The Case for Courtship

Benefit of raising one offspring:	15	(each parent)
Cost of raising one offspring:	20	(shared equally)
Cost of the courtship ritual:	3	(each parent)

Males can be

Faithful: share the job of raising the offspring

Philanderous: leave the female after mating

Females can be

Coy: insist on a courtship

Fast: mate immediately

Payoff

Faithful man meets coy woman:

Courtship + equal sharing of upbringing

- **Cost:** $15 - 3 - \frac{20}{2} = 2$ for each parent.

Faithful man meets fast woman:

No courtship + equal sharing of upbringing

- **Cost:** $15 - \frac{20}{2} = 5$ for each parent.

Unfaithful man meets coy woman:

No mating

- **Cost:** 0 for each person.

Unfaithful man meets fast woman:

No courtship + female does all upbringing

- **Cost:** $\begin{cases} 15 & \text{for the man} \\ 15 - 20 = -5 & \text{for the woman} \end{cases}$

The Game Matrices

Payoffs to Female

		Male Strategies	
		faithful	philanderous
Female	coy	2	0
Strategies	fast	5	-5

Payoffs to Male

		Male Strategies	
		faithful	philanderous
Female	coy	2	0
Strategies	fast	5	15

Stable population: made up of just the right proportions of faithful/philanderous males and coy/fast females so that no individual from either sex would benefit by switching his/her type.

Also called a **Nash Equilibrium**.

Are Equal Proportions of Each Type of Male and Female a Nash Equilibrium?

Females

Should I be coy? Half the time I get benefit 2 and half the time I get benefit 0, for average benefit:

$$\frac{1}{2} \times 2 + \frac{1}{2} \times 0 = 1$$

Should I be fast? Half the time I get benefit 5 and half the time I get cost 5 (benefit -5), for average benefit:

$$\frac{1}{2} \times 5 + \frac{1}{2} \times (-5) = 0$$

Males

Should I be faithful? Half the time I get benefit 2 and half the time I get benefit 5, for average benefit:

$$\frac{1}{2} \times 2 + \frac{1}{2} \times 5 = 3\frac{1}{2}$$

Should I be philanderous? Half the time I get benefit 0 and half the time I get benefit 15, for average benefit:

$$\frac{1}{2} \times 0 + \frac{1}{2} \times 15 = 7\frac{1}{2}$$

The Correct Nash Equilibrium

- $\frac{5}{8}$ of the men faithful, $\frac{3}{8}$ of the men unfaithful
- $\frac{5}{6}$ of the women coy, $\frac{1}{6}$ of the women fast.

The Payoffs

Payoffs to Female

	$\frac{5}{8}$ faithful	$\frac{3}{8}$ philanderous	
coy	2	0	$\frac{5}{8}\times 2+\frac{3}{8}\times 0=1\frac{1}{4}$
fast	5	-5	$\frac{5}{8}\times 5+\frac{3}{8}\times(-5)=1\frac{1}{4}$

Payoffs to Male

		faithful	philanderous
$\frac{5}{6}$	coy	2	0
$\frac{1}{6}$	fast	5	15
		$\frac{5}{6}\times 2+\frac{1}{6}\times 5=2\frac{1}{2}$	$\frac{5}{6}\times 0+\frac{1}{6}\times 15=2\frac{1}{2}$

Iterative Convergence to Nash Equilibrium

A population of males and females with *any* proportion of coy/fast and faithful/philanderous types will naturally go towards a Nash Equilibrium using the following process:

> Each new female entering the population looks at the proportion of faithful and philanderous males and decides, based on the best expected payoff, whether she will be coy or fast. Each new male in the population looks at the proportion of coy and fast females and decides, based on the best expected payoff, whether he will be faithful or philanderous. The population proportions are adjusted accordingly, and the process repeats itself.

After a sufficiently large number of generations doing this, the population percentages will get closer and closer to the true Nash Equilibrium proportions.