Prisoner's Dilemma

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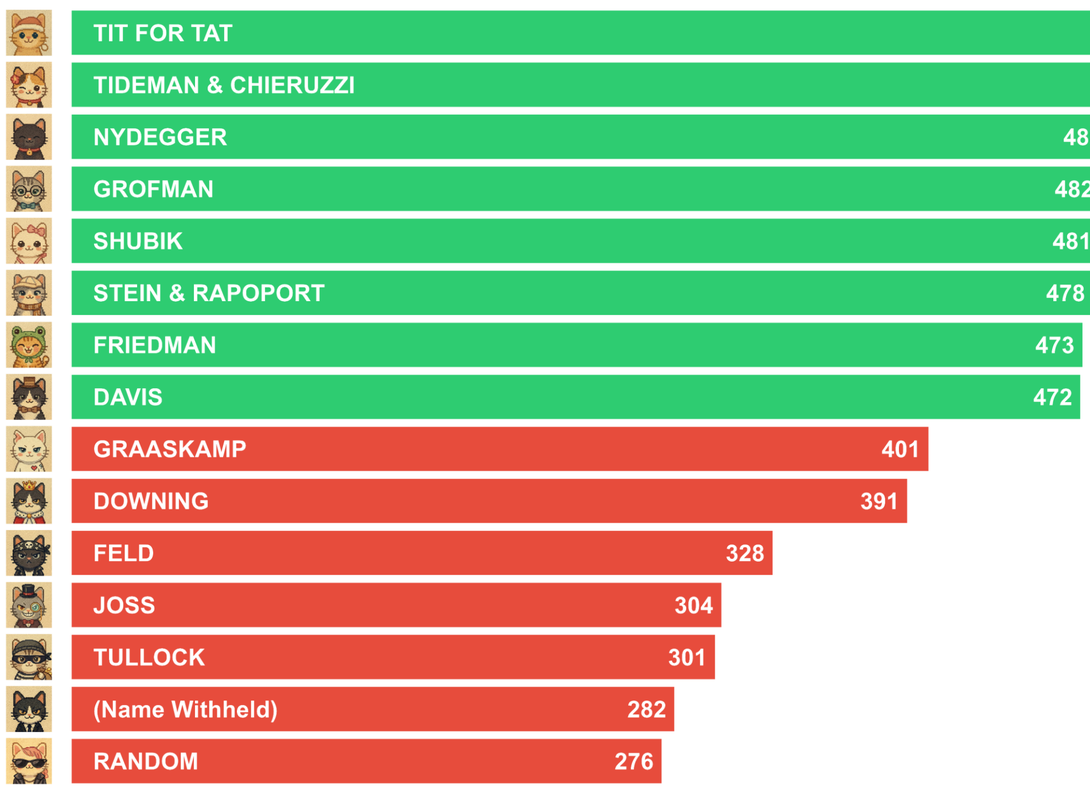
INTRODUCTION

The Prisoner's Dilemma, a **game theory** exercise in which two players can choose to cooperate or not, helps explain cooperation.

If both players **cooperate**, they both receive the **reward for cooperating(3,3)**. If both players **defect**, they both receive the **punishment payoff(1,1)**. If **Player A defects** while **Player B cooperates**, then **Player A receives the temptation payoff(5)** , while **Player B receives the "sucker's" payoff(0)**. Similarly, if **Player A cooperates** while **Player B defects**, then **Player A receives the sucker's payoff(0)** , while **Player B receives the temptation payoff(5)**.

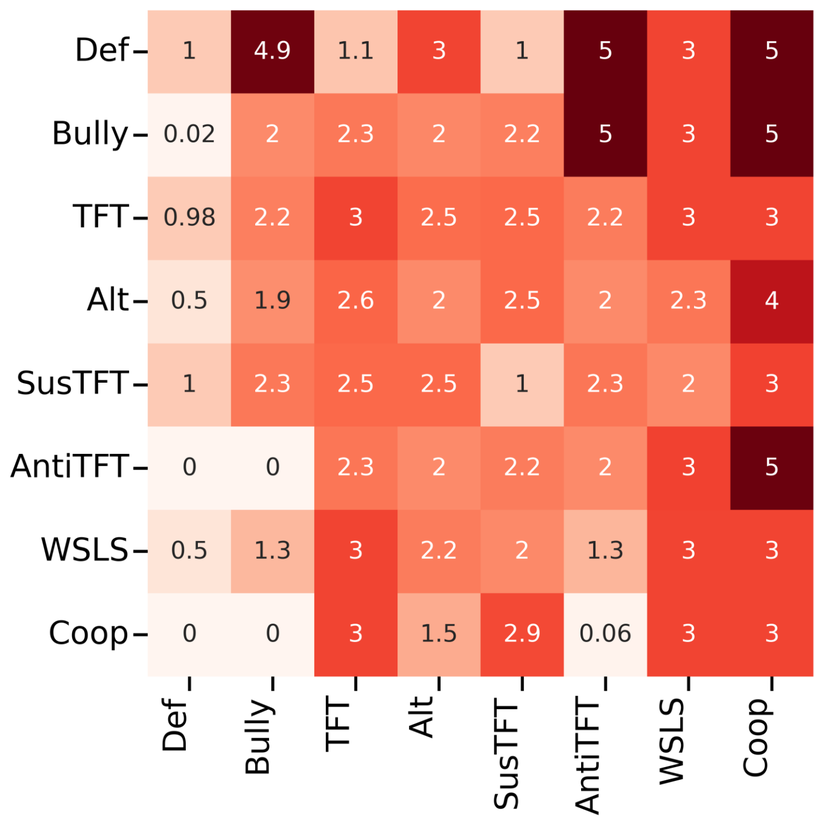
METHODS

Tournament Average Scores

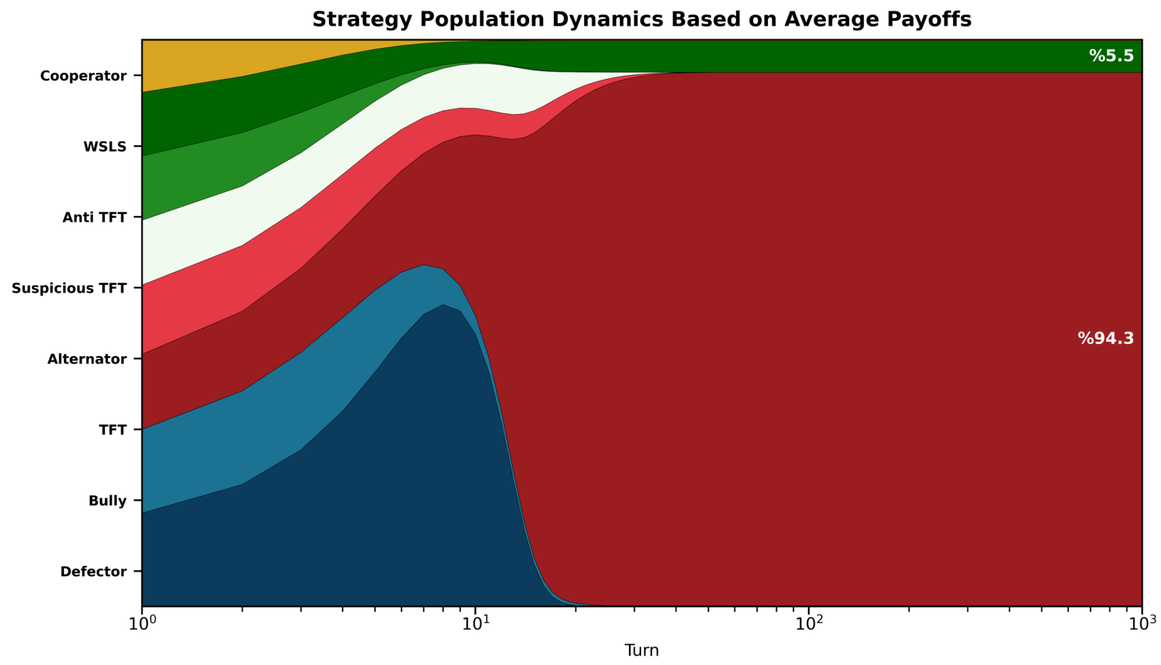


Out of the 15 strategies competing in the tournament, **eight were nice**, while the remaining **seven were nasty**. **The top eight strategies were all nice**. Notably, even the least effective nice strategy performed much better than the best nasty strategy.

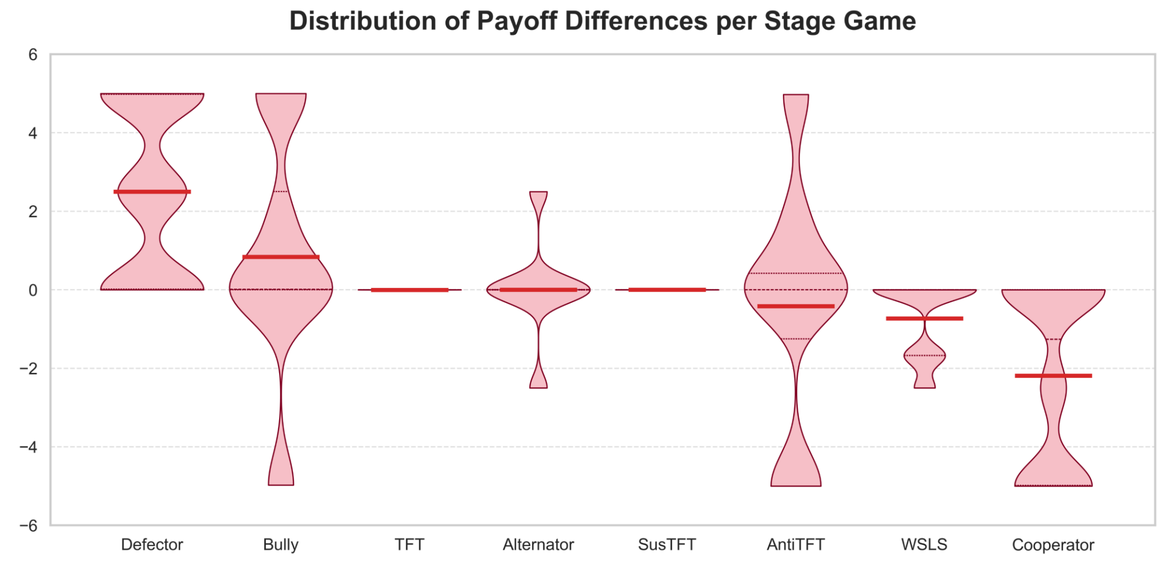
Payoffs



Coop(Cooperator): Always cooperates, **Def(Defector):** Always defects, **TFT(Tit For Tat):** Starts with cooperation, then mimics opponent's last move, **SusTFT(Suspicious Tit For Tat):** Starts with defection, then mimics opponent's last move, **AntiTFT(Anti Tit For Tat):** Plays the opposite of the opponent's last move, **WSLS(Win Stay Lose Shift):** Repeats move if successful, switches if not, **Bully:** Defects until punished, then cooperates, **Alt(Alternator):** Alternates between cooperation and defection.



In the early generations, **"nasty"** strategies like **Defector** and **Bully** rapidly expand by exploiting the naive **Cooperators**. The long-term dynamic is dominated by **Tit For Tat 94.3%**, proving that **reciprocal cooperation** is the most successful strategy for survival, and a small fraction of **Cooperators 0.2%** survives.



While **Defector exploits** others for gain and **Cooperator suffers** heavy losses, **Tit For Tat ensures stability** by forcing a fair, zero-sum outcome. **Anti-TFT** and **Bully** show wide distributions, indicating **unstable performance** where they either win big or lose big depending on the opponent.

CONCLUSION

In the repeated prisoner's dilemma *there is no single best strategy*. The strategy that performs best always depends on the other strategies it's interacting with.

Axelrod's main points: *be nice*, *forgiving*, *but don't be a pushover*.

References

1. *Axelrod, R. (1980). Effective choice in the prisoner's dilemma. Journal of conflict resolution, 24(1), 3-25.*
2. *Knight, Vincent, et al. "An open reproducible framework for the study of the iterated prisoner's dilemma." arXiv preprint arXiv:1604.00896 (2016).*

Furthermore :

GitHub