

Week 13 – Animal contests

I. Standard non-signaling model

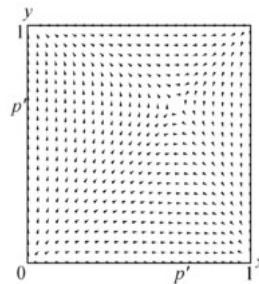
1. Suppose two individuals come upon a resource of value  $V$
2. Each can simultaneously choose to either fight or not
3. The cost to a conflict is  $C$

	Hawk	Dove
Hawk	$(V/2 - C, V/2 - C)$	$(V, 0)$
Dove	$(0, V)$	$(V/2, V/2)$

4. If  $V/2 < C$ , then this is a game of chicken with a mixed strategy Nash equilibrium
5. The phase portrait is:



6. Now suppose that there is some asymmetry in the world (outside of the control of the individuals) that individuals could correlate their strategy to.



7. What about signaling?
  1. Kim has a model of signaling. Suppose two signals,  $a$  and  $b$ .
  2. We simultaneously signal to each other and if we signal different signals, one does Hawk the other Dove.
  3. If the signals match we play the mixed equilibrium
  4. To prevent me from signaling Hawk, that signal must come with a cost
  5. This is a bit odd... Hurd's point on 665
    1. But perhaps 3 signals?
  6. One of Hurd's criticisms of this model
    1. Other asymmetries are better
8. What if  $V/2 > C$ ?
  1. Now the resource is worth fighting over and both will fight for it
  2. Signaling does nothing
9. Assumptions of this model that might be relaxed:
  1. No asymmetries

2. Fighting ability is equal
  1. The probability of winning a contest is  $\frac{1}{2}$
  2. The cost to fighting is the same for both individuals
3. Resource value ( $V$ ) is equal
4. Aggressiveness is a choice that cannot be recommitted
  1. One cannot rip the steering wheel off

II. Relaxing equal ability assumption – Hurd and Enquist

1. Suppose row is a better fighter, and so will win the resource if there is a fight

	Hawk	Dove
Hawk	$(V-C, -C)$	$(V, 0)$
Dove	$(0, V)$	$(V/2, V/2)$

2. Now  $\langle$ Hawk, Dove $\rangle$  is a Nash. If  $V > C$ , then it's unique.
3. What if there is a population of individuals who are good and bad fighters and there is imperfect information?
  1. Suppose first that the difference is just in who wins:

	Hawk, Hawk	Hawk, Dove	Dove, Hawk	Dove, Dove
Hawk, Hawk	$V/2 - C$	$5V/8 - C/2$	$7V/8 - C/2$	$V$
Hawk, Dove	$3V/8 - C/2$	$V/2 - C/4$	$5V/8 - C/4$	$3V/4$
Dove, Hawk	$V/8 - C/2$	$3V/8 - C/4$	$V/2 - C/4$	$3V/4$
Dove, Dove	$0$	$V/4$	$V/4$	$V/2$

2. The conditional  $\langle$ Hawk, Dove $\rangle$ ,  $\langle$ Hawk, Dove $\rangle$  is Nash for  $C > V/2$  versions of the game
  1. This is when I would rather split than fight
  2. Otherwise  $\langle$ Hawk, Hawk $\rangle$  is dominant
4. Hurd and Enquist generalize this game
  1. They add an additional strategy “Wait then fight”
  2. They make the costs different for different abilities
    1.  $C(\text{weak, strong}) > C(\text{weak, weak}) = C(\text{strong, strong}) > C(\text{strong, weak}) > 0$
  3. There is a cost for being attacked, even when one gives up
    1.  $E(\text{weak, strong}) > E(\text{weak, weak}) = E(\text{strong, strong}) > E(\text{strong, weak}) > 0$
    2.  $E(a) < C(a)$
  4. The cost to waiting when the other fights is  $D$
  5. When individuals are of equal ability it is worth fighting  $V > C(\text{strong, strong})$

6. In the case of perfect information the ESS is:
  1. Attack when equal
  2. Given up when weaker
  3. Pause attack when stronger
7. If private information, depending on parameter values,
  1. Attack always
  2. Attack if strong, Give up if weak
  3. Pause attack if strong, Give up if weak
8. What about with communication?
  1. One sided communication
    1. Let one signal to the other and then learn the other's type
      1. Separating is an ESS when
        1.  $E(\text{weak, strong}) > \frac{1}{2} V + C(\text{strong, strong})$
        2.  $0 > -C(\text{strong, weak}) + D$
      2. What if I learn your type before signaling?
        1. Then I want to signal the opposite of your type, and signaling is destroyed
      3. What if I never learn your type?
        1. No signaling, same as before
9. Points
  1. "Costs" may be exogenous to the signal (part of the cost of engaging in fights one will probably lose)
  2. Temporal structure of signaling matters very much
  3. Fighting is significantly reduced
5. Other things worth signaling:
  1. Subjective resource value

### III. Explaining deception

1. Mixed ESS
2. Anderson and Mesterson-Gibbons model
  1. Recall the Graffen models from weeks past (pg 12, 14)
  2. Example graphs on page 139
  3. The benefit is increasing as I get worse, but so are the costs
  4. With the right sorts of curves one can get a situation where the best and worst want to signal.
3. Like the other circumstances, this partial pooling equilibrium can be stable

### IV. Empirical examples

1. A serious problem measuring what is being signaled, since fights are rare.
2. How does one measure, RHP or Subjective resource value?
3. Birds postural displays
  1. What is being signaled?
    1. Display carries information about what the bird's next move is
    2. Display + receiver response does carry information about bird's next move
    3. Both of these are signaling aggressiveness, but it might be signaling something else behind that
      1. Recall Hurd's point and Enquist and Hurd's model

2. Costs?
  1. Retaliation costs are likely (ala Enquist)
  2. Not much evidence
4. Badges of Status
  1. What is being signaled?
    1. Position in the dominance hierarchy
    2. Correlated with body size, age, and sex (fighting ability?)
  2. What maintains honest?
    1. Retaliation costs, ala Enquist?
      1. Not good evidence
    2. Production costs?
      1. Testosterone hurts the immune system – not good evidence
    3. Predation?
      1. Not much evidence
    4. Arbitrary ordering to avoid fights?
      1. Hard to imagine
5. Weapon displays
  1. What is being signaled?
    1. The weapon!
  2. Honesty is mostly maintained by it being an index
  3. Interesting case of deception, however
    1. A confirmation of Anderson and Mesterton-Gibbons
6. Frequency of calls
  1. What is being signaled?
    1. Body size <-> fighting ability
  2. Honesty
    1. Maybe an index
    2. Lying is costly because it's harder to attract mates
  3. Interesting case of two different signals sharing a mechanism
    1. Regular calls indicate body size
    2. Lowered calls indicate aggression.