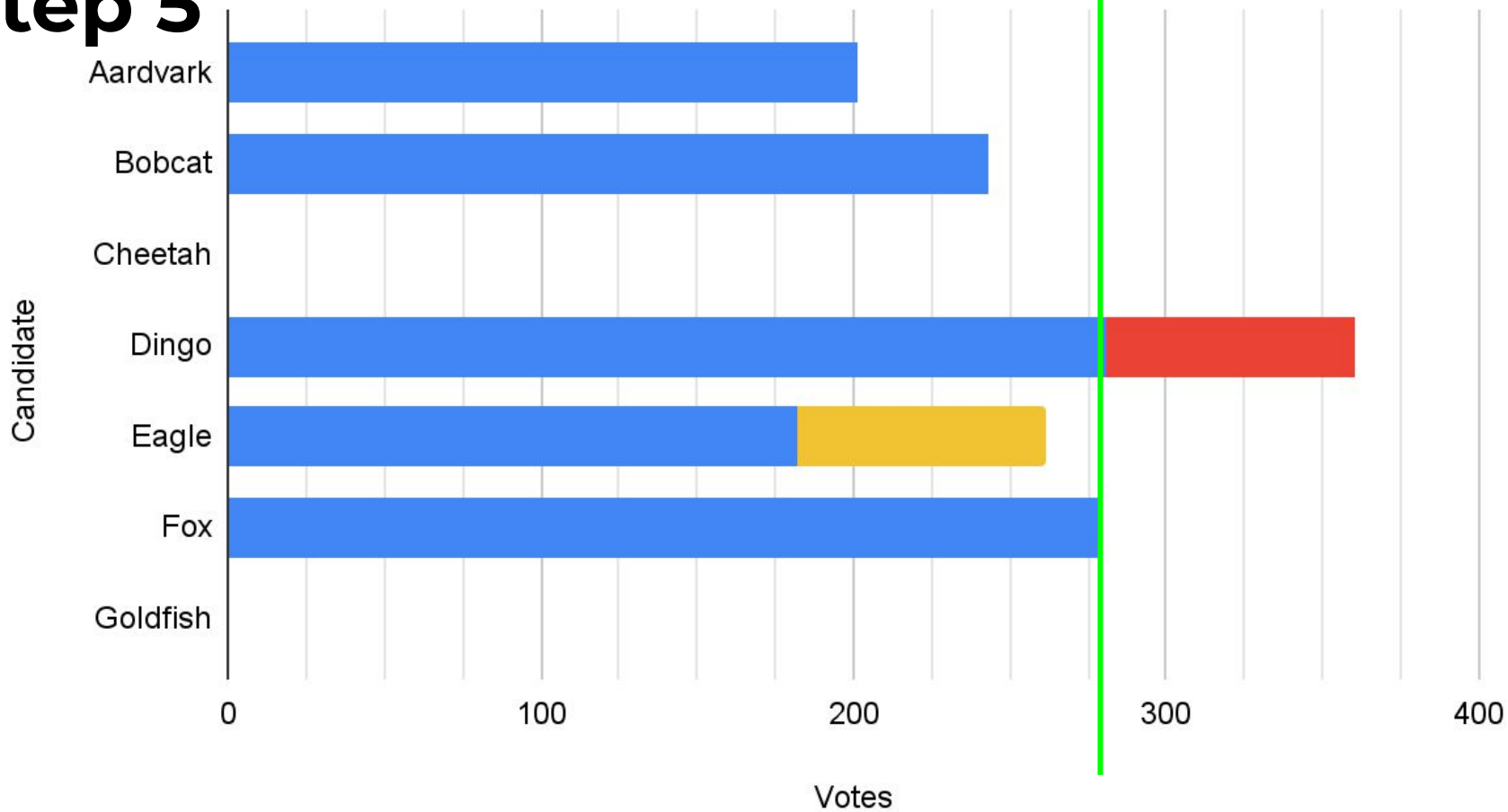


Step 4



Step 5

■ Votes ■ Loss ■ Surplus



Step 6

Votes Loss Surplus

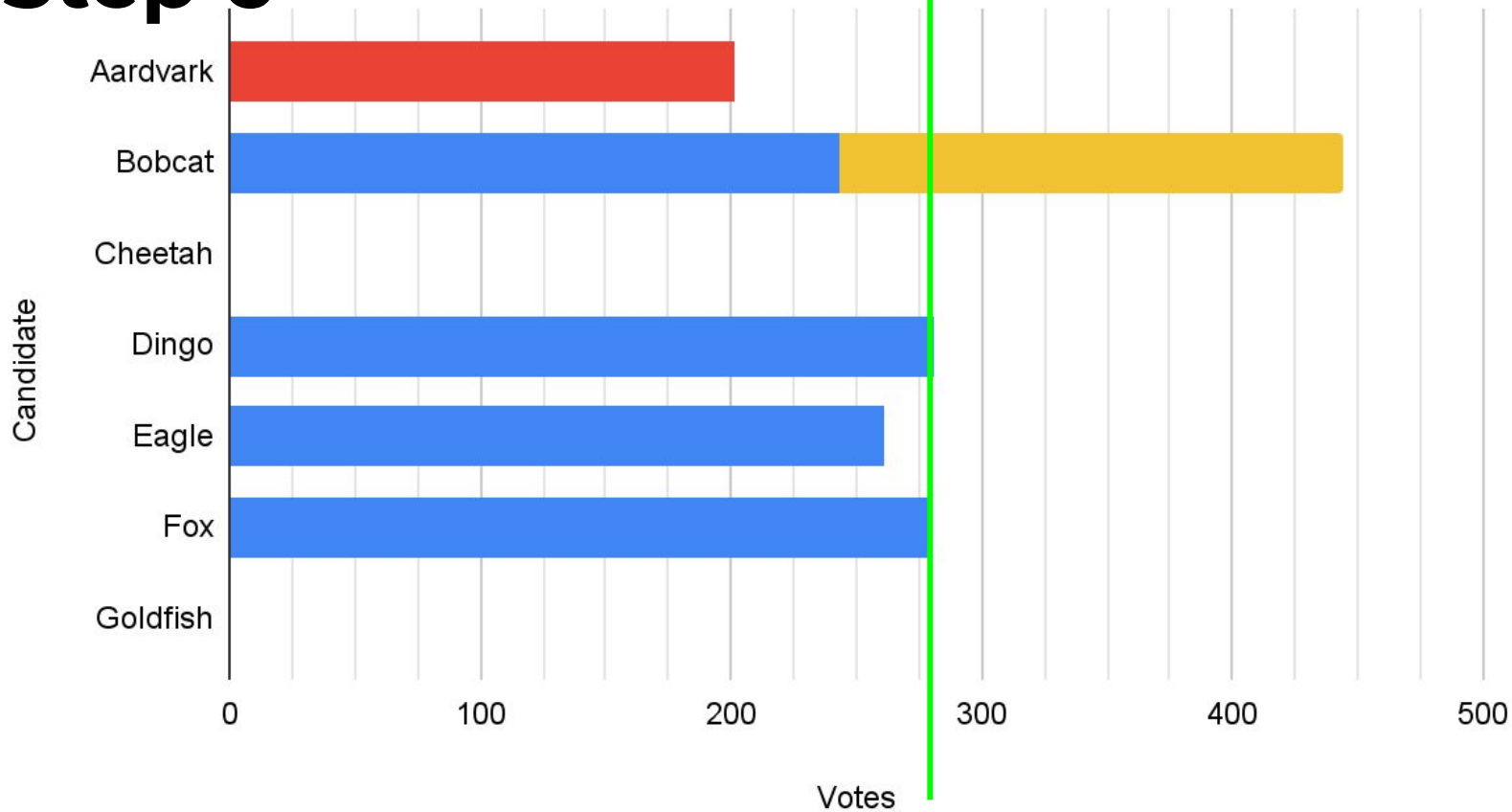


Image credits

- [File:Aardvark \(Orycteropus afer\).jpg](#) by Theo Kruse, CC BY-SA 4.0
- [File:Bobcat \(Lynx rufus\) California.jpg](#) by Marlin Harms, CC BY 2.0
- [File:Gepard \(Acinonyx jubatus\) Tiergarten Schönbrunn.jpg](#) by Alexander Leisser, CC BY-SA 4.0
- [File:Female Dingo from close distance.jpg](#) by Majkalala, CC BY-SA 4.0
- [File:Kaiseradler Aquila heliaca 2 amk.jpg](#) by AngMoKio, CC BY-SA 2.5
- [File:Alaska Red Fox \(Vulpes vulpes\).jpg](#) by Gregory "Slobirdr" Smith, CC BY-SA 2.0
- [File:Fantail Goldfish Carrot.jpg](#) by Ry362, CC BY-SA 3.0

