



# Book Rock, Paper, Scissors

## Game Theory in Everyday Life

Len Fisher  
Basic Books, 2008  
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## Recommendation

Len Fisher, an award-winning author of popular science books, has written an entertaining, enlightening and practical guide to the abstruse discipline of game theory. Fisher shows how game theory explains phenomena as mundane as why spoons go missing from a coffee break room, as ingenious as rabbinical problem solving in the Talmud and as fateful as global warming. *BooksInShort* finds that his lively writing invites a wide audience. Fisher engages lay readers by elucidating an intensively mathematical subject without heavy reliance on equations or jargon. His treatment of the subject makes game theory appear only slightly more complicated than child’s play. In fact, he often uses children’s games to illustrate the role of game theory in daily life.

## Take-Aways

- Learning game theory – particularly how to identify traps – has practical, everyday benefits.
- People often choose to accept no reward instead of taking one they see as unfairly small.
- A “Nash Equilibrium” is a two-party situation that neither party can independently change without cost.
- The reciprocal game “Tit for Tat” can lead to cycles of retaliation.
- People are more likely to cooperate with those they will encounter again in the future.
- Cooperation is easier in small groups than in large ones.
- Two parties struggling to form an alliance may succeed if a noncooperative third party interjects.
- Establish your credibility by agreeing to pay a price if you break an agreement.
- If you want people to trust you, show that you trust them first.
- Stick with a winning strategy as long as it wins, and if it fails, switch immediately to a new one.

## Summary

### Games People Play

Game theory explains many of life’s mysteries and provides a way to understand everything from domestic squabbles to military confrontations. Game theory is based on more than competition. In fact, cooperation may be the ideal response in some games. Individuals, groups and entire nations can sidestep some traps in game theory by getting along instead of allowing destructive competition to intensify.

“Game theory is all around us. Despite its name, it is not just about games – it is about the strategies that we use every day in our interactions with other

people.”

One of the most famous destructive patterns in game theory is known as “the Tragedy of the Commons.” Game theorist Garrett Hardin publicized this pattern in 1968, using the example of grazing land that several livestock herders share. Each herder can make a little extra profit by allowing one more animal to graze. But if all of the herders do so, overgrazing will ensue and the land will turn barren. The Tragedy of the Commons also explains why spoons may disappear from a company’s coffee break room. Each employee who takes a spoon from the break room gains some convenience at no cost. But, of course, when every person takes a spoon, none remain. This theory also sheds light on such serious issues as international conflicts over global warming. Each country may derive some economic benefit from burning fossil fuels without restraint. However, if every country does that, the global consequences will be disastrous for all.

“Rock, Paper, Scissors”

People around the world play versions of the game Rock, Paper, Scissors, including “Snake-Frog-Slug” in Japan and “Elephant-Human Being-Earwig” in Indonesia. Whatever it is named, this zero-sum game has an intransitive quality. Rock beats scissors, scissors beats paper and paper beats rock, but rock does not beat paper, paper does not beat scissors and scissors does not beat rock. The Rock, Paper, Scissors game provides useful insights into many problems. For example, what is the best survival strategy for the least-skilled shooter in a “true,” or a three-way pistol duel? Suppose that one of the three is an excellent shot, one is mediocre and one is bad. The best strategy for the bad shooter is to step back and let the other two shoot at each other. The ABC television network appeared to adopt that strategy by airing noncomedy programming in late-night slots rather than competing directly with popular comics on CBS and NBC.

“Standing back to let the strong ones fight it out before entering the fray [works] in many areas of life.”

Nature itself seems to play Rock, Paper, Scissors. For example, one species of California lizards has three different categories of males identifiable by throat color. The sneaky yellow throats defeat the aggressive orange throats, and the defensive blue throats have an advantage over the yellow throats. But blue doesn’t beat orange.

“The Seven Deadly Dilemmas”

Seven dilemmas in game theory are especially perilous for the players, and can have national or international consequences:

1. “The Prisoner’s Dilemma” is at work when cooperation would benefit two parties but each acts independently, undermining any momentum toward an alliance.
2. The Tragedy of the Commons is similar to the Prisoner’s Dilemma except that it involves more than two parties.
3. The “Free Rider” dilemma can lead to the loss of shared resources. Individuals may be able to enjoy a community resource without paying for it. But if no one voluntarily pays and everyone chooses instead to be a free rider, they all exhaust the resource.
4. In the “Volunteer’s Dilemma,” an entire group will suffer a loss unless one member voluntarily makes an effort or a sacrifice, yet no one wants to be the first to act.
5. In a dilemma called “Stag Hunt,” a group can win a massive reward if all the members cooperate with each other. However, members may elect to chase smaller but surer individual rewards by refusing to cooperate.
6. “Chicken” or “brinkmanship” is a game that pulls two parties to the brink of conflict. One party must retreat first or both parties will face a catastrophic loss. In some cases, neither party is willing to back down. In other cases, losses threatened by one party may be enough to discourage the other party from engaging in conflict. For example, you could make a threat that is so dangerous that even if there is only a small chance of it materializing, the overall probability equation makes it rational for the other party to back down, and not you.
7. The “Battle of the Sexes” is a dilemma for men and women who desire togetherness but prefer different activities.

The Prisoner’s Dilemma

A crime story commonly illustrates the Prisoner’s Dilemma, a central focus of game theory. Consider the case of two captured thieves who committed a burglary carrying concealed weapons but left behind little evidence. Police encourage each thief to plead guilty to burglary and to testify that the other one was involved in the crime. If both thieves plead guilty to burglary and each testifies against the other, both will get four-year sentences. If both thieves plead innocent and refuse to testify against each other, both will get two years in prison for a lesser crime. The best strategy for both thieves would be admitting nothing and accusing no one. But because neither thief knows what the other will say to the police, each concludes that pleading guilty to burglary and implicating the other is the most prudent strategy. The Prisoner’s Dilemma is one of the most thoroughly studied problems in game theory. The Cold War arms race was a real example of this dilemma. Countries would have been better off if they spent less money on arms. However, no country could afford to become militarily weaker than its adversaries.

“The Prisoner’s Dilemma presents us with a logical conundrum that lies at the heart of many of the world’s most serious problems.”

American mathematician John Nash, subject of the movie *A Beautiful Mind*, won the Nobel Prize for discovering the trap in the Prisoner’s Dilemma. To understand this trap, imagine two men walking toward each other on a sidewalk wide enough for one. If one man or the other steps aside, both can pass. However, neither man can change his mind without causing an impasse. Communication and cooperation can help people avoid the “Nash equilibrium” trap.

“Global warming is one example: Why not gain an economic advantage by letting other countries bear the cost of reducing carbon emissions?”

John Nash’s work also led to the “Nash bargaining solution,” a mathematical method of identifying fair shares. If you multiply the possible shares by each other, the biggest value represents the most equitable option. You can use this tactic to compare different ways of splitting a sum between two individuals. For example, the fairest way to split \$100 between two people is giving each of them half the money, because 50 multiplied by 50 equals 2,500. Giving \$51 to one person and \$49 to the other is less fair because 51 multiplied by 49 equals 2,499.

“We experience the ghostly hand of the Tragedy of the Commons every time we use our computers to surf the Web.”

Psychological experiments show that two parties often prefer a 50-50 split even when one party is more powerful. In experiments, researchers gave cash to one person

with instructions to share it with a second party in a mutually agreeable way or forfeit the whole sum. Rationally, the first party should offer only a tiny share, and the second party should accept a tiny share because it would be better than nothing at all. But in practice, people tend to reject offers below 30% and accept nothing to protest the unfairness of the offer. Money, it turns out, isn't everything. Brain research suggests that people who reject a financial reward may get an emotional boost from enforcing the norms of fairness.

## Minimizing Maximum Losses

Antipathy to unfairness appears to be an evolutionary endowment that human beings share with other primates. Monkeys actually will throw food back at a zookeeper if they perceive that other monkeys unfairly received more food. Children sometimes do the same thing. The author once threw a dessert at his mother because he felt she unfairly favored his brother with a bigger portion. So, how can you divide desserts and other goodies without causing envy or resentment? One solution is familiar to many parents: Let one child cut the cake and the other choose the piece he or she wants. In this case, the cutter has an incentive to make sure both pieces are equal. This is a variant of a strategy that game theorists call "Minimax," short for "minimizing your maximum possible loss." The solution has wide applicability. John von Neumann, a game theory pioneer, applied it to poker. Other researchers have found that professional athletes intuitively strive to minimize their maximum possible losses.

"Unfortunately, in the adult world, cycles of retaliation and counter-retaliation can lead to more serious consequences, including messy divorces, ongoing sectarian violence, terrorism and war."

The Babylonian Talmud, a central text of Judaism, uses an interesting application of the Minimax concept. Rabbis must decide how to divide an estate among a man's three widows. Separate prenuptial agreements presuming an estate worth 600 dinars had guaranteed 100 dinars to the first widow, 200 dinars to the second widow and 300 dinars to the third. But what if the estate was worth less than 600 dinars? The rabbis came up with three different formulas, according to the value of the estate. They ruled that if the estate had a value of 300 dinars, the first widow would get 50 dinars, the second widow 100 dinars and the third widow 150 dinars, the exact proportions in their agreements. If the estate was worth 100 dinars, the three widows would each get an equal share. If the estate was worth 200 dinars, the first widow would receive 50 dinars and the other two widows would get 75 dinars each. Nobel Prize-winning game theorist Robert Aumann and economist Michael Maschler applied game theory to explain the 50-75-75 solution. Their research shows that the Talmudic solution was the fairest possible outcome because it featured an "equal division of the contested sum."

## Building Trust

People often agree to cooperate and then violate the agreement. Two ways to limit cheating are reducing the incentive for renegeing on a deal and employing a third party to enforce adherence to the deal's terms. Other solutions include making breach of contract too costly or designing the contract to allow for partial payments, instead of a large upfront payment. Retaliating against a cheater may invite reciprocal action. In the two-way game "Tit for Tat," each party does whatever the other does. This can be mutually rewarding if a series of cooperative actions ensue. But Tit for Tat also can lock players into endless retaliatory cycles.

"The sense of fairness seems to be deeply ingrained in our psyche and may come from...our evolutionary history."

The survival of coalitions depends on trust. But trust may be unrewarding and it is risky. The risks include possible betrayal and loss, as in the case of naively trusting people who fall for Internet scams. Properly placed trust, however, can produce mutually satisfying outcomes. You can use two different tactics to signal that your commitments are credible. The first way is to raise your personal cost of betraying the other person by:

- Putting your reputation on the line.
- Going step-by-step, as in project contracts that pay as upon completion of each phase.
- Teaming up so that peer pressure comes into play. Roman legionnaires faced a death penalty if they did not attack with gusto; anyone who neglected to kill lazy laggards was subject to the same penalty.
- Developing a contract and including a penalty clause to "make [it] stick."

"Credible commitment works, even in the absence of underlying trust between parties."

The second way is to close off avenues of escape from keeping your commitment by:

- Submitting to the authority of a powerful third party whose word is law.
- Making escape impossible. Spanish conquistador Hernán Cortés destroyed the ships that brought him and his soldiers to Mexico, leaving no alternative to war.
- "[Putting] your decision in the hands of fate" by limiting your ability to affect its results, and letting the outcome simply unfold.

"The trouble with game theory is that it can explain anything. If a bank president was standing in the street and lighting his pants on fire, some game theorist would explain it as rational." (strategic analyst Richard Rumelt)

Game theory offers other types of practical advice. Engage in reciprocal games with players you plan to work with over a long period of time. If possible, structure their costs and benefits to eliminate the seven deadly dilemmas. For example, divide any burdens or gains fairly among players to eliminate envy. Use rewards to keep players in a coalition. Show trust in order to gain it. If you are the first to display trust, you will give your counterparty an incentive to trust you. If coalition building bogs down, consider switching to a smaller playing field. Cooperation and trust are easier to achieve in small groups of players than in large ones.

## About the Author

**Len Fisher**, Ph.D., is the author of *Weighing the Soul* and *How to Dunk a Doughnut*, which was named Best Popular Science Book of the year by the American Institute of Physics. He is the recipient of an Ig Nobel Prize for calculating the optimal way to dunk a doughnut.

