Simulating Language
Lecture 3: Evolving innate signalling systems

Simon Kirby

simon@ling.ed.ac.uk

Recap on signalling and communication

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- Treat signalling system as a mapping between a fixed set of *meanings* and a fixed set of *signals*
- Modelled as (innately-determined) matrices of weighted associations
- Different matrices give different production and reception behaviours
- Communicative accuracy for a speaker and hearer can be defined as the proportion of utterances where hearer converges on same meaning as speaker

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- But can we be sure this is right?
- We need to model it...
- ...but first, some basic theory

Evolution by natural selection: preconditions

- Favourable heritable traits become more common over time, due to differential reproduction
- Three conditions:
  - Variation
  - Heredity
  - Selection

Variation

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- different bodies
- different properties
- different abilities
- different phenotypes

Heredity

- These traits are passed on from parent to offspring

Selection

- Not all traits are equal
- Some traits improve your chances of passing those traits on, some don't
- Differential reproduction
  - "The difference that makes a difference"

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    - Relatively good at finding food, avoiding predators, attracting mate(s), rearing young, communicating, ...
- This is adaptation
    - "'design' in life - those properties of living things that enable them to survive and reproduce in nature." (Ridley, 1996, p. 5)

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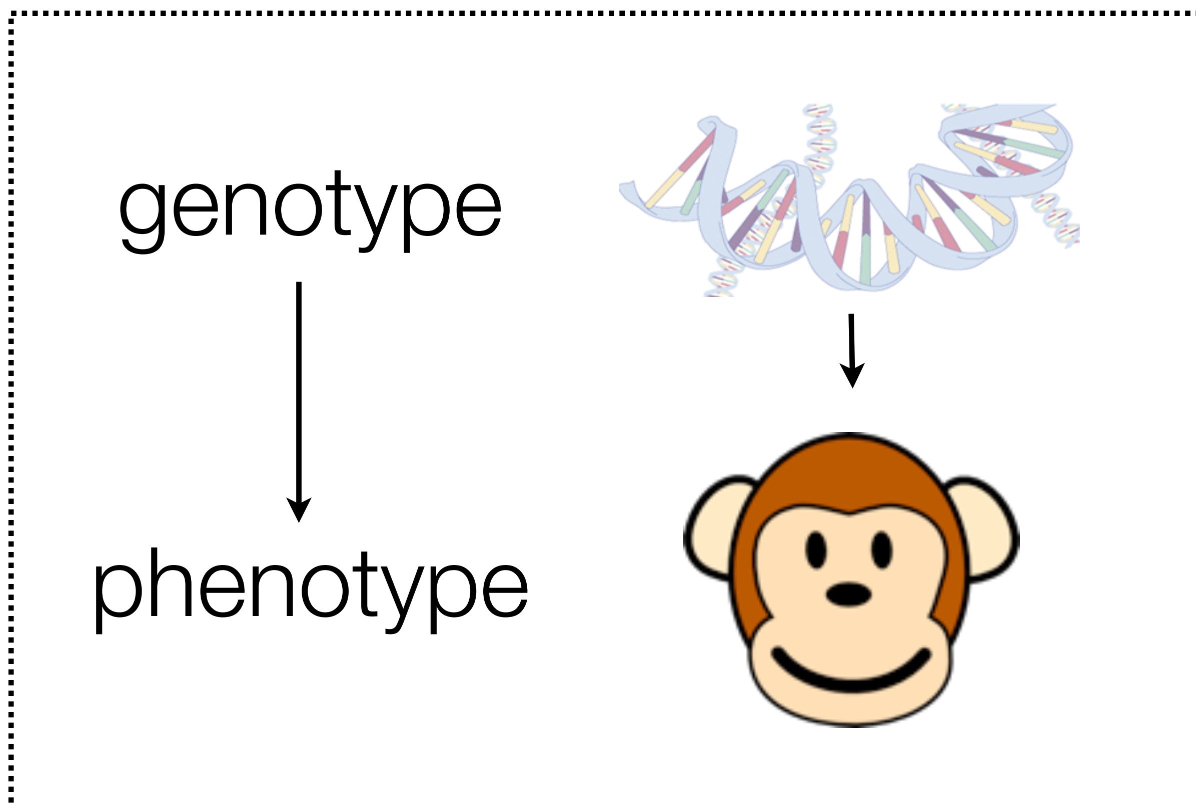

Modelling evolution

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- Key ingredients:

1. A population of organisms
2. A task they are trying to succeed at
3. A measure of how *fit* they are at this task
4. A way of selecting the fittest
5. A way of allowing the genes of the fittest to survive
6. A mechanism for introducing variation into the gene pool

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  6. Replace old population with new one
  7. Repeat steps 2 to 6 many times

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- Key considerations:

  How do you pick communicative partners?
  Who gets rewarded for successful communication?

- Find out answers in the labs on Monday and Thursday (and in the reading - Oliphant, 1996)

Readings

- Oliphant, M. (1996) The dilemma of Saussurean communication. *Biosystems*, 37:31-38

- Mitchell, M. (1998) An introduction to genetic algorithms. pp. 1-16.