The effect of differential quality and differential zealotry in the best-of-n problem

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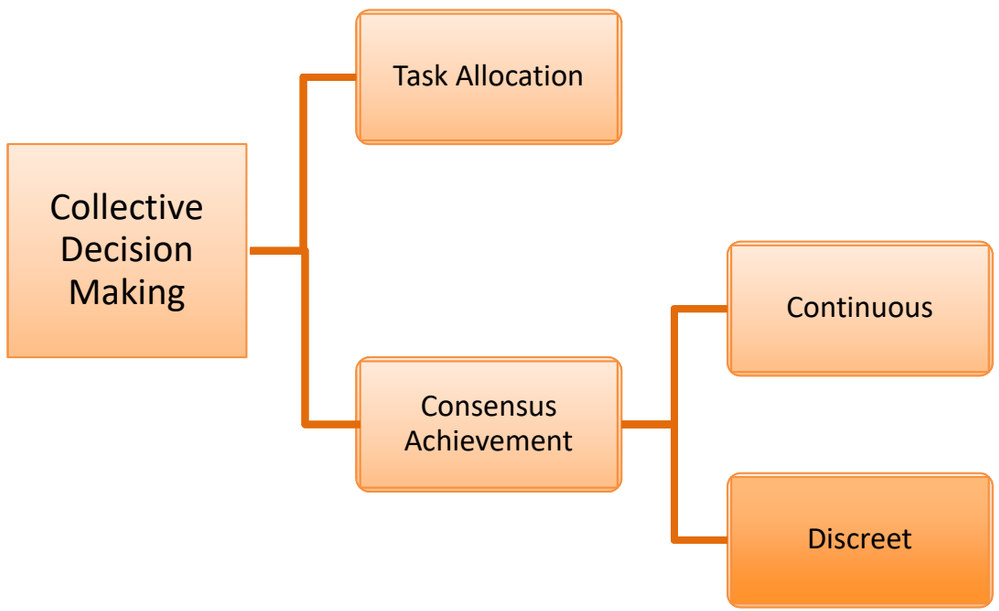
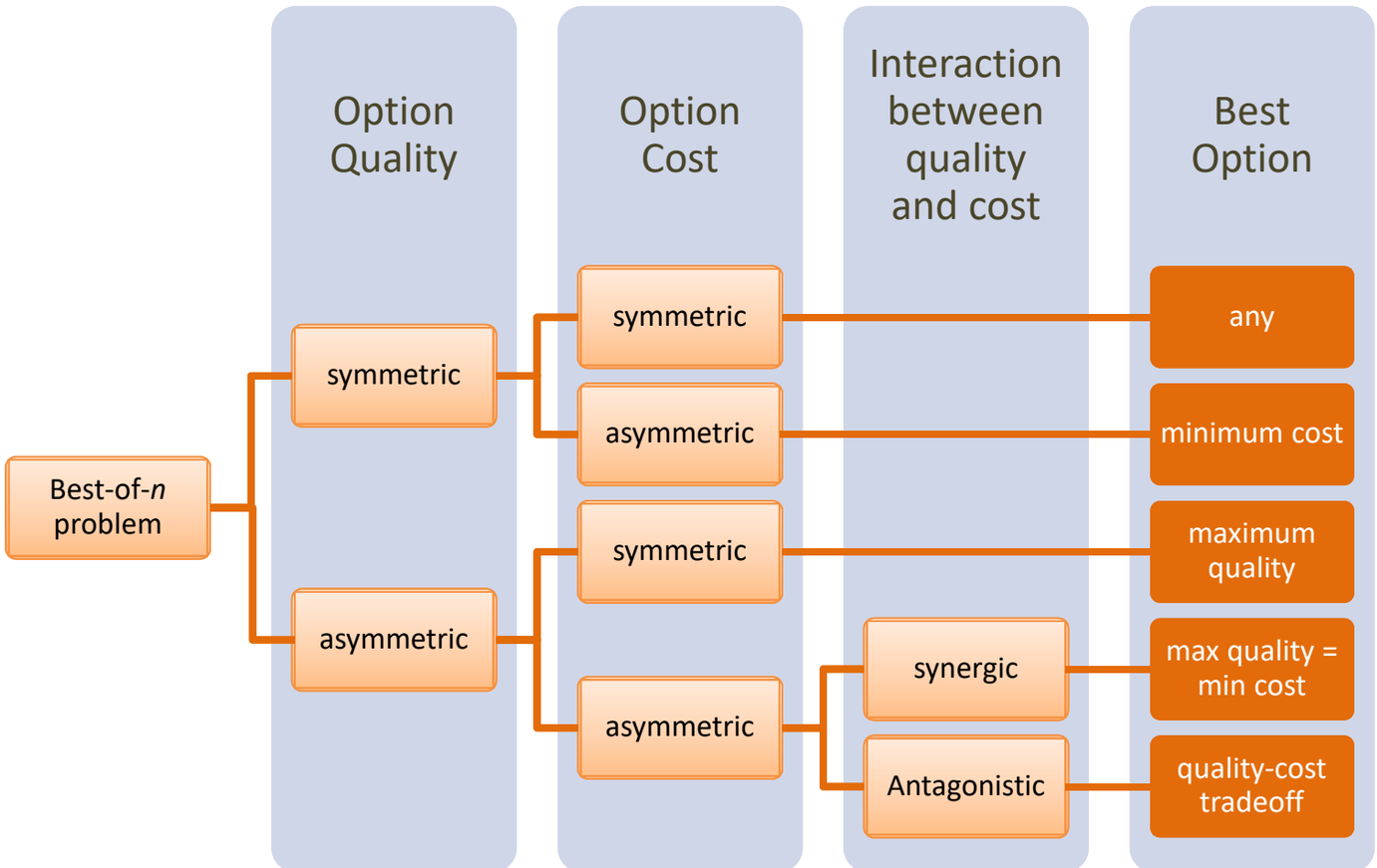
Collective Decision Making: Taxonomy



Best-of-*n* Problem

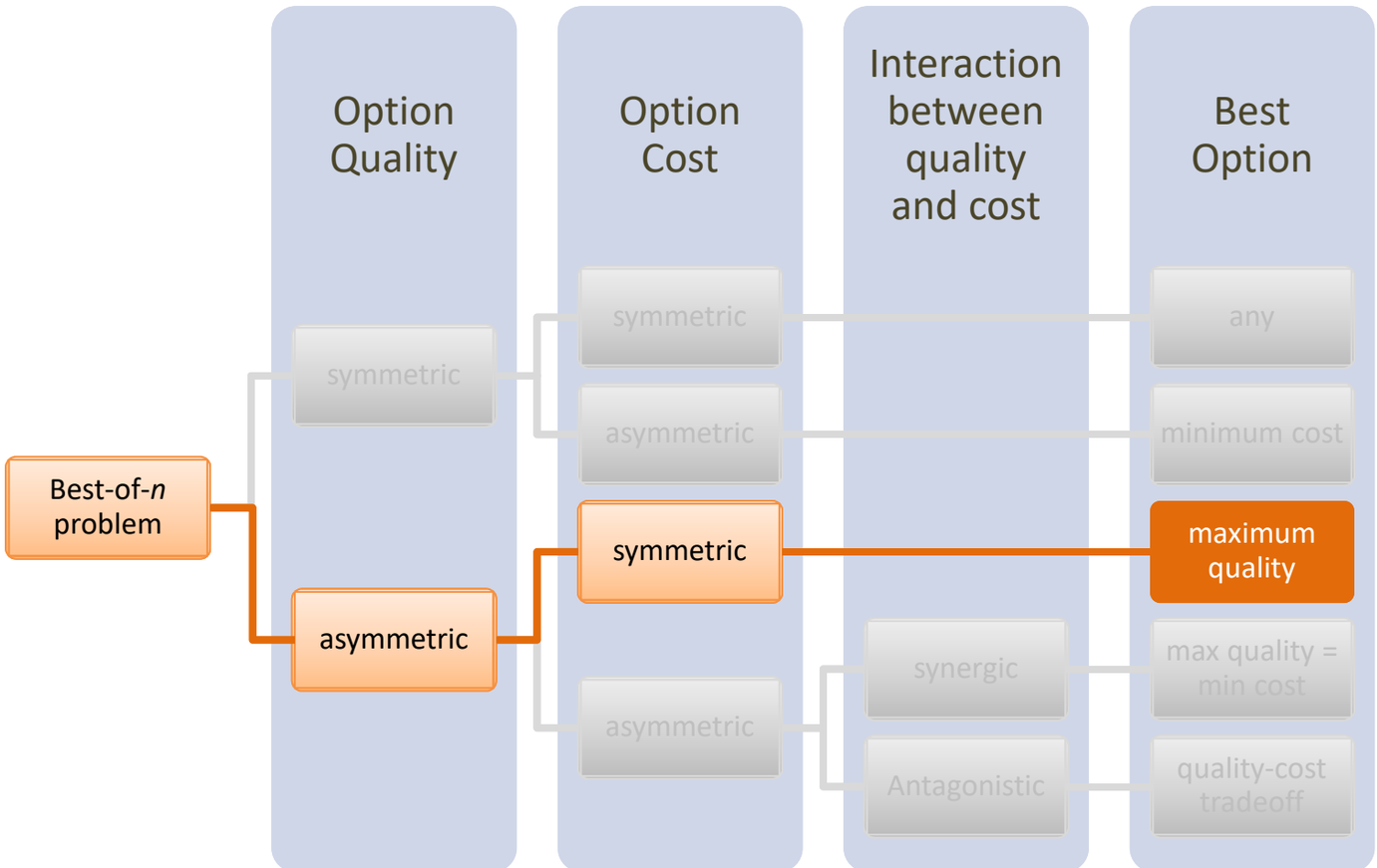
Valentini, G., Ferrante, E., Dorigo, M.: The best-of-n problem in robot swarms: Formalization, state of the art, and novel perspectives. Frontiers in Robotics and AI 4, 9 (2017)

Collective Decision Making: Best-of-*n* Problem



Valentini, G., Ferrante, E., Dorigo, M.: The best-of-n problem in robot swarms: Formalization, state of the art, and novel perspectives. Frontiers in Robotics and AI 4, 9 (2017)

Collective Decision Making: Focus on Quality



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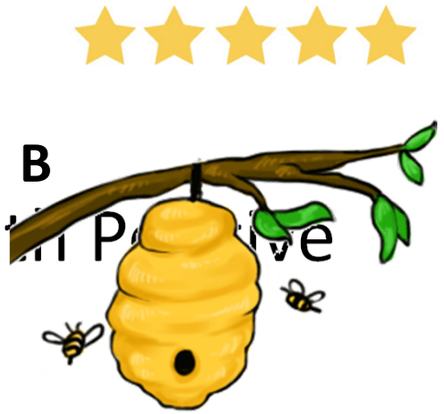
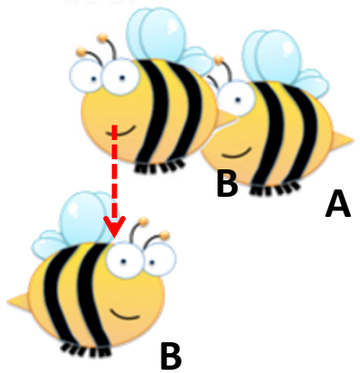


...king for Maxi...uality wi...Positive Feedback Modulation

Swarm

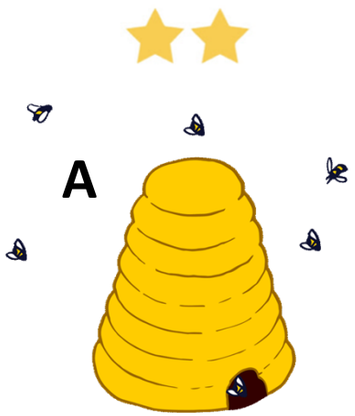
Voting for new nest

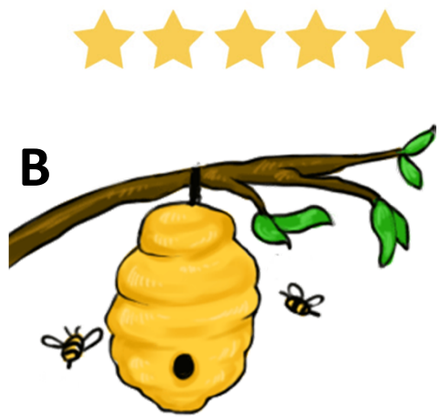
A or B



Dissemination Mode

Differential quality vs differential zealotry





Swarm
Voting for new nest
A or B

Normal Agent
Can change opinion

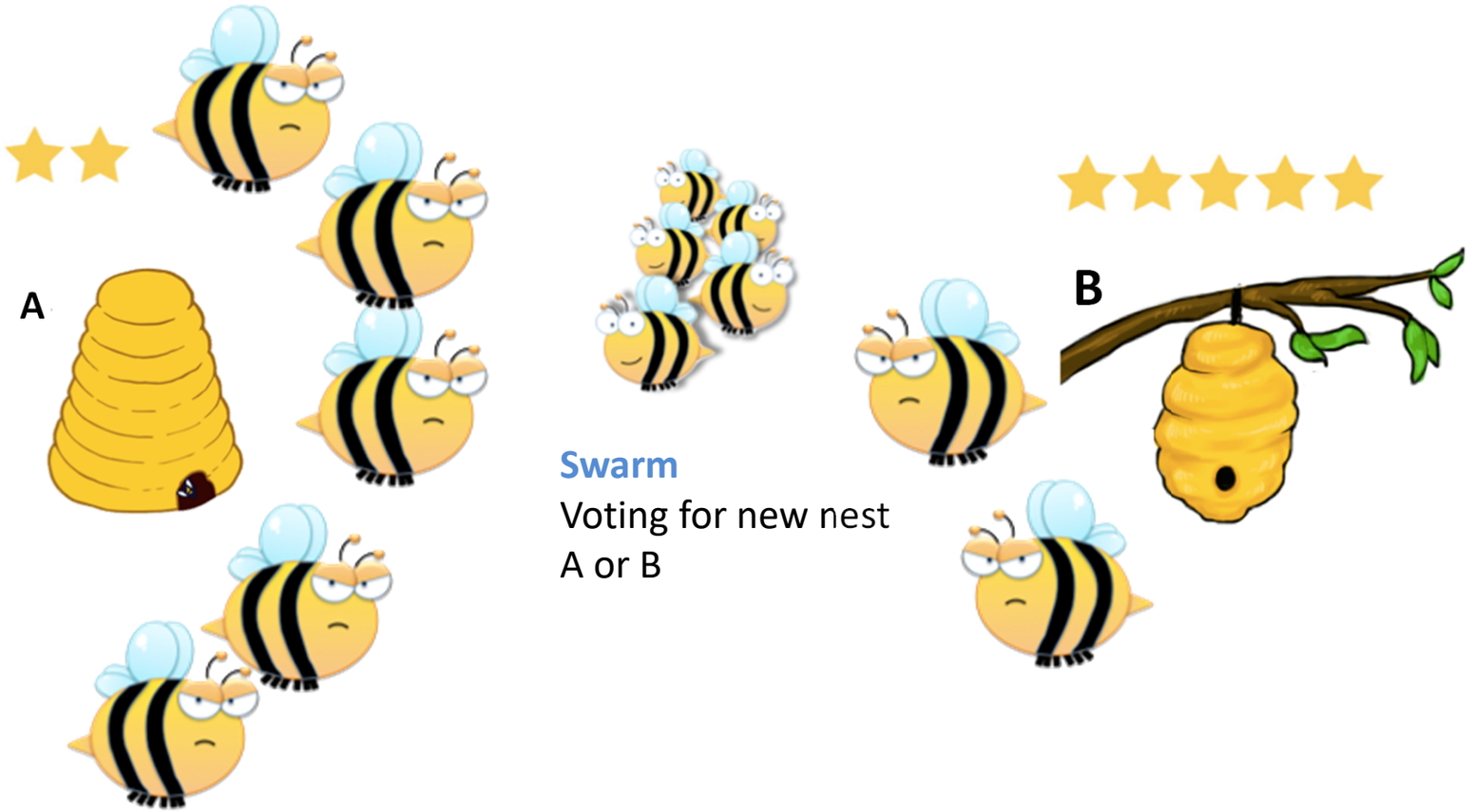
Zealot
Never change opinion

Differential quality vs differential zealotry

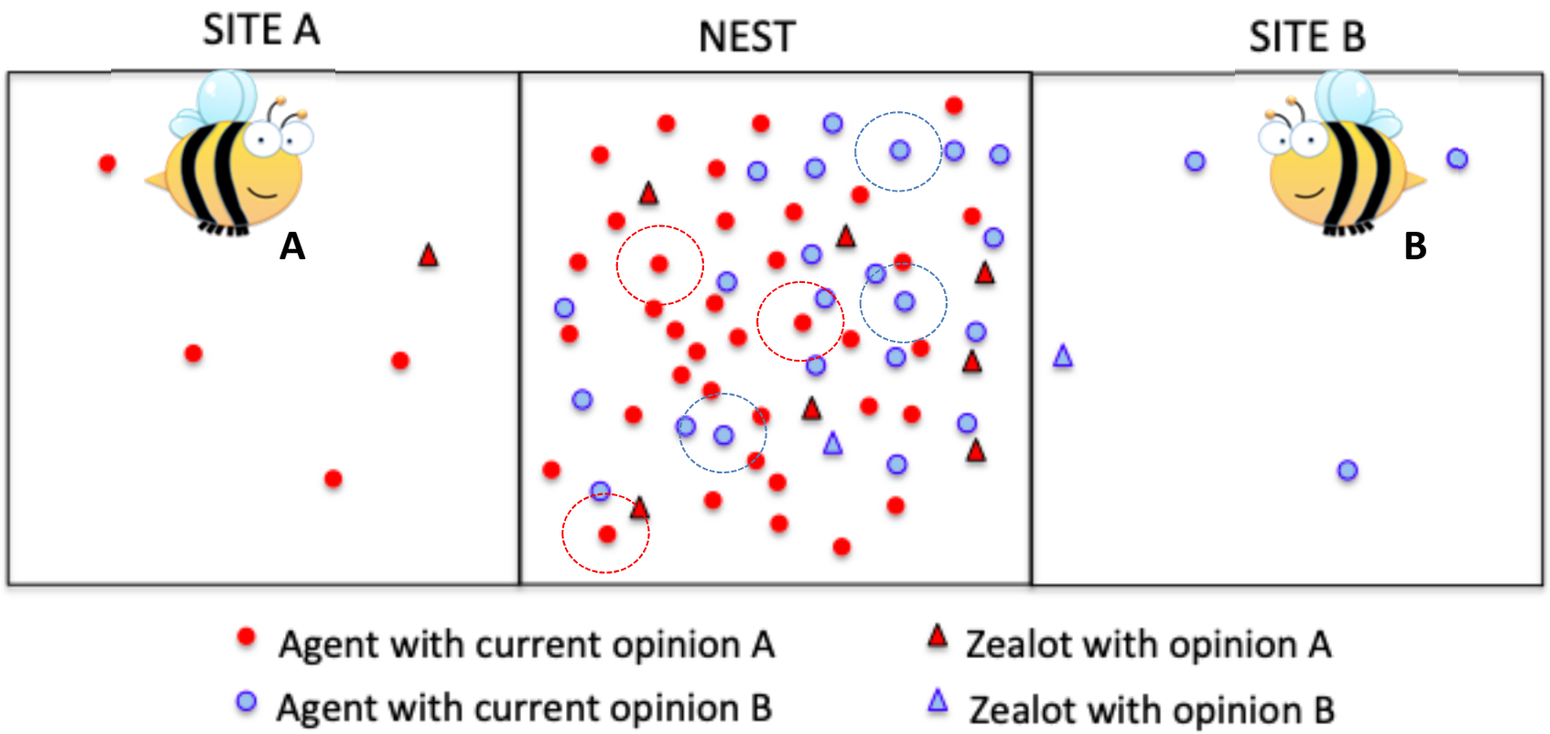
Swarm
Voting for new nest
A or B

What if there are **more zealots** promoting option with **lower quality**?
Will option with **lower** quality **wins over** option with **better** quality?

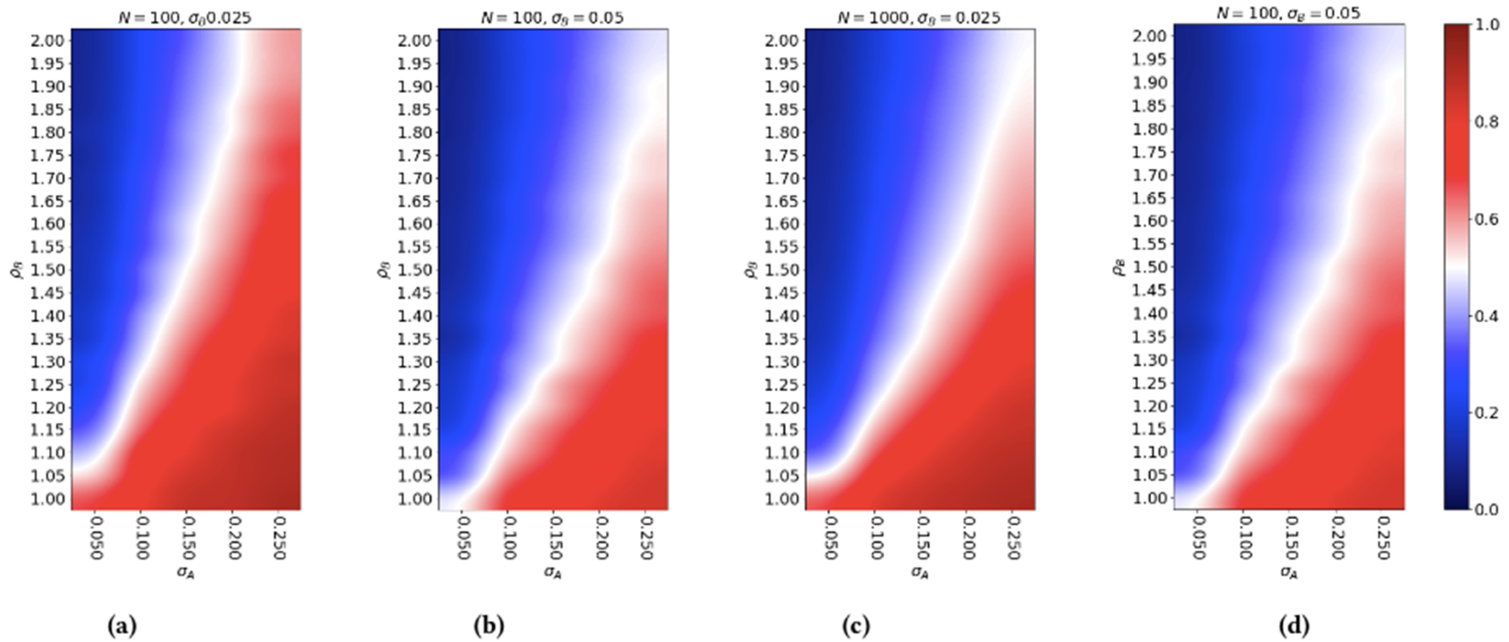
Differential quality vs differential zealotry: Steps



Swarm Robots Simulation



Results


$N = 100, \sigma_0 0.025$
$N = 100, \sigma_0 = 0.05$
$N = 1000, \sigma_0 = 0.025$
$N = 100, \sigma_E = 0.05$
ρ_0
ρ_E
σ_A
2.00 1.95 1.90 1.85 1.80 1.75 1.70 1.65 1.60 1.55 1.50 1.45 1.40 1.35 1.30 1.25 1.20 1.15 1.10 1.05 1.00
0.050 0.100 0.150 0.200 0.250
1.0 0.8 0.6 0.4 0.2 0.0
(a)
(b)
(c)
(d)

Conclusions

- the quality of an option is more influential than the quantity of the zealots
- the swarm tends to choose the right option even when zealots for the low quality options are five times more numerous
- Results are not much affected by the swarm size N or by the proportion of zealots pitching for option with lower quality (σB).
- Future studies include working with higher number of options *n* and adding mathematical model.

Thank you!

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