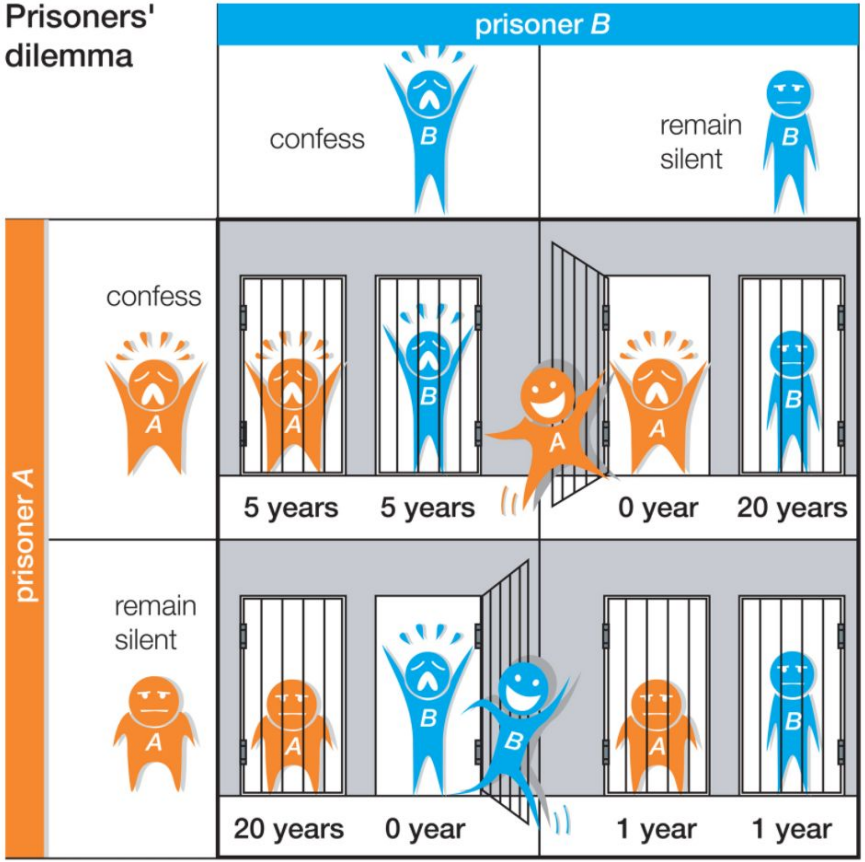
Game Theory: A Practical Application of Logic and Analytic Thinking

By Nick Laffin

OH NO!

You and your accomplice have just been arrested for grand theft auto. The police have enough evidence to put you away for 1 year, but the District Attorney believes she can get more time out of the both of you. She offers each of you a deal. If one of you confess that the other member of your party committed the crime and the accomplice chooses silence, you will walk free. However if you both confess, your accomplice and you will both get 5 years in jail. You have no real relationship with your accomplice and during this time you will not see or hear from them. What do you do? Circle your choice below and find out your fate with a randomly paired partner.



What is game theory?

Game theory is the process of modeling the strategic interaction between two or more players in a situation containing rules and outcomes.

In the real world

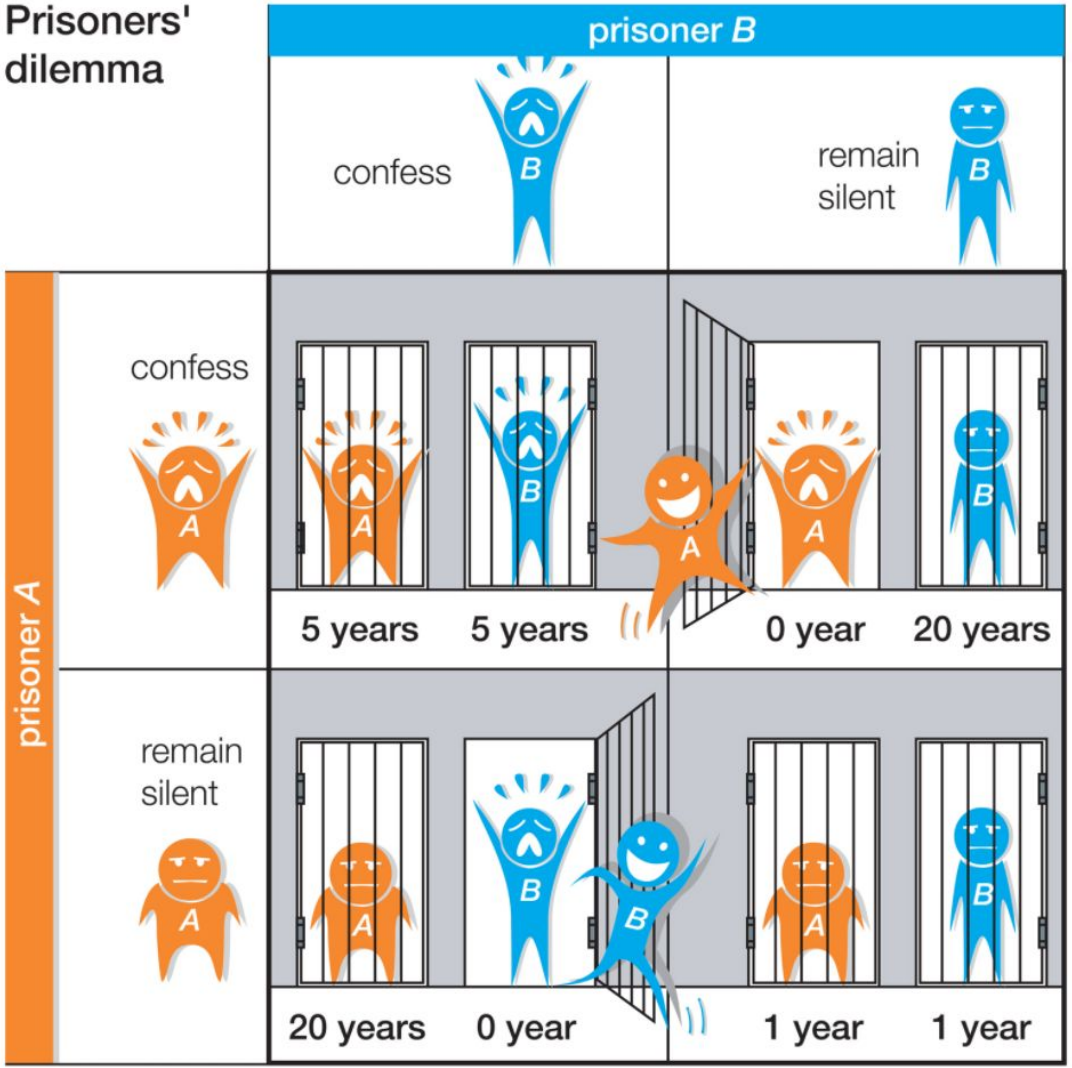
Cooperative games - A game where every player has agreed to work toward a common goal.

Non-cooperative games - A game which involves competitive social interactions. It is never a cooperative game.

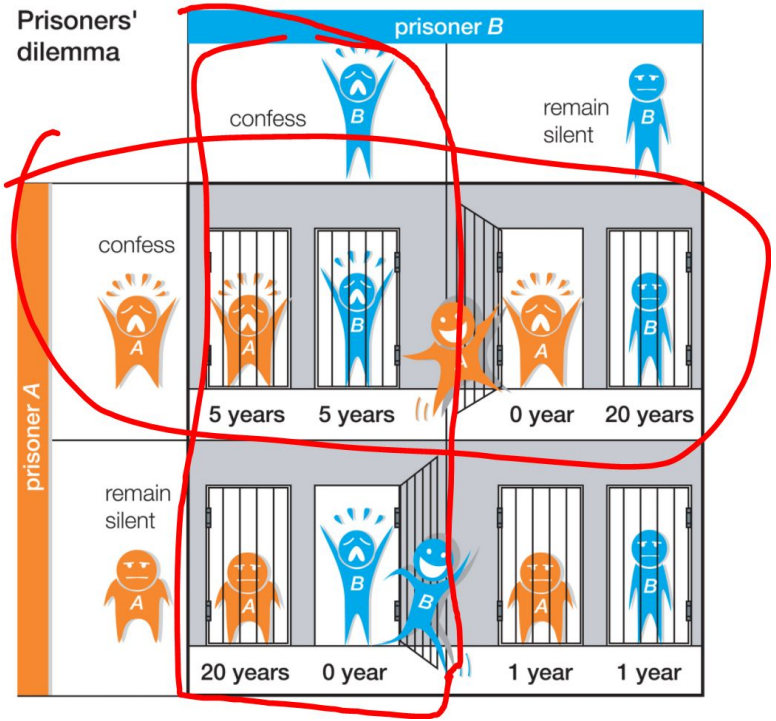
Everything else you need to know

- Game - A set of circumstances that have rules and a result dependent on the actions of two or more players.
- Players - A strategic decision maker within the context of the game who is rational.
- Strategy - A complete plan of action a player will take given the set of circumstances and rules that exist within the game.
- Payoff - The result a player receives from arriving at a particular outcome.
- Equilibrium - The point in a game where both players have made their decisions and an outcome is reached.

Prisoners' dilemma



The best strategy



Nash Equilibrium and Dominant Strategy

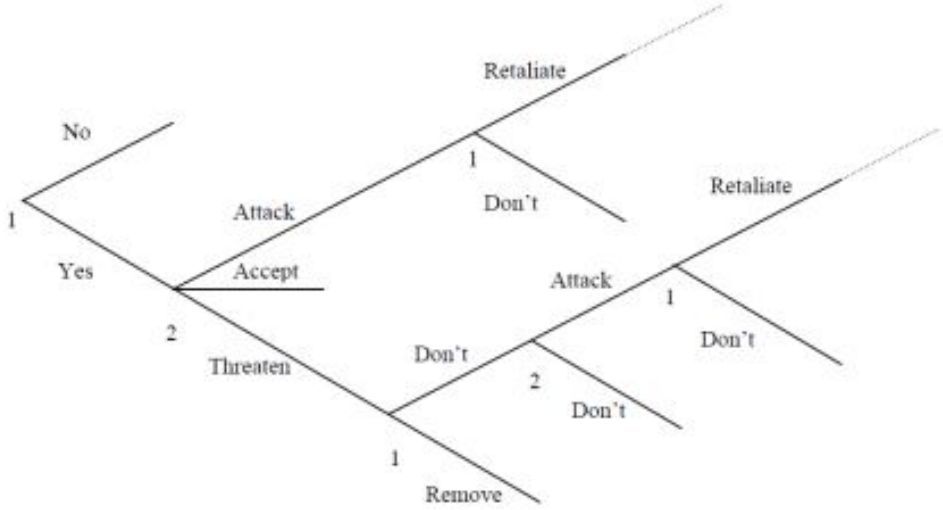
- The Nash equilibrium exists in any noncooperative game, when each player chooses the strategy that is the best response to the strategies that the other players choose

- The dominant strategy is the choice the player makes the leaves them better off, no matter what their opponents strategy will be.

Possible Workplace Example

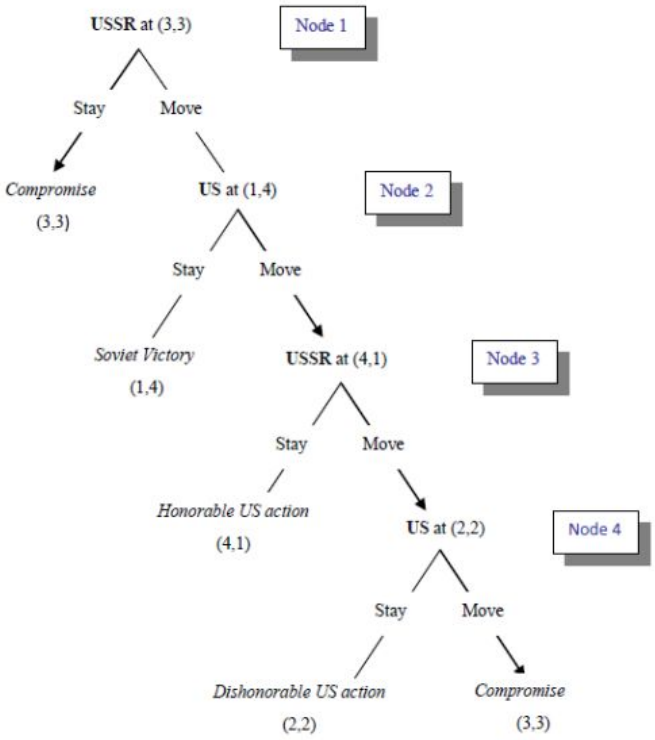
Expensive research and development games cannot be played repeatedly! If one firm invests in R&D, can another rival firm decide not to follow? They might lose the competitive edge in the market Payoffs in the table are the changes in profits (£m) resulting from decisions		Firm B	
		R&D Project	No R&D project
Firm A	R&D Project	(+£5m, +£45m)	(+£85m, -£10m)
	No R&D Project	(-£10m, +£85m)	(+£30m, +£70m)

The Cuban Missile Crisis



Key: Player 1 = Khrushchev
Player 2 = Kennedy
Yes = Install missiles; No = Do not install missiles
..... = game continues

The Cuban Missile Crisis



Key: → = Rational Choice

The Cuban Missile Crisis

		State B	
		Cooperate (C)	Defect (D)
State A	Cooperate (C)	*Compromise* (3,3)	*B Wins* (2,4) *
	Defect (D)	*A Wins* (4,2) *	*Conflict* (1,1)

Key: (x,y) = payoff to State A, payoff to State B

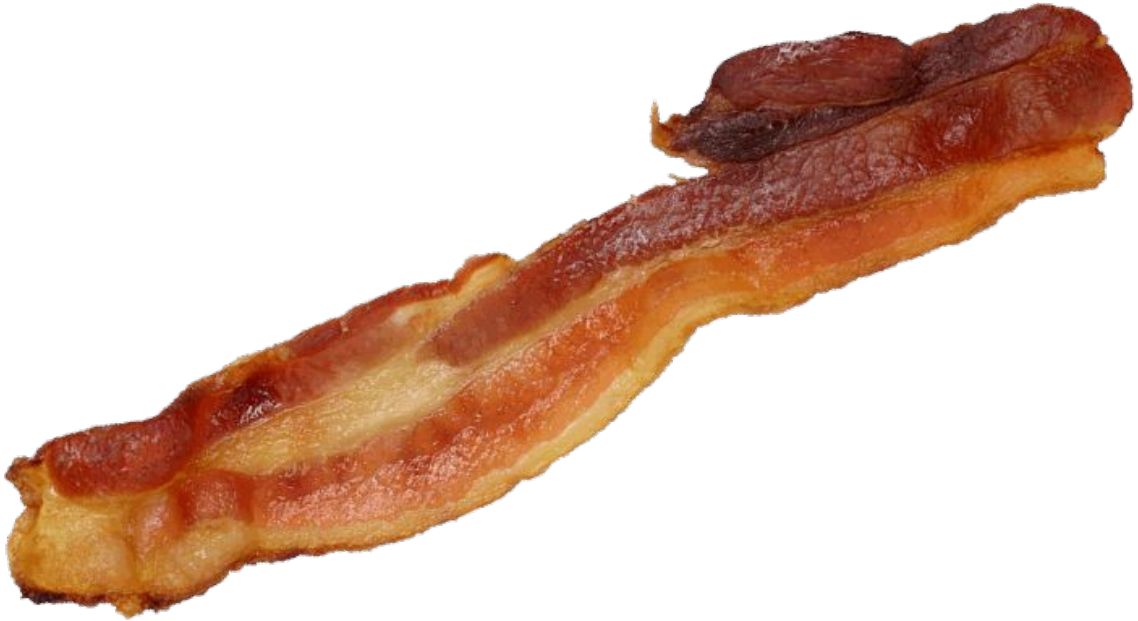
4 = best; 3 = next-best; 2 = next-worst; 1 = worst; * = Nash equilibrium

The Cuban Missile Crisis

		Soviet Union:	
		Withdraw (W)	Maintenance (M)
United States:	Blockade (B)	*Compromise* (3,3) *	*Soviet Victory US capitulation* (1,4)
	Air Strike (A)	*'Dishonorable' US action; Soviets thwarted* (2,2)	*'Honorable' US action; Soviets thwarted* (4,1)

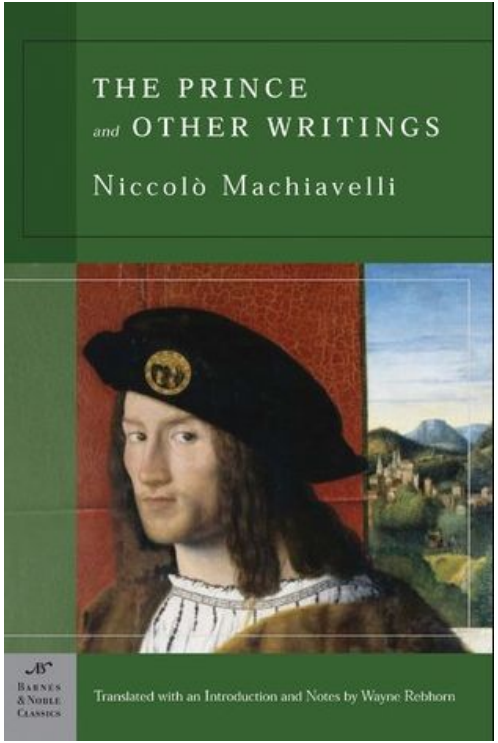
Key: (x,y) = payoff to United States, payoff to Soviet Union
4 = best; 3 = next-best; 2 = next-worst; 1 = worst
* = Nonmyopic Equilibrium

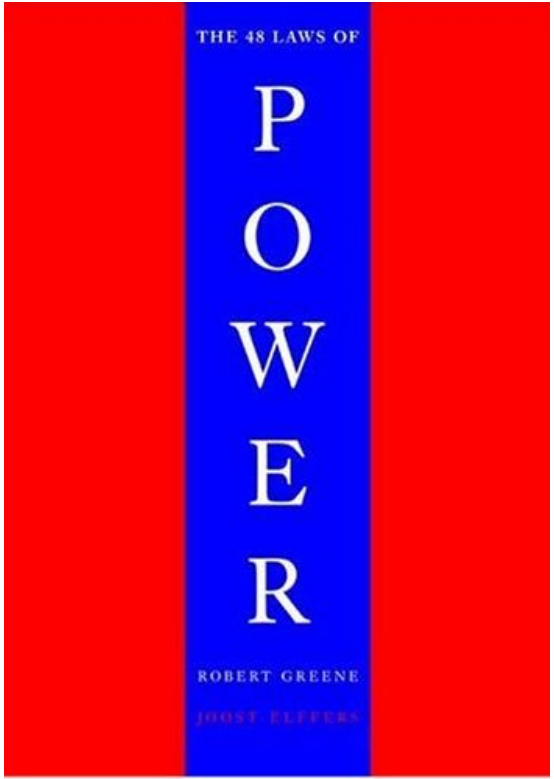
IT IS YOUR BACON OUT THERE!



Interested

Read these two literary works.





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