

The Competitive Advantage of Cooperation

Why Nice Guys (should) Finish First

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Databases - How*2&Y*

Agenda

- Social Darwinism vs. Evolution of Cooperation
- Selection @ Work
- Mathematics of Cooperation
 - The Prisoner's Dilemma
- Non-Zero-Sum Games
 - Diversity / Barter
- Competition and Cooperation
- Prerequisites for the Evolution of Cooperation

Sources

- The Selfish Gene
 - By Richard Dawkins
 - Originally published in 1976
 - 4th Edition / 40th Anniversary Edition in 2016
 - German: “Das egoistische Gen”
- The Evolution of Cooperation
 - By Robert Axelrod
 - Originally published in 1984
 - Revised Edition published in 2006
 - German: “Die Evolution der Kooperation”

Social Darwinism

- Today considered a toxic term
- More closely related to Breeding than to Evolution
 - Breeding works towards an arbitrarily defined goal
 - Evolution works towards a moving target
- Historically used to justify Racism, Euthanasia and others
- **NOT this session's subject**

Evolution of Cooperation

- Based upon Observations in Nature
 - Altruism in Populations of Individuals considered amoral
 - ◆ Selfishness of Altruism
 - Mutualistic Symbiosis
 - ◆ Between different Species or Individuals of the same Species
 - Behaviour in Competition
- Adoptable for Human Populations / Communities
 - Regardless of their Exposure to Biological Evolution

Evolution vs. Social Structures

- Analogies
 - Both are subject to Variation and Selection
 - Changes Over Time are driven by Circumstances
 - ◆ Rewards and Penalties
 - Inheritance / Genes match Tradition / Memes

Evolution vs. Social Structures

Differences

- Unconscious, Slow
 - Generations
- Abstract Arbiter
 - Filter eliminating the Unfit
- Amoral
- Conscious, Fast
 - Individuals can control their memes
- Self-made Rules
 - Filter or Teaching / Learning
- Ethics (?)

Selection @ Work

- Who are “The Fittest” in “Survival of the Fittest”
 - Who **is** “The Fittest” isn’t relevant for complex organisms
 - It’s about “The Fittest”, not the Strongest, Biggest, Fastest, ...
 - ◆ Diversity multiplies the Dimensions of Fitness
- Selection works upon
 - The Individuals of a Population
 - ◆ Fuels Selfish Behaviour
 - Populations competing for Resources
 - ◆ Rewards Cooperative Behaviour / Same or Different Species
 - Species
 - ◆ Rewards Cooperative Behaviour / Failure leads to Extinction

Mathematics of Cooperation

- **The Prisoner's Dilemma**

- Defect looks like the better Choice
 - ◆ Regardless of the other Player's Behaviour
 - ◆ $5 > 3, 1 > 0$
 - ◆ Rewards the Individual
- Cooperate provides the better total Benefit
 - ◆ $3 + 3 > 5 + 0 > 1 + 1$
 - ◆ Rewards the Population or Species

Benefit	Coop.	Defect
Coop.	3 \ 3	0 \ 5
Defect	5 \ 0	1 \ 1

- A Non-Zero-Sum (**NZS**) Game

Repeated Prisoner's Dilemma

- Iteration changes the Game
 - Ongoing Reward for Mutual Cooperation
 - Opportunity to compensate (“penalise”) previous Defect
- Individual and Total Benefit grow through Cooperation
 - The Individual's Benefit grows absolutely, but not relatively compared to Peers
 - Pairs or groups of Cooperators benefit compared to known Defectors, if they are denied Cooperation or even Interaction
- In a Competitive Setup, Defective Behaviour continues to be rewarded unless penalised

Transformation into Social

- Define Goals, Rewards and Penalties
- Encourage / Reward Desired Actions
 - Regulation rewarding Cooperative Behaviour
 - Non-Zero-Sum
- Keep Iterations Unlimited
 - End of Iterations encourages Defective Behaviour
 - ◆ Especially if only one Actor is aware of the end
 - If there is an end, make sure all Actors know
- Act expectable and reliable
 - “Tit for Tat”

Non-Zero-Sum and Diversity

- Team Members with Different Values provide Potential for Non-Zero-Sum Interactions
 - Could be Win- Win- or Loose- Loose- Scenarios
 - Identify and prevent Loose- Loose- Scenarios
- As Team Leader: Know these Values
 - Learn about Team Members' personal and cultural background
 - Encourage Openness
- Watch out for Compatible or Incompatible Members

NZS in History & Reality: Trade

- Barter
 - Value for the Buyer exceeds Value for the Seller (mutually)
 - E.g. trading in Salt for Grain
- Bronze
 - Alloy consisting of Copper and Tin
 - ◆ Main Ingredients exist in different Locations
 - ◆ Alloy's Value exceeds the Cumulated Value of Ingredients

NZS in History & Reality: War

- Destruction is a cumulative Loss
 - Winner's Gain is reduced by Destruction
 - Loser's Loss is increased by Destruction
- Defence requires fewer Resources than Attack
 - Recent examples: WW I, Vietnam
 - Generally on a Tactical Level
- Cold War Overkill
 - Threat of Total Destruction eliminates any Possible Gain

NZS in History & Reality: Sports

- Doesn't match Prisoner's Dilemma in order to discourage "Cooperation" leading to a Draw
- Winner gains 3 Points, each Player gains 1 Point for a Draw, Loser gets no Points
 - Starting with a Draw, each Player has more to gain than to lose
 - The Cumulative Opportunity from a Draw Situation (1 Point possible Loss, 2 Points possible Gain, $2 - 1 = 1$) equals the C. O. from a Losing Situation (no Risk of Loss, 1 Point possible Gain)
 - With Two Matches, the Cumulative Benefit of each Player winning one, losing one (3 Points) exceeds the C. B. of two Draws (2)

NZS in History & Reality: Poker

- Counting Chips, it's a Zero-Sum Game
- However, the Impact of losing 5 Chips out of 10 is more dramatic than the Impact of losing (or winning) 5 Chips while holding a Stack of 100
- Even more Drama: **All-In**
 - Betting 10 Chips out of 10
 - The All-In Player is Out of the Game when losing

NZS in History & Reality: Traffic

- Traffic Congestion behind a Slow Vehicle
 - The Slow Vehicle can give way at a Lay-By, losing Time
 - Faster Vehicles behind benefit
- Keep Crossroads Clear
 - Failure may result in Mutual Lock or even Deadlock

Cooperation and Competition

- Cooperation does not exclude Competition
 - In Fact, very serious Competition is essential for Evolution
“Mother Nature has Sharp Teeth and Bloody Talons”
- The Important Part is the Balance between Benefit and Loss
 - Social Equivalent is “Fair Play”
- To encourage Cooperative Behaviour, set up Rules
 - Deregulation usually fails to encourage Cooperation

Axelrod's Tournament: Setup

- Call for Algorithms playing Prisoner's Dilemma
 - Input is the Partner's Previous Actions
- Each Combination of Algorithms is evaluated
 - Repeated Execution
- Algorithms are rated for their Total Score

And the Winner is... **Tit for Tat**

- Starts with Cooperation, continues by copying Partner's previous Action
- Characteristics
 - Nice Doesn't Defect First
 - Reciprocal Rewards Cooperation, Penalises Defect
 - Not Envious Never Scores Better than Rival / Partner
 - Forgiving Allows Compensation of Previous Defect
 - Simple Reliable
 - ◆ Simplest Algorithm in this Tournament

Soft Spots in Axelrod's Setup

- A Different Population of Algorithms may produce a Different Result
- Only One “Generation”
 - No Inheritance or Reproduction
- Only One Instance per Algorithm
- Players can't choose their Interaction Partner / Rival
- No External Selection or Resource Limits
 - No Competition between Individuals

Requirements for Evol. of Coop.

- Repeated Prisoner's Dilemma Style Interaction
- Actors evaluate and memorise the previous Interaction Result
- Sufficient Number / Percentage of Cooperative Actors
- Actors recognise each other
- Actors can choose their Interaction Partner
- Reciprocity / Mutuality

Transformation into Social (1)

- Repeated Interaction
 - Long Term Engagements and Team Structures
- Actors evaluate and memorise the previous Interaction Result
 - Transparency
 - Awareness of own and Partner's Values
- Sufficient Number / Percentage of Cooperative Actors
 - Staffing, Team Mix

Transformation into Social (2)

- Actors recognise each other
 - Limits Community to a Maximum Size
 - ID Tags and Reputation Systems push the Limit
- Actors can choose their Interaction Partner
 - Minimum Community Size required
 - Balance of Power
- Reciprocity / Mutuality
 - Staffing, Team Mix, Team Structure
 - Self Confidence

Where Cooperation Works

- Mutual Insurance Societies e.g. between local Farmers
- Small Teams / Peer Groups
 - Buddy System as the smallest Team
 - Hierarchy breaks down Large Units, like in a Roman Legion
 - ◆ Legion (~5000) - Cohort - Centuria - Contubernium (8)
 - ◆ Soldiers from a Contubernium share e.g. Mule, Tent & Fireplace
 - ◆ Discipline was enforced through Contubernium
 - ◇ Collective Punishment in case of Individual Failure
 - ◇ Decimation in case of Large Scale Mutiny
 - Green Beard Effect
- **SAP Community Network!**

Where & Y Cooperation Fails

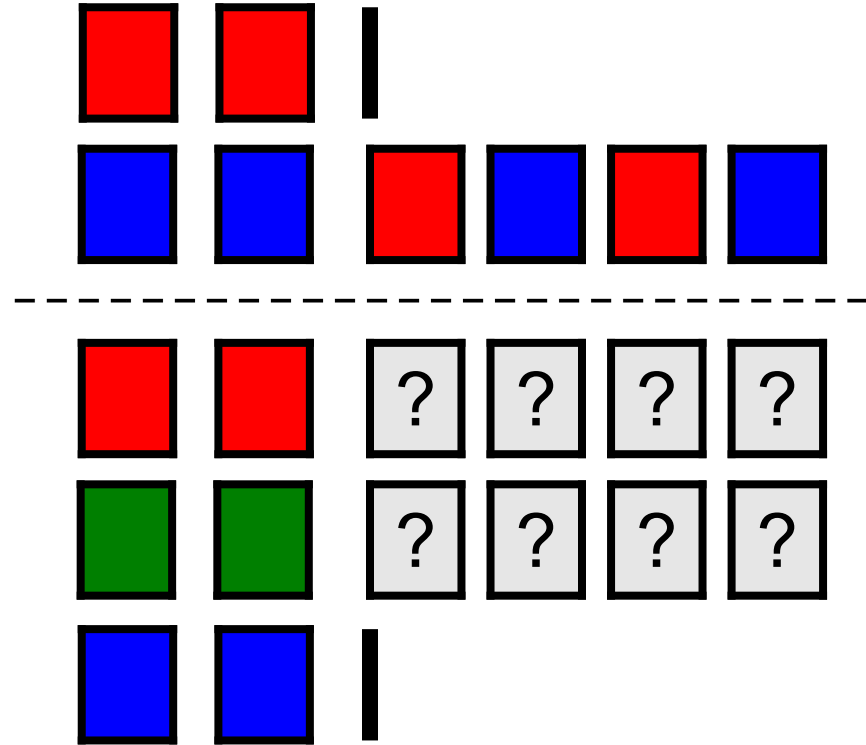
- Individual Traffic, Public Parking
 - Many Actors, Lack of Recognition, Loss is distributed.
 - Enormous Loss in case of Mutual Defect (Collision)
 - Different Behaviour in Public vs. Designated Resident Parking
- Very Large Communities, Public Forums on Social Media
 - Many Actors, Lack of Recognition
 - High Reward and Low or no Penalty for Defect

Lessons Learned

- Encouraging internal Cooperation strengthens external Competitiveness
 - More efficient Use of Resources
- Defective internal Competition weakens Competitiveness
 - Waste of Resources and Energy
- Measures and Rules to encourage Cooperation
 - Act Foreseeable and Reliable
 - Communicate Values and set up for Transparency
 - Reward Cooperative and penalise Defective Behaviour
 - Strengthen Individuals Self Confidence
 - Consider Team Size and Character Mix

Food for Thought: Traffic

- When merging Lanes, the “Fair” / Cooperative Approach is to preserve the Sequence of Vehicles
- Merging 2 Lanes to 1
 - Every Driver knows the Late Merge / Zipper Method
- **What about Merging 3 Lanes to 2?**
 - Hint & Solution at End of Deck



More Sources and References

- The Situation Is Hopeless But Not Serious (“Anleitung zum Unglücklichsein”)
 - By Paul Watzlawick
 - Chapter 14 about Zero-Sum and Non-Zero-Sum Games
- Collapse (“Kollaps”)
 - By Jared Diamond
- Nice Guys Finish First
 - BBC Cast with Richard Dawkins
 - e.g. <https://www.dailymotion.com/video/x1jprgh>

Thank you!

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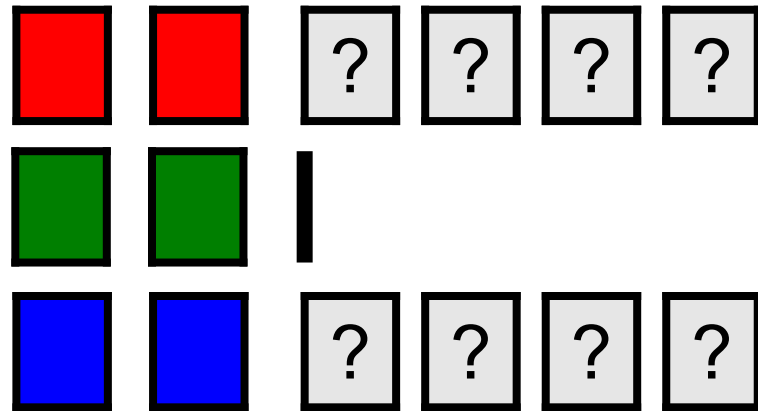
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Merging 3 Lanes to 2: Hint

- Imagine it's the Middle Lane that ends
- Then find out how to achieve the same Result if one of the Outer Lanes ends



Merging 3 Lanes to 2: Solution

Source: [https://en.wikipedia.org/wiki/Merge_\(traffic\)](https://en.wikipedia.org/wiki/Merge_(traffic))

Every Other Car from the Middle Lane moves between 2 Blocks of 2 Cars from the remaining Outer Lane.

Every remaining Car in the Middle Lane allows 2 Cars from the ending Outer Lane into the Gap created.

