

The Prisoner's Dilemma

Day 1

The classical scenario is as follows:

Two criminals have been arrested on suspicion of a serious crime. The police have found contraband on each that will lead to lesser charges, but in order to convict the two of the serious crime, they need a confession. The two criminals are being detained in separate rooms, and have no knowledge of what the other is saying. The outcomes are the following:

- If neither of them confess, they can only be charged with the lesser crime and serve a small sentence (Lets say 1 year).
- If they both confess, they serve a greater sentence for the serious crime, but the confession reduces the full penalty a little(5 years).
- If one of them rats out the other, the rat goes free and the other serves a full sentence for the serious crime(10 years).

We can look at the outcomes on a **payoff matrix**.

	Player 1 cooperates	Player 1 defects
Player 2 cooperates	P1:1 year P2:1 year	P1:freedom P2:10 years
Player 2 defects	P1:10 years P2:freedom	P1:5 years P2:5 years

From the point of view of either player, it is the better strategy to defect, regardless of what the other player will do. Thus, both players will defect. We call this outcome a **Nash Equilibrium**.

We can generalize this game to include any reflexive interaction between 2 players.

	Player 1 cooperates	Player 1 defects
Player 2 cooperates	P1:R P2:R	P1:T P2:S
Player 2 defects	P1:S P2:T	P1:P P2:P

These letters have significance. R is the reward for cooperation, T the temptation to defect, P the punishment, and S is the sucker's payoff for trusting a dishonest person.

For this model to work we require $T > R > P > S$.

Now even though the game predicts that the outcome will be the equilibrium of double defection, in games involving people psychology can play a role. It is assumed that each criminal has no loyalty, but if they are loyal friends, then we may arrive at the outcome of double cooperation. Similarly, we can look at the role that **threats** play in such interactions. A player can be threatened into cooperation. For this to occur, it is necessary that the threat be credible.

This scenario can be altered to look at scenarios that have similar payoff matrices but do not involve criminals. These situations are such that mutual cooperation is beneficial, but the temptation of defection (cheating) is great.

A good example is bartering or sales. One player is the buyer, the other the seller. The outcomes are as follows:

- If both players cooperate, the seller receives a good price in exchange for a good product.
- If the buyer cheats, the seller is conned into exchanging a good product for a small price (or counterfeit).
- If the seller cheats, the buyer receives an inferior good (lemon) in exchange for a good price.
- If both defect, then no sale is made and both walk away with nothing.