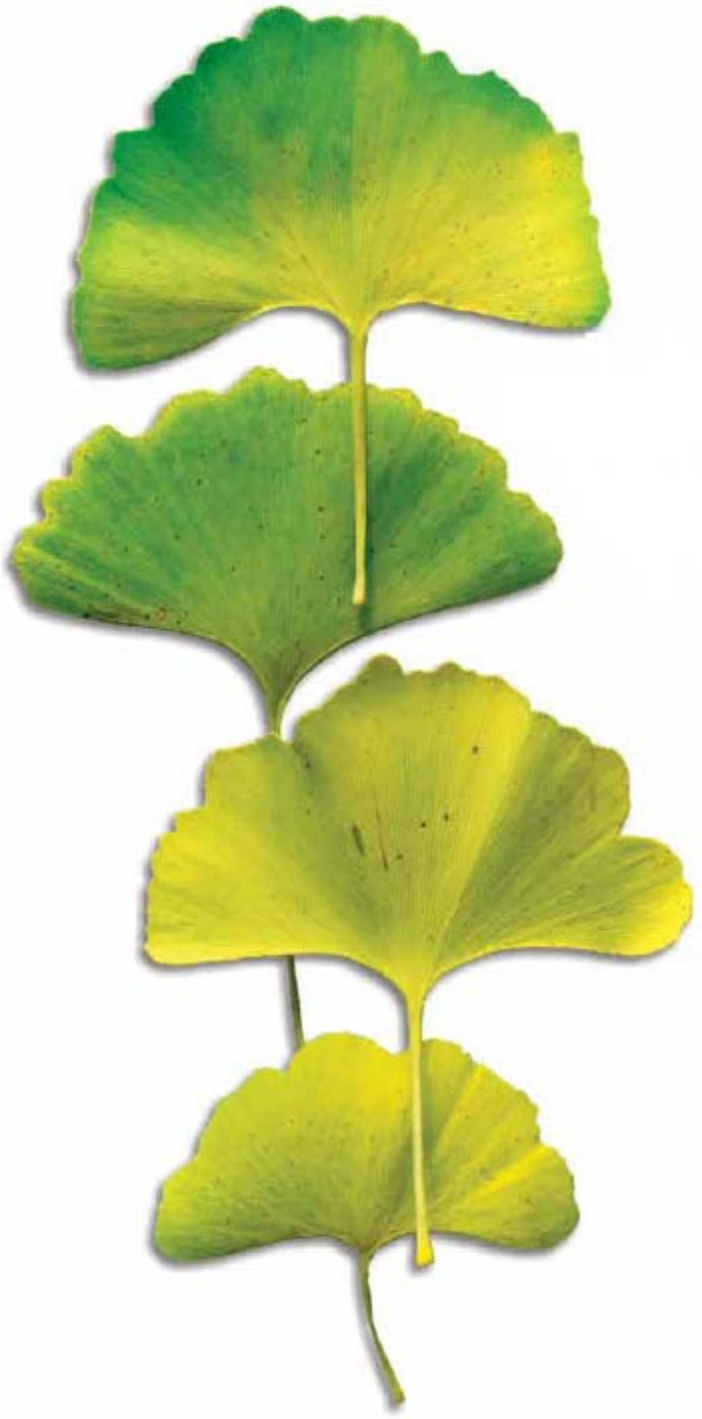
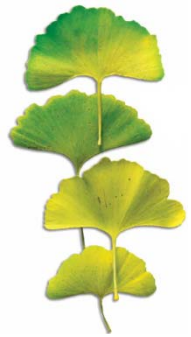


Chapter 12

A Game-Theoretic Approach to Strategic Behavior

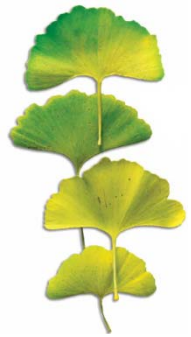
Chapter Outline

- The Prisoner's Dilemma: An Introduction to the Theory of Games
  - The Nash Equilibrium
  - The Maximin Strategy
  - Strategies for Repeated Play
- Sequential Games
- The Evolution of Strategic Preferences
  - A Parable of Hawks and Dove
  - The Commitment Problem



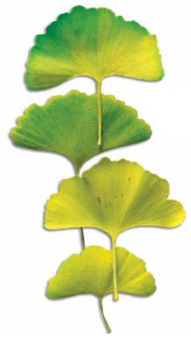
Prisoner's Dilemma

- ***Situation:*** Two prisoners are held in separate cells for a serious crime that they did, in fact, commit. The prosecutor, however, has only enough hard evidence to convict them of a minor offense, for which the penalty is, say, 1 year in jail. Each prisoner is told that if one confesses while the other remains silent, the confessor will go free while the other will spend 20 years in prison. If both confess, they will get an intermediate sentence, say, 5 years. The two prisoners are not allowed to communicate with one another.



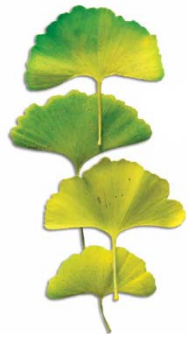
Dominant Strategy

- ***Dominant strategy:*** the strategy in a game that produces better results irrespective of the strategy chosen by one's opponent.



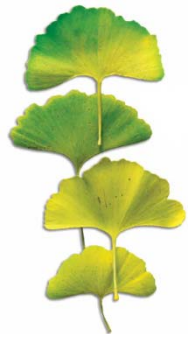
The Nash Equilibrium Concept

- ***Nash equilibrium:*** the combination of strategies in a game such that neither player has any incentive to change strategies given the strategy of his opponent.
  - A Nash equilibrium does not require both players to have a dominant strategy!



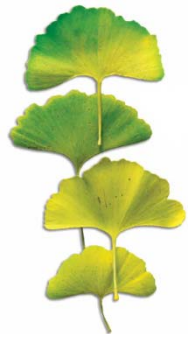
The Maximin Strategy

- ***Maximin strategy:*** choosing the option that makes the lowest payoff one can receive as large as possible.



Tit-for-Tat

- ***Tit-for-tat strategy:*** The first time you interact with someone, you cooperate. In each subsequent interaction you simply do what that person did in the previous interaction. Thus, if your partner defected on your first interaction, you would then defect on your next interaction with her. If she then cooperates, your move next time will be to cooperate as well.
  - Requirement: there not be a known, fixed number of future interactions.



Sequential Games

- ***Sequential game:*** one player moves first, and the other is then able to choose his strategy with full knowledge of the first player's choice.
  - Example - United States and the former Soviet Union (USSR) during much of the cold war.
- *Strategic entry deterrence* – they change potential rivals' expectations about how the firm will respond when its market position is threatened.

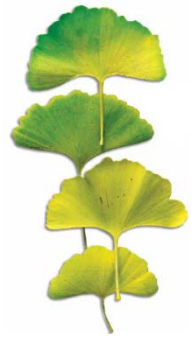


Figure 12.1: Nuclear Deterrence as a Sequential Game

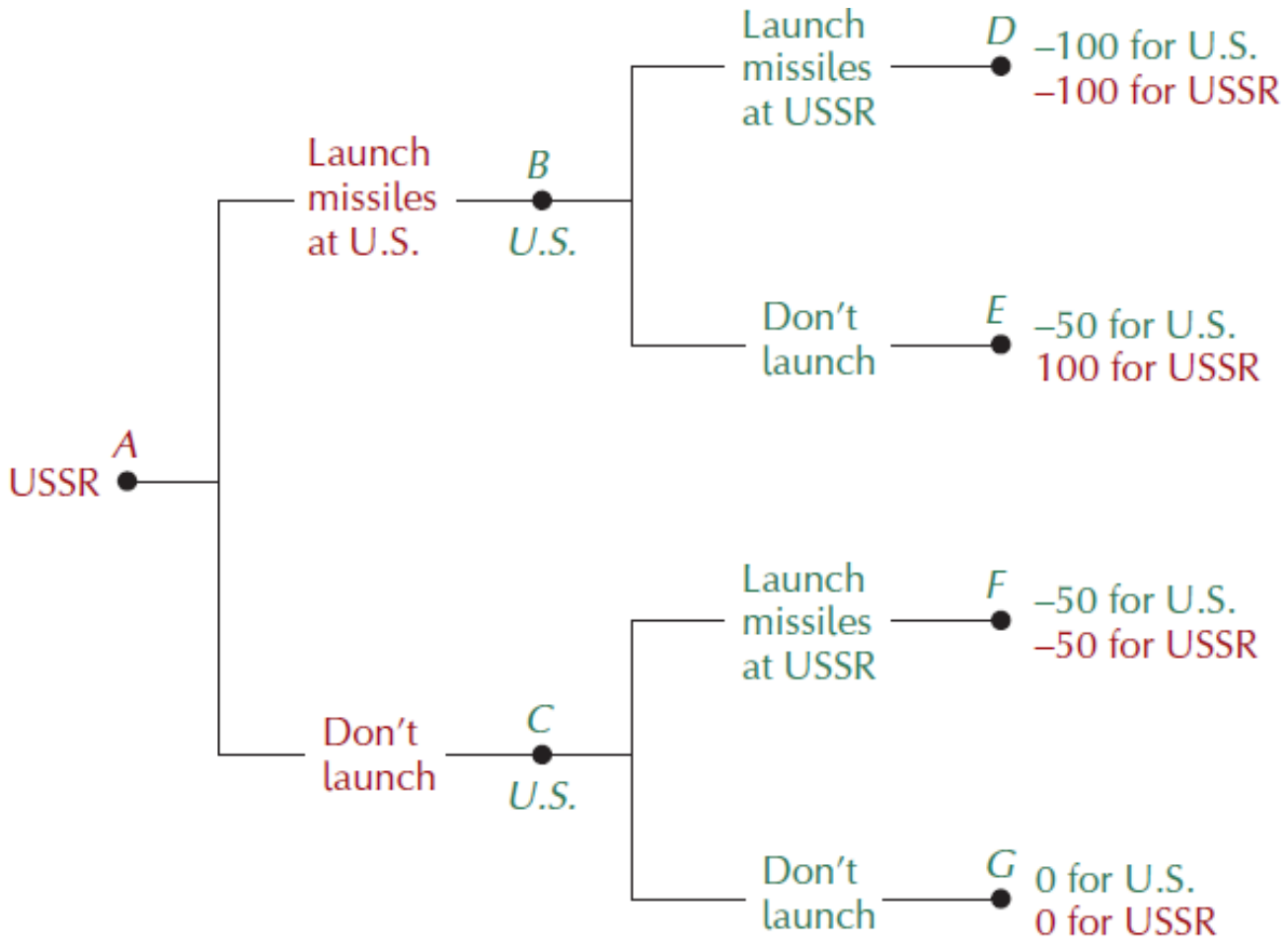


Figure 12.2: The Decision to Build the Tallest Building

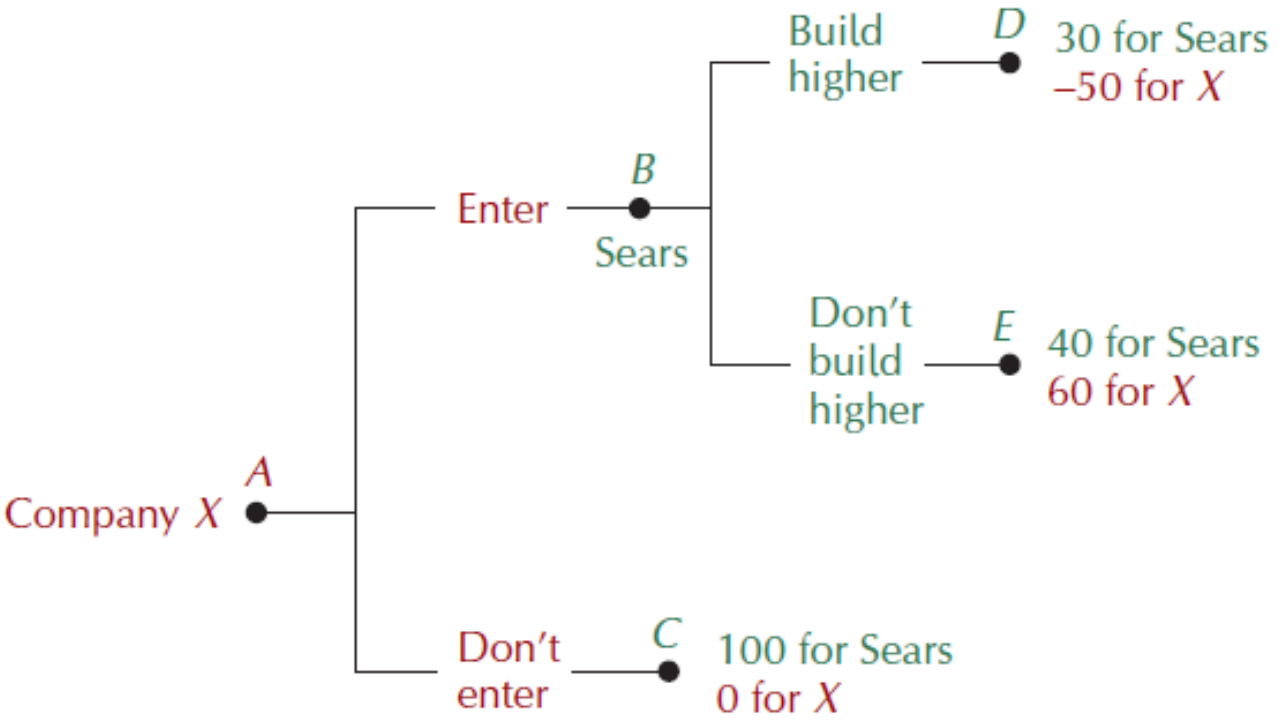
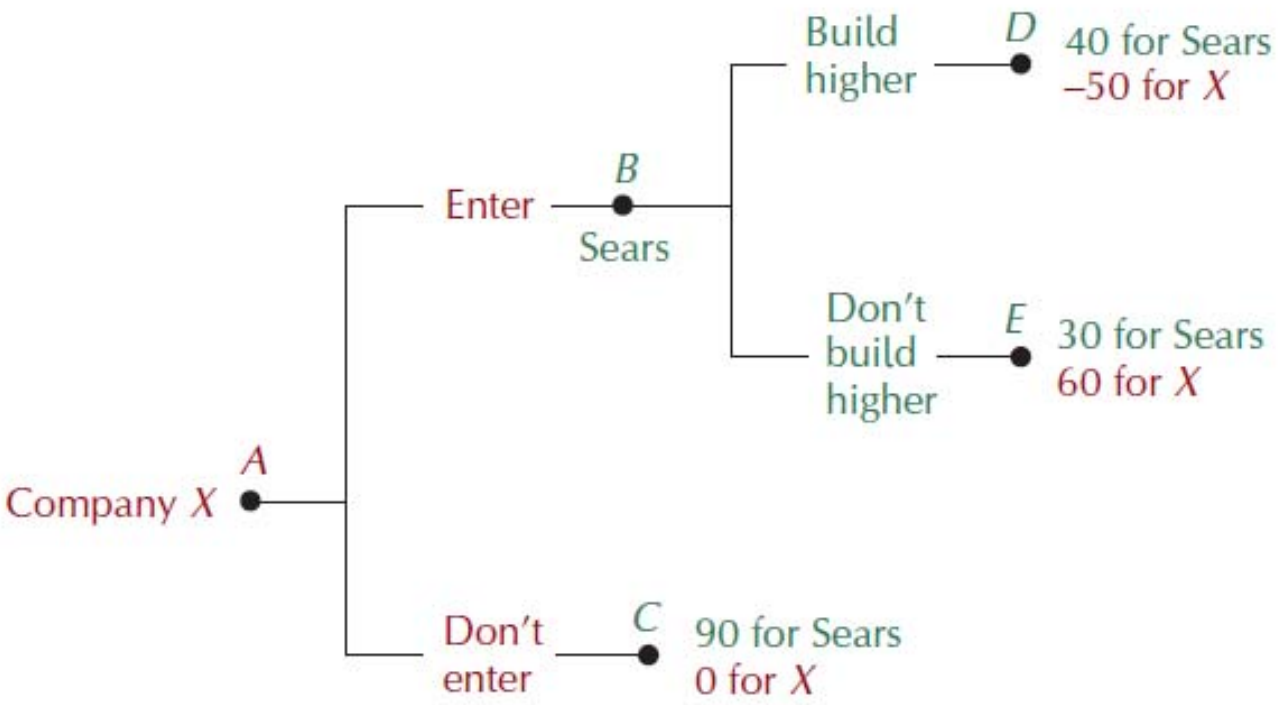


Figure 12.3: Strategic Entry Deterrence



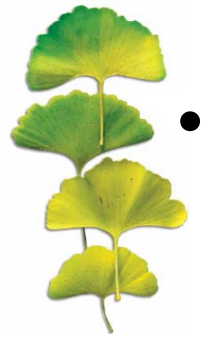
A Parable Of Hawks And Doves

- A population that consists of individuals who are the same except with respect to their taste for aggressive behavior.

- Two types:
  - "hawk" - strong preference for aggressive behavior.
  - "dove" - prefers to avoid aggressive behavior.

- When that individual comes into conflict with another over an important resource each type has different strategies:

  - The hawk's strategy is always to fight for the resource.
  - The dove's strategy is never to fight.



- If these two types compete for the scarce resources required for survival, which type will win out?

A Parable Of Hawks And Doves

- Three possible pairings:
  - (1) two doves
  - (2) two hawks
  - (3) a hawk and a dove.

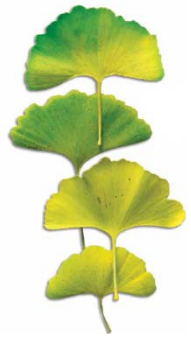
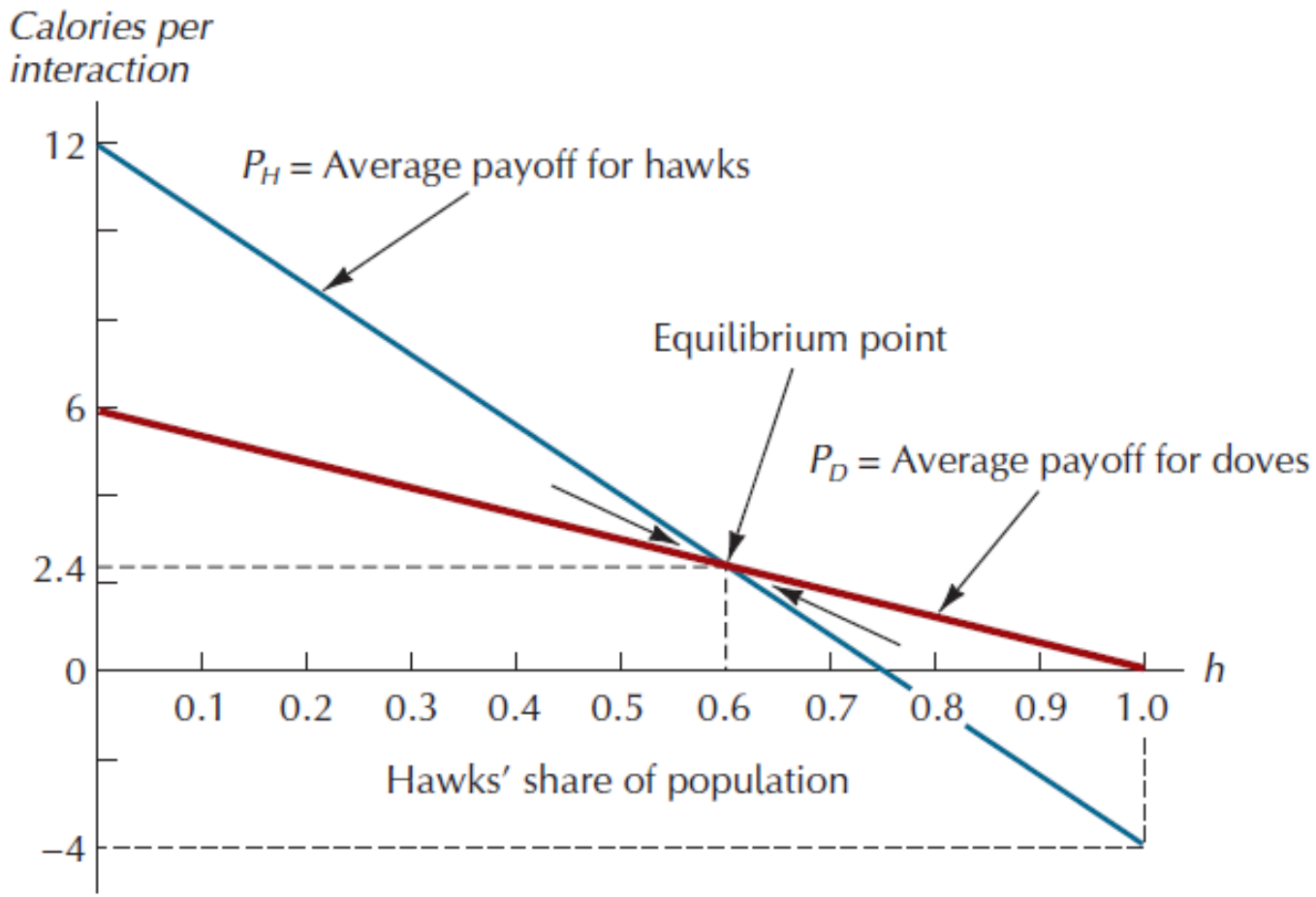


Figure 12.4: Average Payoffs for Hawks and Doves



Commitment Problem

- ***Commitment problems:*** games where the common feature is that people can do better if they can commit themselves to behave in a way that will later be inconsistent with their own material interests.

- ***Commitment device:*** a device that commits a person to behave in a certain way in the future, even though he may wish to behave otherwise when the time comes.

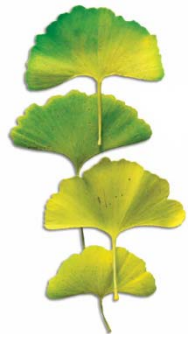
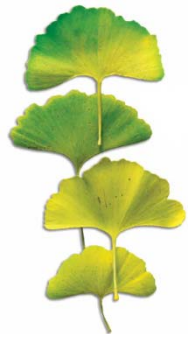


Illustration: The Cheating Problem

- Egoists are pitted against nonegoists in a struggle to survive.
- Commitment problem: in joint business ventures, each of which consists of a pair of individuals.
- In these ventures each person can behave in either of two ways:
  - He can "cooperate," – to deal honestly with his partner
  - He can "defect," - to cheat his partner.



Population Movements When Cooperators And Defectors Look Alike

- Cooperators and defectors look exactly alike.
  - Impossible to distinguish between the two types.

- Because everyone looks the same, they must take their chances.
  - The expected payoffs to both defectors and cooperators therefore depend on the likelihood of pairing with a cooperator, which in turn depends on the proportion of cooperators in the population.

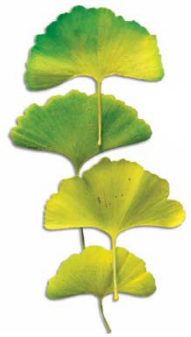
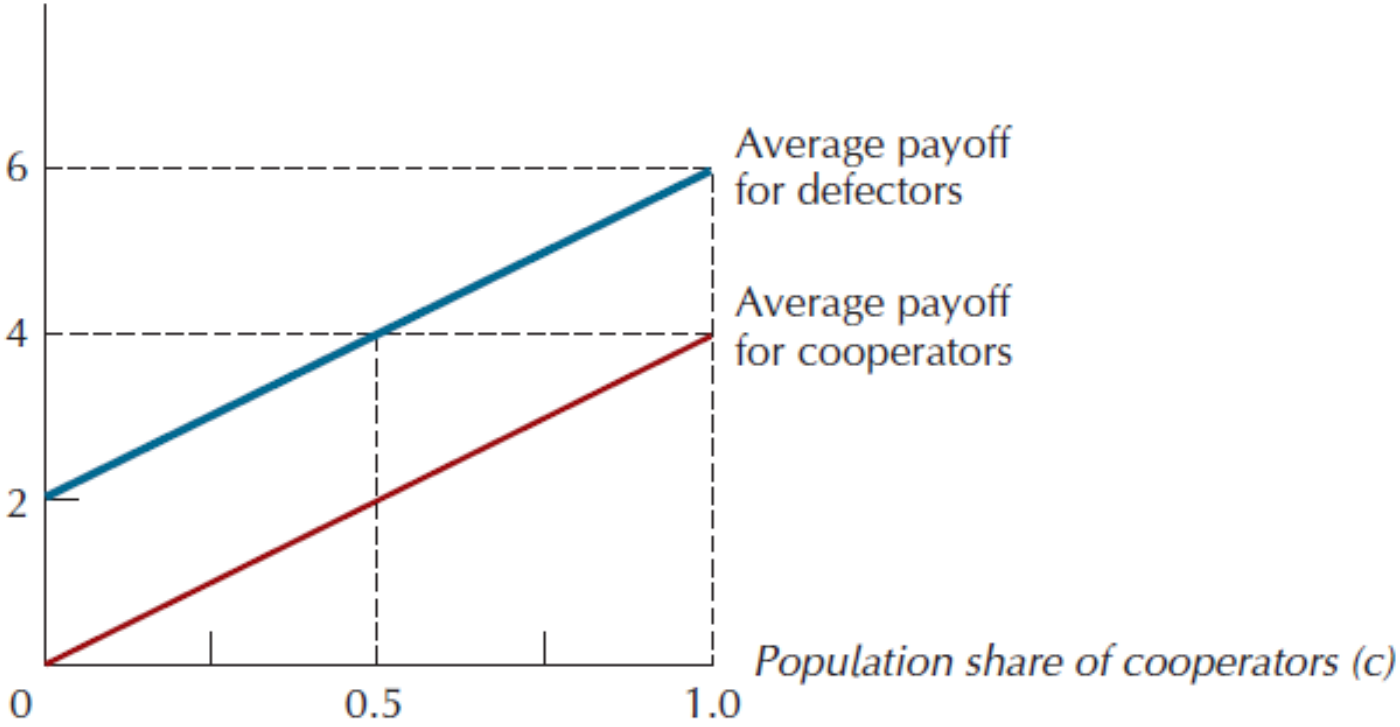


Figure 12.5: Average Payoffs when Cooperators and Defectors Look Alike



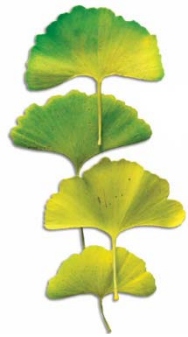
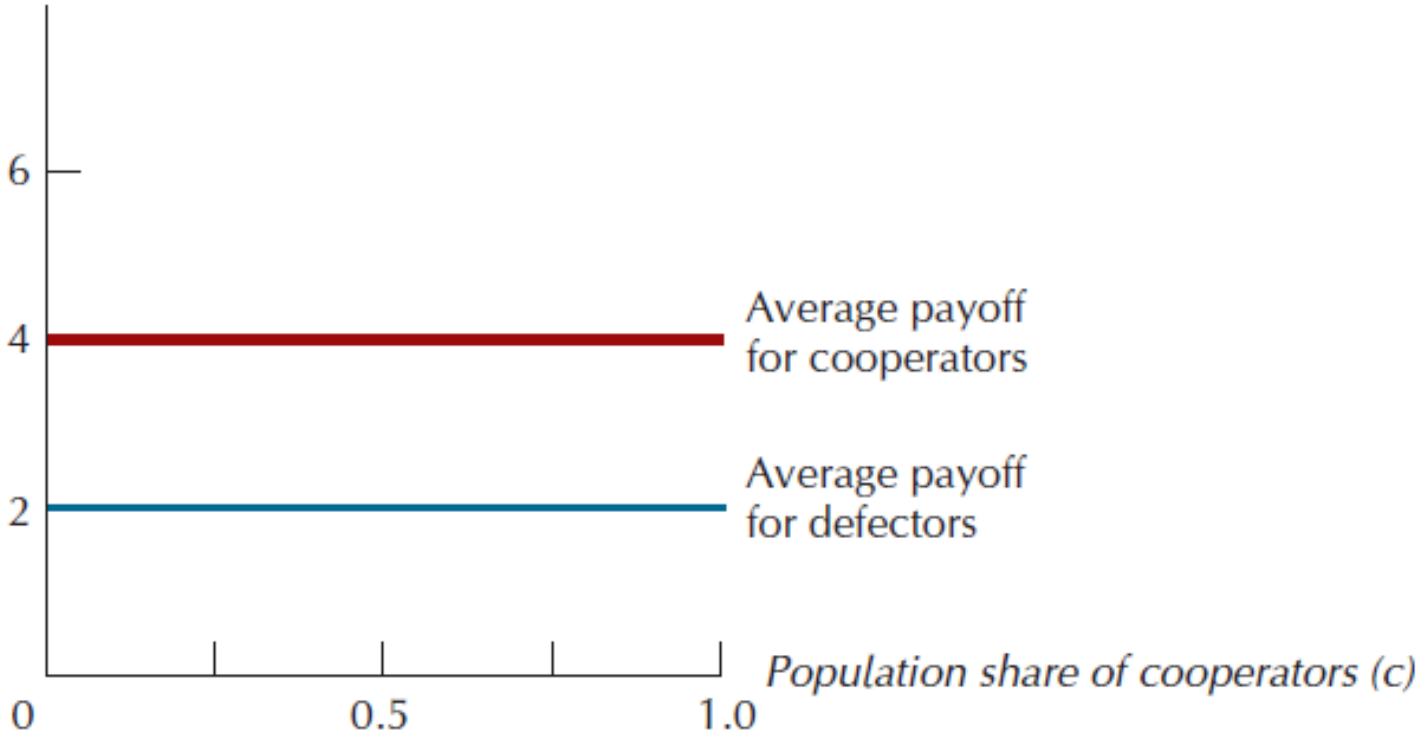


Figure 12.6: Average Payoffs When Cooperators and Defectors are Perfectly Distinguishable



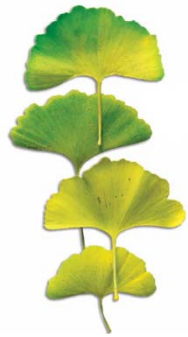
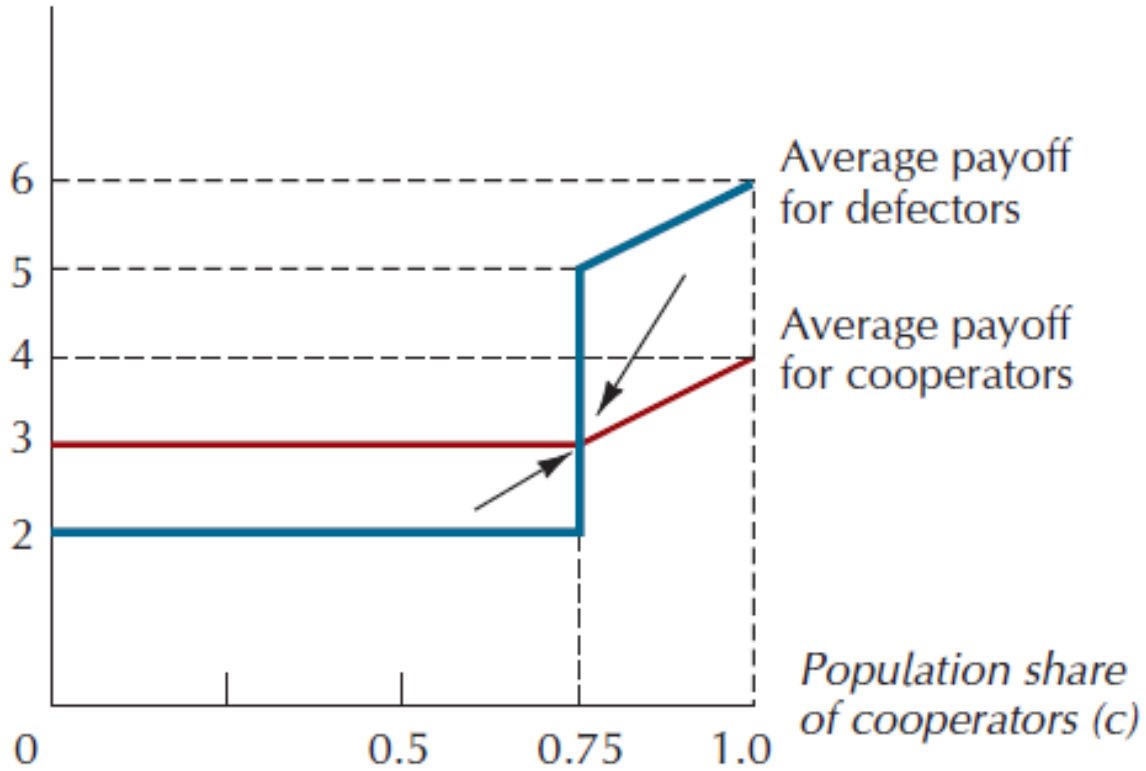


Figure 12.7: Average Payoffs with Costs of Vigilance



A Parable Of Hawks And Doves

- Conclusion from Parable:
  - Usefulness of a preference for a certain mode of behavior depends on the frequency with which others in the population also prefer that behavior.
  - Traits are often favored for their effects on *individual* payoffs, not for their effects on the payoffs of populations as a whole.