COGS300

Cultural evolution

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The Burke and Wills expedition

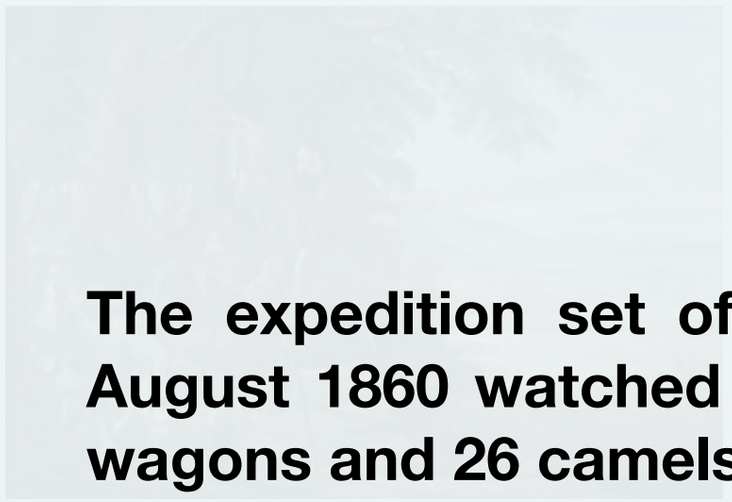
9 February 1861

21 April 1861

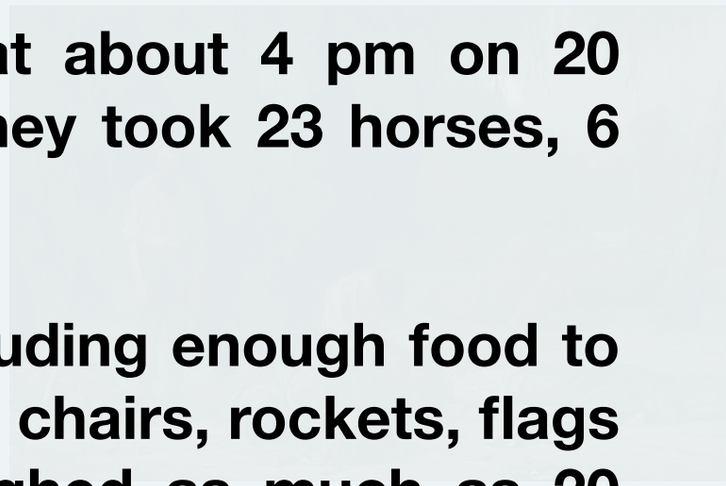
20 August 1860

28 June 1861

The Burke and Wills expedition



The expedition set off from Royal Park, Melbourne at about 4 pm on 20 August 1860 watched by around 15,000 spectators. They took 23 horses, 6 wagons and 26 camels.



The expedition took a large amount of equipment, including enough food to last two years, a cedar-topped oak camp table with two chairs, rockets, flags and a Chinese gong; the equipment all together weighed as much as 20 tonnes.

https://en.wikipedia.org/wiki/Burke_and_Wills_expedition

The Burke and Wills expedition

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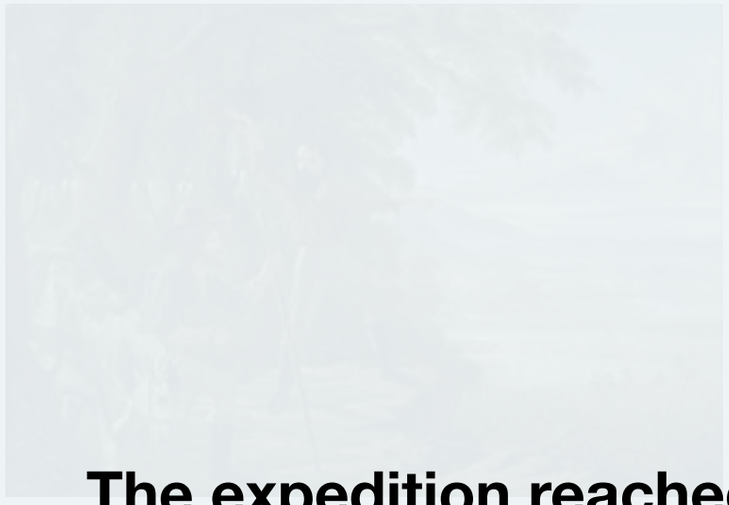

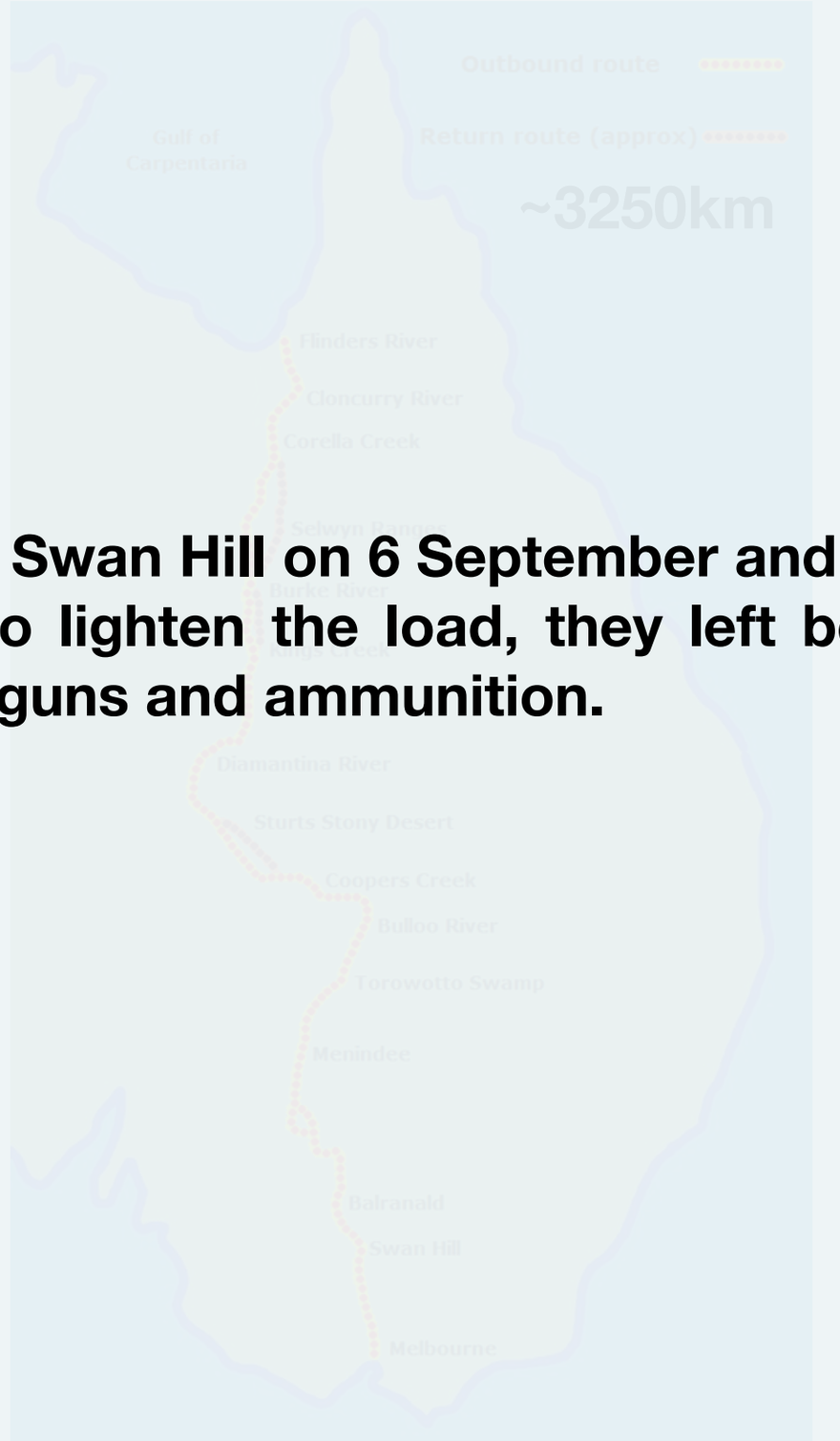

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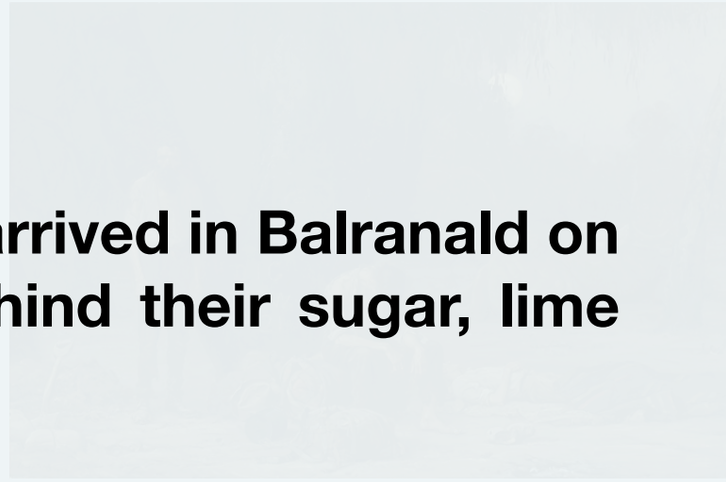

The expedition reached Swan Hill on 6 September and arrived in Balranald on 15 September. There, to lighten the load, they left behind their sugar, lime juice and some of their guns and ammunition.

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The Burke and Wills expedition

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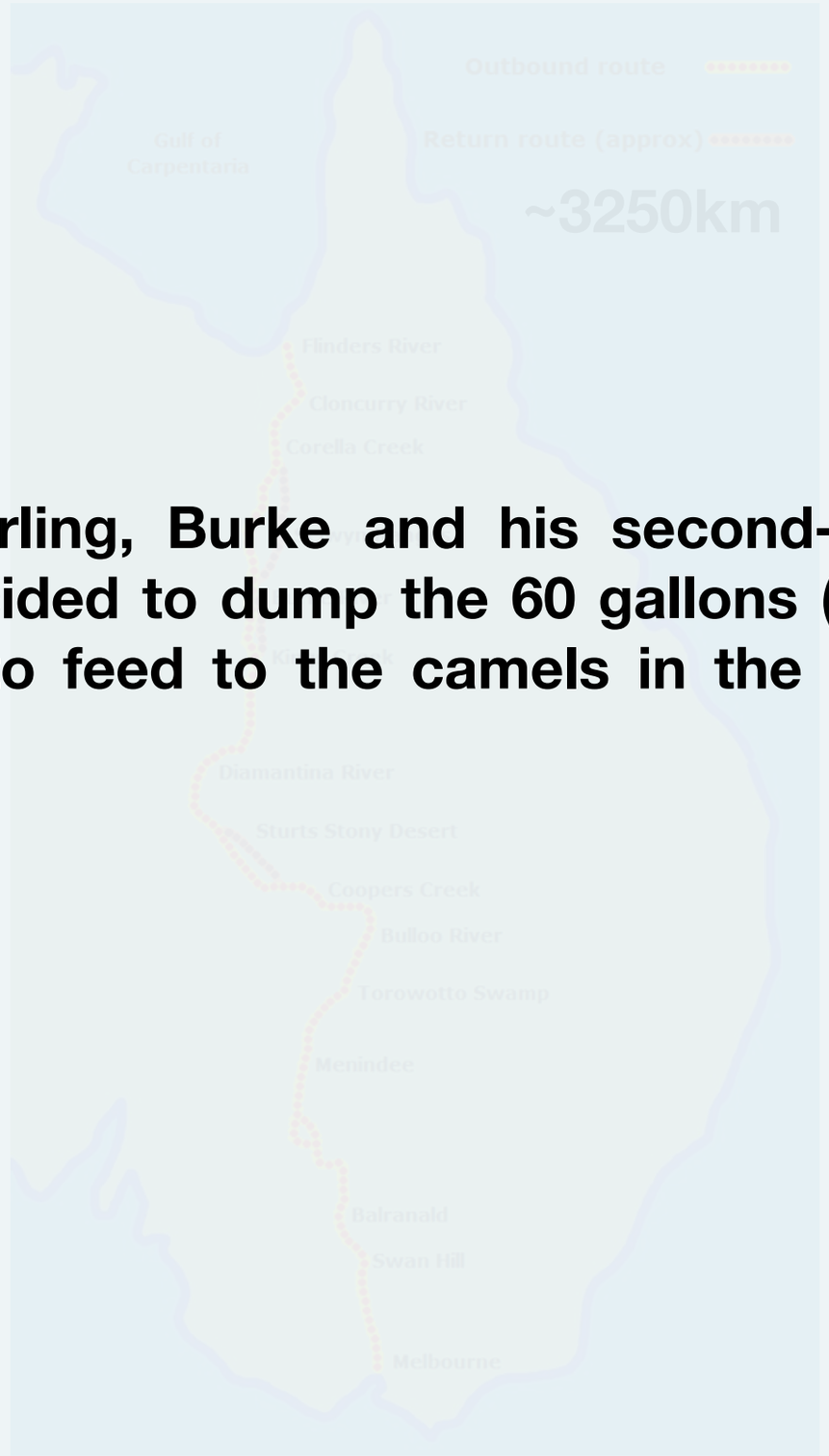

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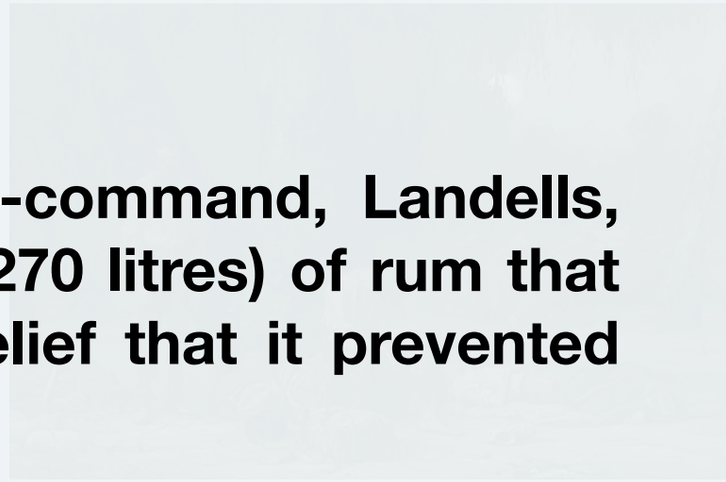

At Bilbarka on the Darling, Burke and his second-in-command, Landells, argued after Burke decided to dump the 60 gallons (≈270 litres) of rum that Landells had brought to feed to the camels in the belief that it prevented scurvy.

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The Burke and Wills expedition

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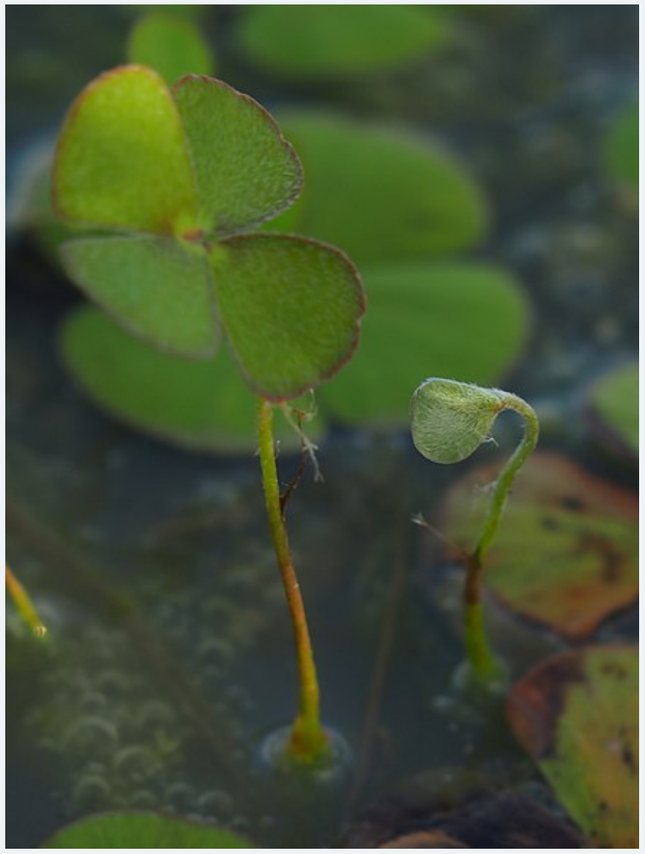

damper / bush bread

incorrectly prepared: high in thiaminase
-> vitamin B1 deficiency, also known as beriberi

Cultural evolution

- **individual learning**: learning without reliance on other individuals (e.g. trial and error, scientific discovery)
- **social learning**: learning that involves some form of reliance on others who already possess a given piece of knowledge (e.g. imitation, explicit instruction)

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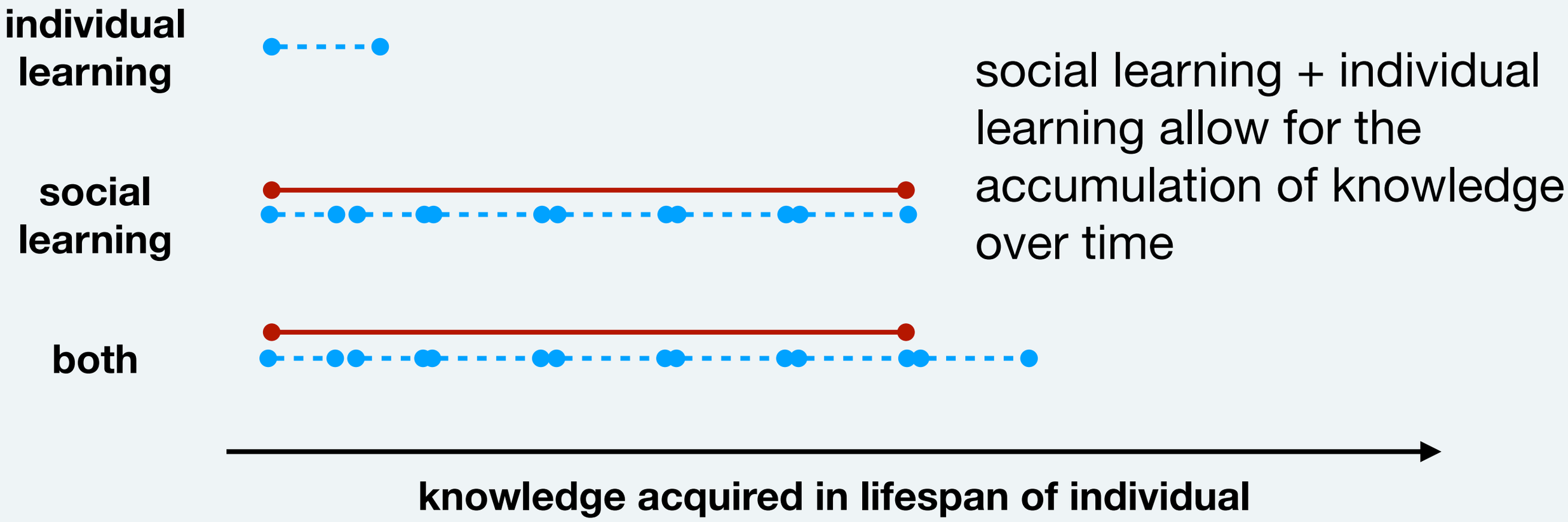


Cultural evolution

- both individual learning and social learning are biologically costly
  - big & well-developed brains (instead of e.g. muscles)
  - time spent learning / doing R&D (instead of gathering food)
  - prosociality (instead of e.g. eating all the food)
- how is social learning adaptive, then?

Cultural evolution

environment / adaptation

biological adaptation sufficient

time (generations)

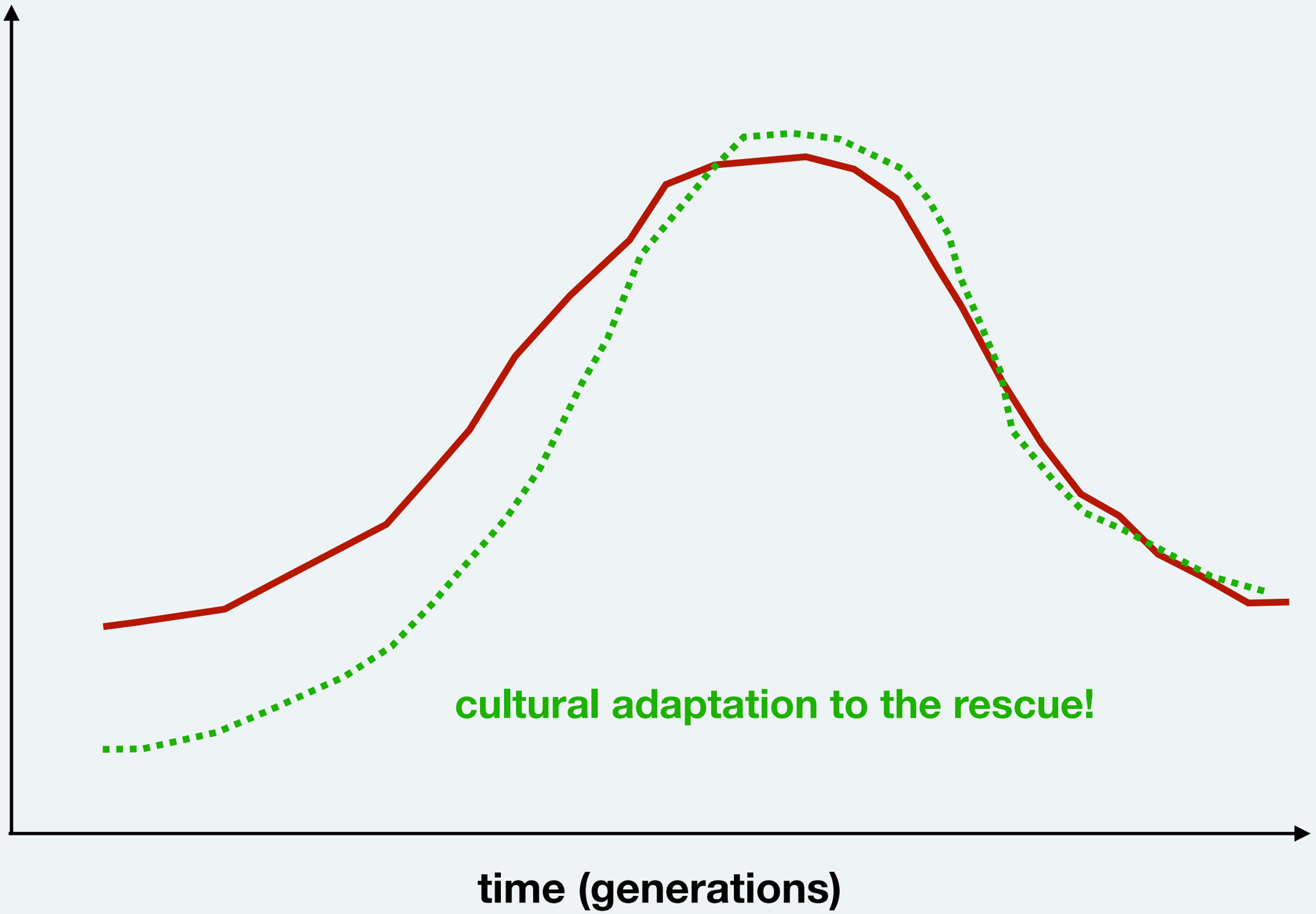
Cultural evolution

environment / adaptation

biological adaptation too slow

time (generations)

Cultural evolution



Cultural evolution

environment / adaptation

no adaptation possible :(

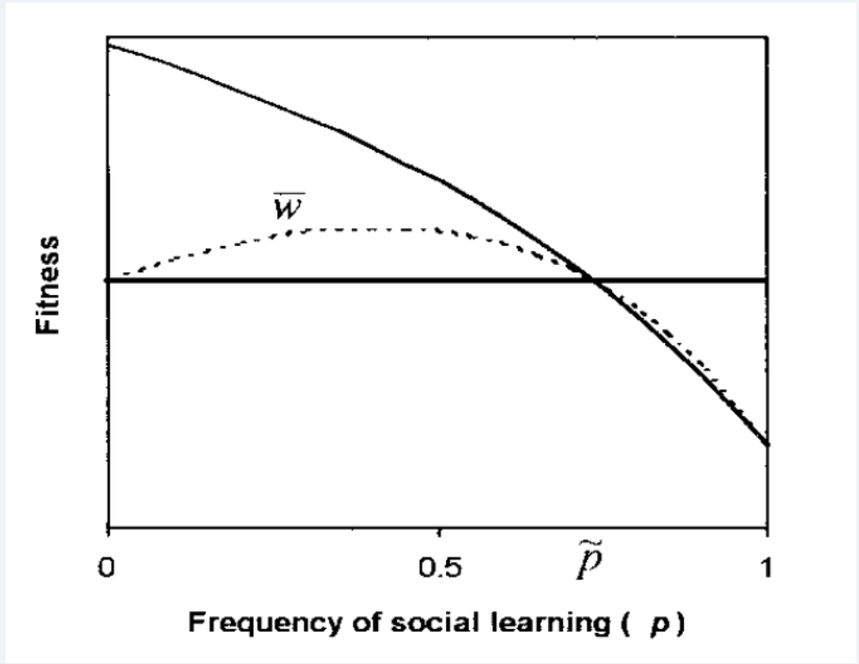
time (generations)

Cultural evolution

- one suggestion:
  - brain size relative to body size correlates positively with social learning & individual learning across species
  - increases in brain size relative to body size in several mammalian lineages over last 14 million years
  - also: increases in environmental variability (= climate in this case) over same period
- (but: correlation does not equal causation…)

Cultural evolution

- a (now discounted) theory of the adaptive advantage of social learning:
  - individual learning / discovery is potentially very costly (e.g. discovering what mushroom species are edible…)
  - social learning less costly (as the price has already been paid by others)



in a variable environment, the fitness advantage conferred by social learning decreases as the number of individual learners falls

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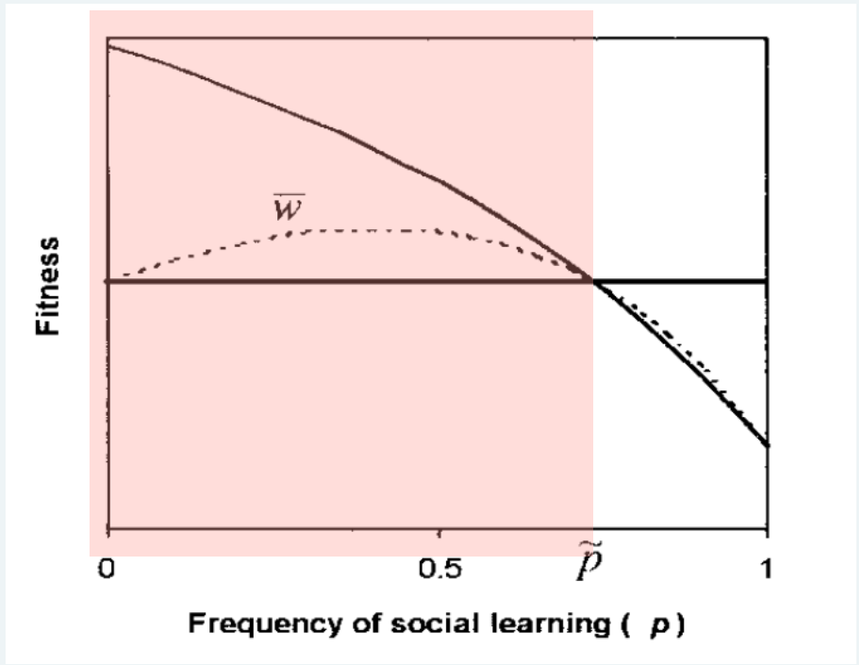

social learning -> higher fitness

number of social learners increases

Cultural evolution

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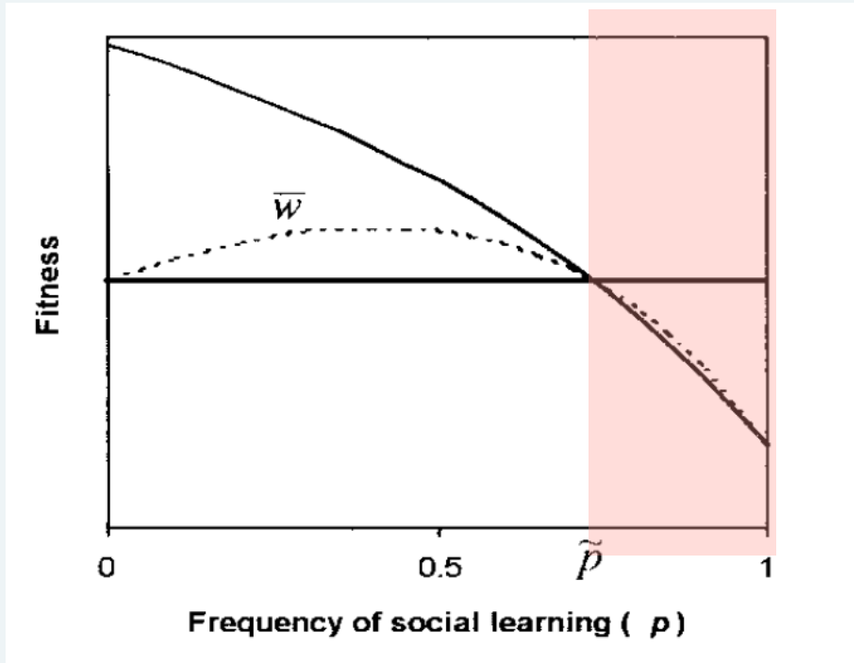

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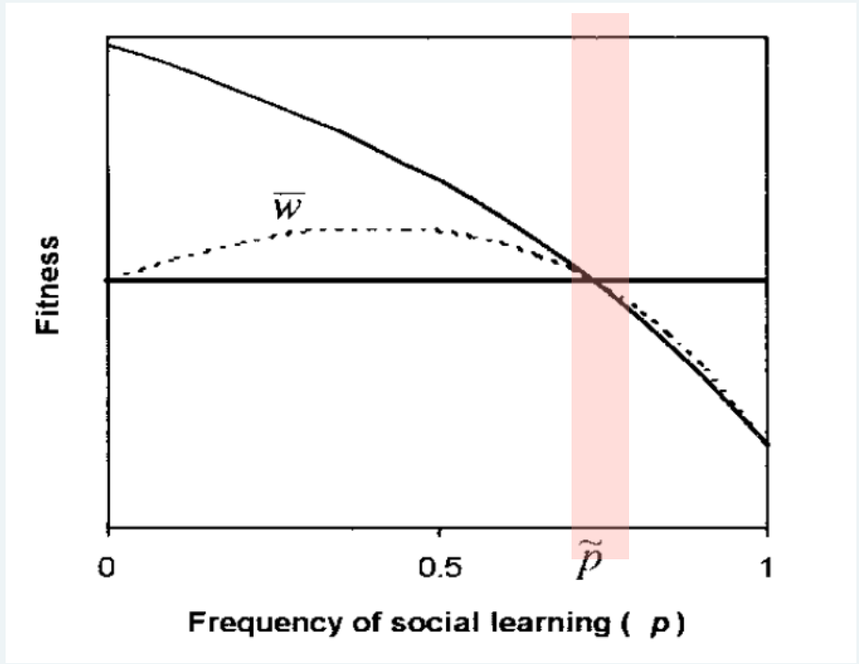
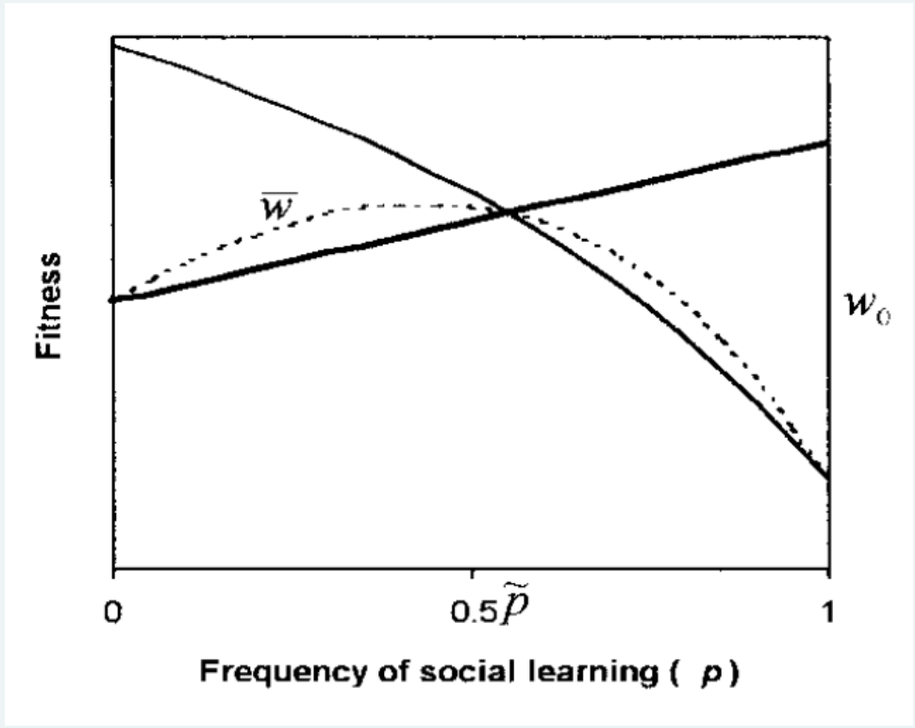


equilibrium: no population-level adaptive advantage compared to individual learning :(

Cultural evolution

- social learning can only increase the average fitness of a population if it “allows the accumulation of behaviours that no individual learner could acquire in its lifetime”
- i.e. social learning is only beneficial if has a mutually reinforcing relationship with individual learning



Cultural evolution

- why is cultural evolution (mostly) unique to humans?
  - “true” imitation…

    https://www.youtube.com/watch?v=JwwclyVYTkk

Cultural evolution

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  - “true” imitation…

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  - **scenario 1**: modest degree of social learning
    individuals hang around others who have discovered e.g. a new means to extract food (e.g. cracking nuts); more likely to rediscover the same adaptive behaviour
  - **scenario 2**: true imitation
    individuals learn directly from other individuals, and can build atop their innovations (e.g. devise a more efficient method for cracking nuts)

Cultural evolution

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  - Theory of Mind

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Cultural evolution

- why is cultural evolution (mostly) unique to humans?
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  - symbolic communication

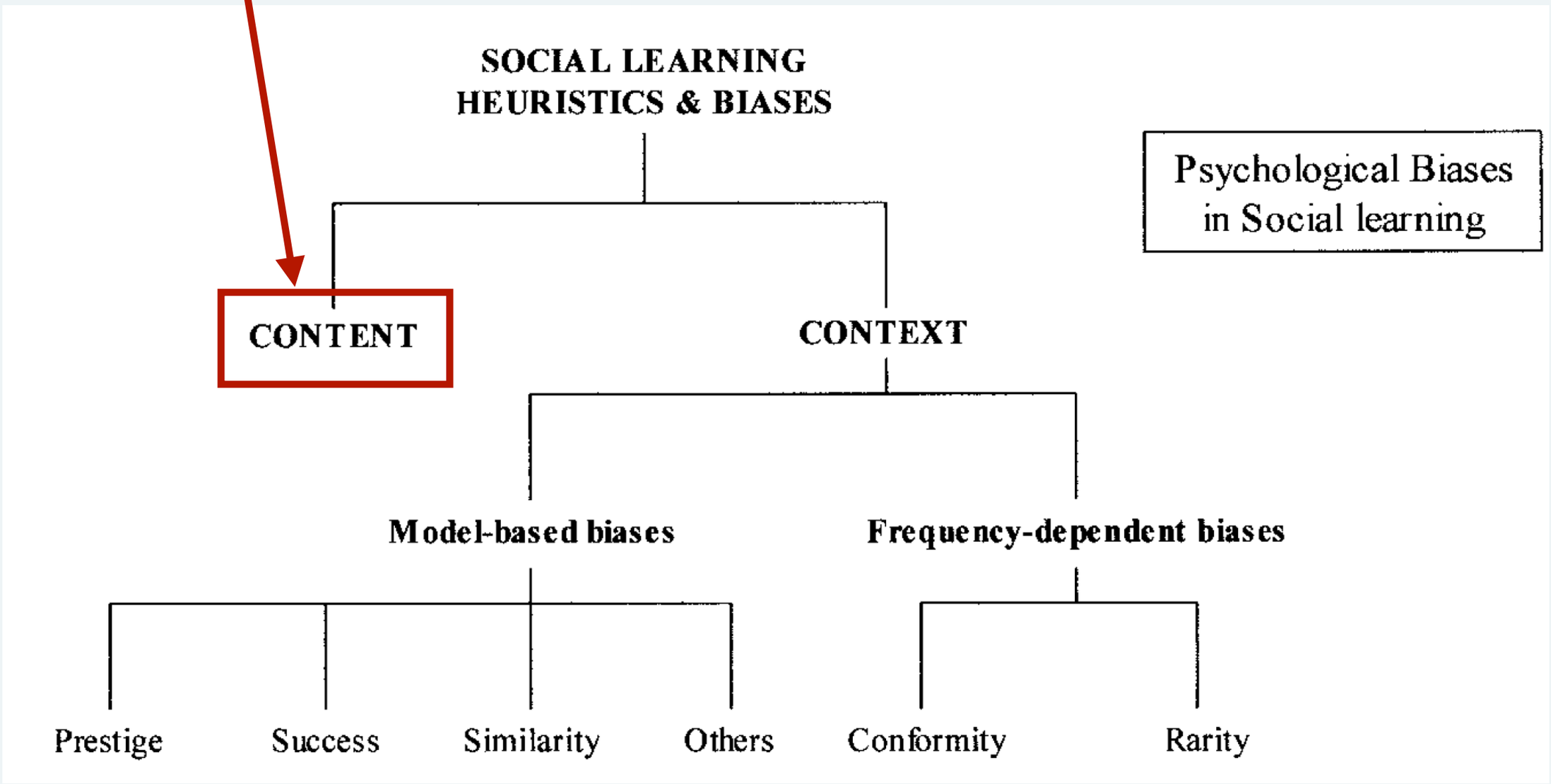
    “The vacuum of space will kill you in a matter of minutes.”
- … costly cognitive capacities!

Cultural evolution

- what kind of cognitive mechanisms can guide cultural evolution?
  - the “costly information hypothesis”:
    - when maximally accurate information is costly to acquire, evolution favours the extraction of (potentially less accurate) information from other members of the group through various heuristics / biases
  - content vs. context biases

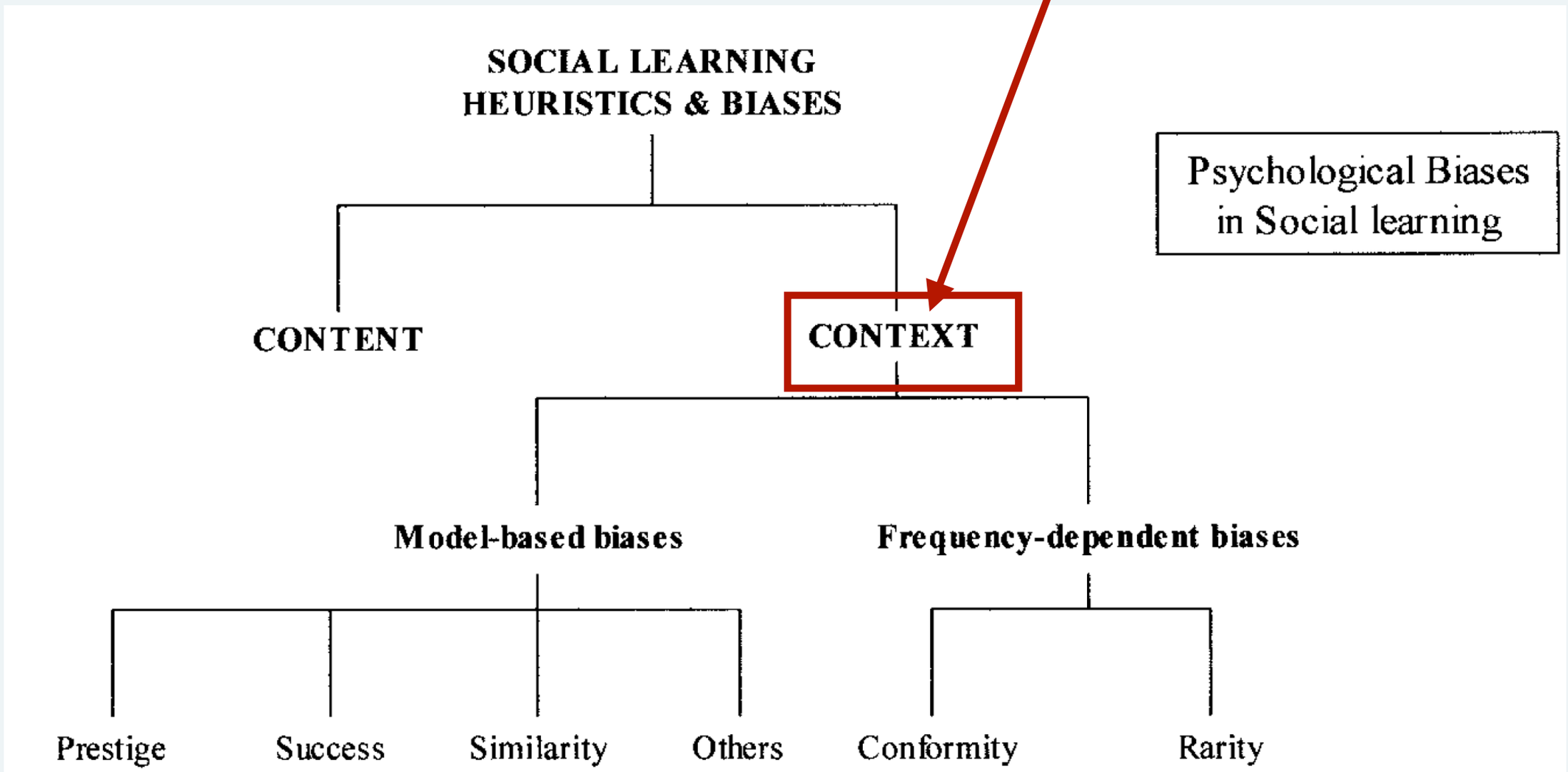
Cultural evolution

WHAT WE LEARN
e.g. innate linguistic abilities



Cultural evolution

HOW WE LEARN
e.g. who should I learn from?



Cultural evolution

- prestige & success biases
  - variation in how successful individuals are in a group, some of it conditioned by culturally learnable behaviours
  - makes sense to learn from more successful individuals!
  - ability to rank individuals in terms of success also observed in other species
  - but not the ability to selectively learn from successful individuals

Cultural evolution

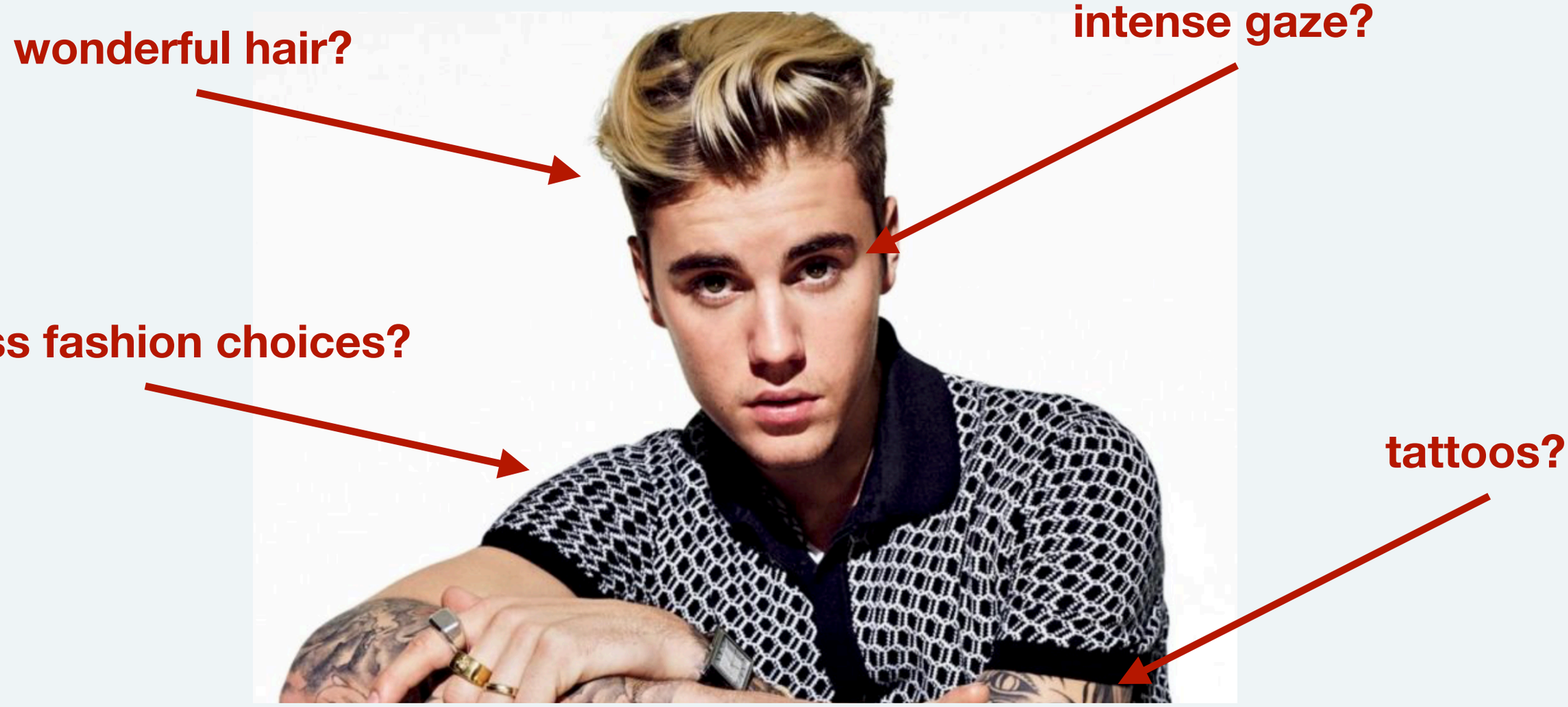
- prestige & success biases: challenges
  - teasing apart random variation (noise) vs. true success

one hit wonders Justin Bieber

- strategies:
  - learning from multiple individuals, probability of learning proportional to success
  - aggregate over different instances of success: e.g. track wealth, health, etc.

Cultural evolution

- prestige & success biases: challenges
  - what makes Justin Bieber so successful?



Cultural evolution

- prestige & success biases: challenges
  - what makes Justin Bieber so successful?

Cultural evolution

Can you think of examples where an individual is successful due to some specific trait, but other individuals copy multiple aspects of their behaviour?

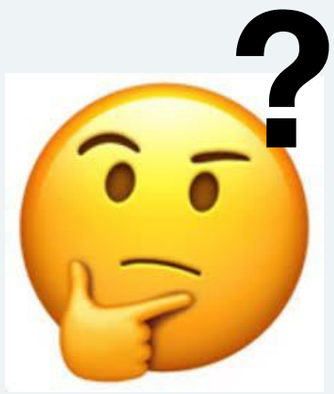
Cultural evolution

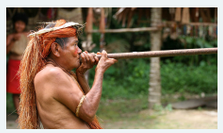
- prestige & success biases:
  - success-based copying may lead to prestige hierarchies
  - access to successful individuals is limited
  - learners can maximise likelihood of access by paying deference to successful individuals
  - cultural evolution of overt displays of prestige hierarchies
  - newcomers can make use of such cues in trying to determine who to learn from

Cultural evolution

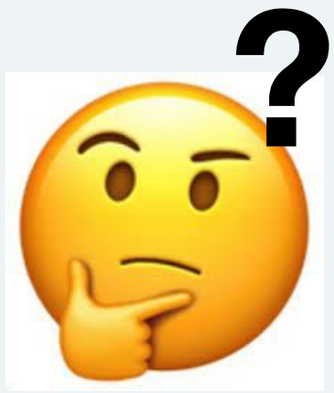
- conformity biases:
  - information about success may be difficult to obtain
  - some strategies may only be marginally better than others
    - e.g. 60% chance of figuring out that blowgun is slightly more efficient than bow & arrow using individual learning

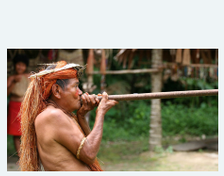
Cultural evolution





Cultural evolution





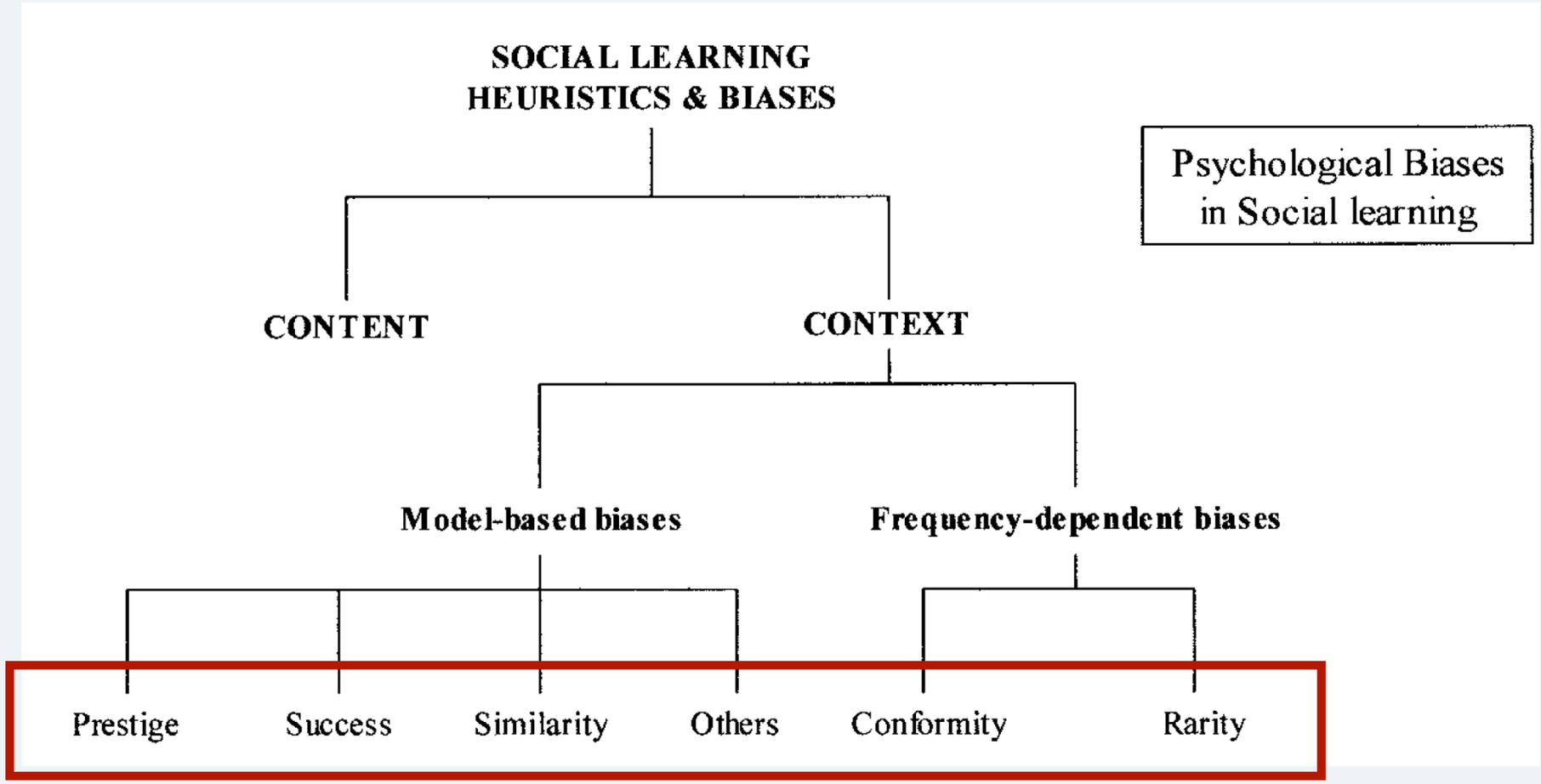
Cultural evolution

conforming to the majority in such a situation will lead to choosing the adaptively more advantageous pattern with a probability > 60%

Cultural evolution

- conformity biases: challenges
  - if all learning is based on conformity, there won't be any innovation
  - best strategy: a mix of conformist learning, other forms of transmission (e.g. parent-offspring) and individual learning

Cultural evolution



Can you think of examples where social learning biases backfire, leading to adaptively negative behaviours / societal issues?