The Baldwin effect in the evolutionary naming game model

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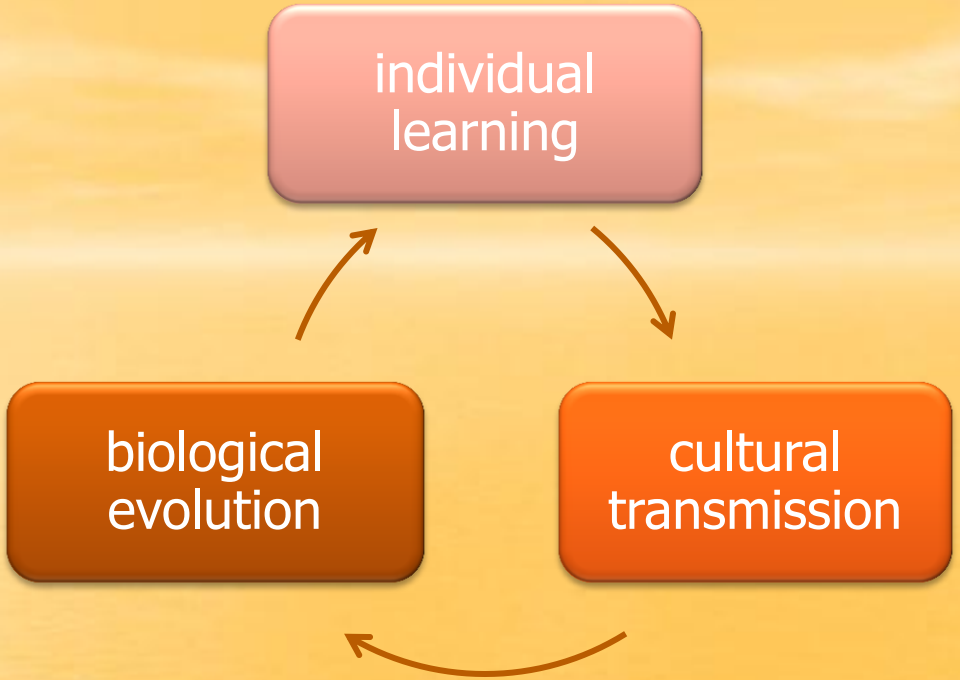
- computer modelling
- simulations of the naming game
- shared vocabulary
- evolutionary naming game model
- Baldwin effect

(KIRBY, 2007)

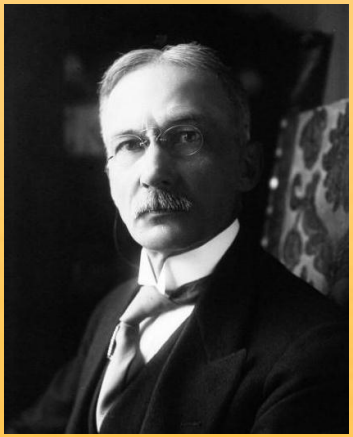


Language is a complex adaptive system, which emerges from local interactions between its users and develops according to principles of evolution and self-organization.

- individual's adaptation shall not affect genetic evolution

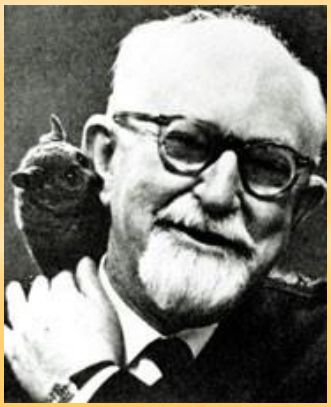
- James Baldwin (1896):

  epigenetic factors can shape the congenital endowment



- The Baldwin effect:

  what must be learned ontogenetically, can become innate



- George G. Simpson (1953)
  - reintroduction of Baldwinian evolution
- Conrad Waddington
  - canalization
  - genetic assimilation
- Geoffrey E. Hinton & Steven J. Nowlan (1987)
  - computer simulations
  - growing interest

- the Baldwin effect as a significant factor in the evolution of language
  - Waddington (1975)
  - Pinker & Bloom (1990)
  - Deacon (1997)
  - Newmeyer (2000)
  - Briscoe (1998, 2002)
  - Turkel (2002)
  - Yamauchi (2004)

1. nature–nurture problem
2. Darwinian account for language evolution
3. connection of learning and evolution
(cultural and phylogenetic aspects of language)

- Conrad H. Waddington
  - ability to use language
  - gradual evolution
  - accumulation
  - genetic assimilation

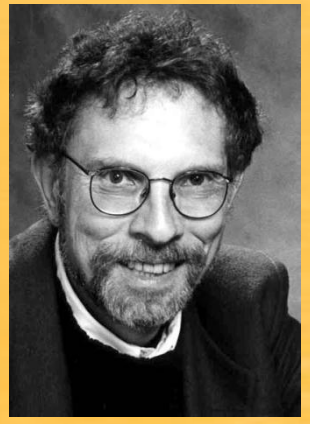
- Steven Pinker & Paul Bloom
  - language has evolved gradually by natural selection
  - Baldwin effect may be involved

- Terrence W. Deacon (1997):

No innate rules,
no innate general principles,
no innate symbolic categories
can be built in by evolution.

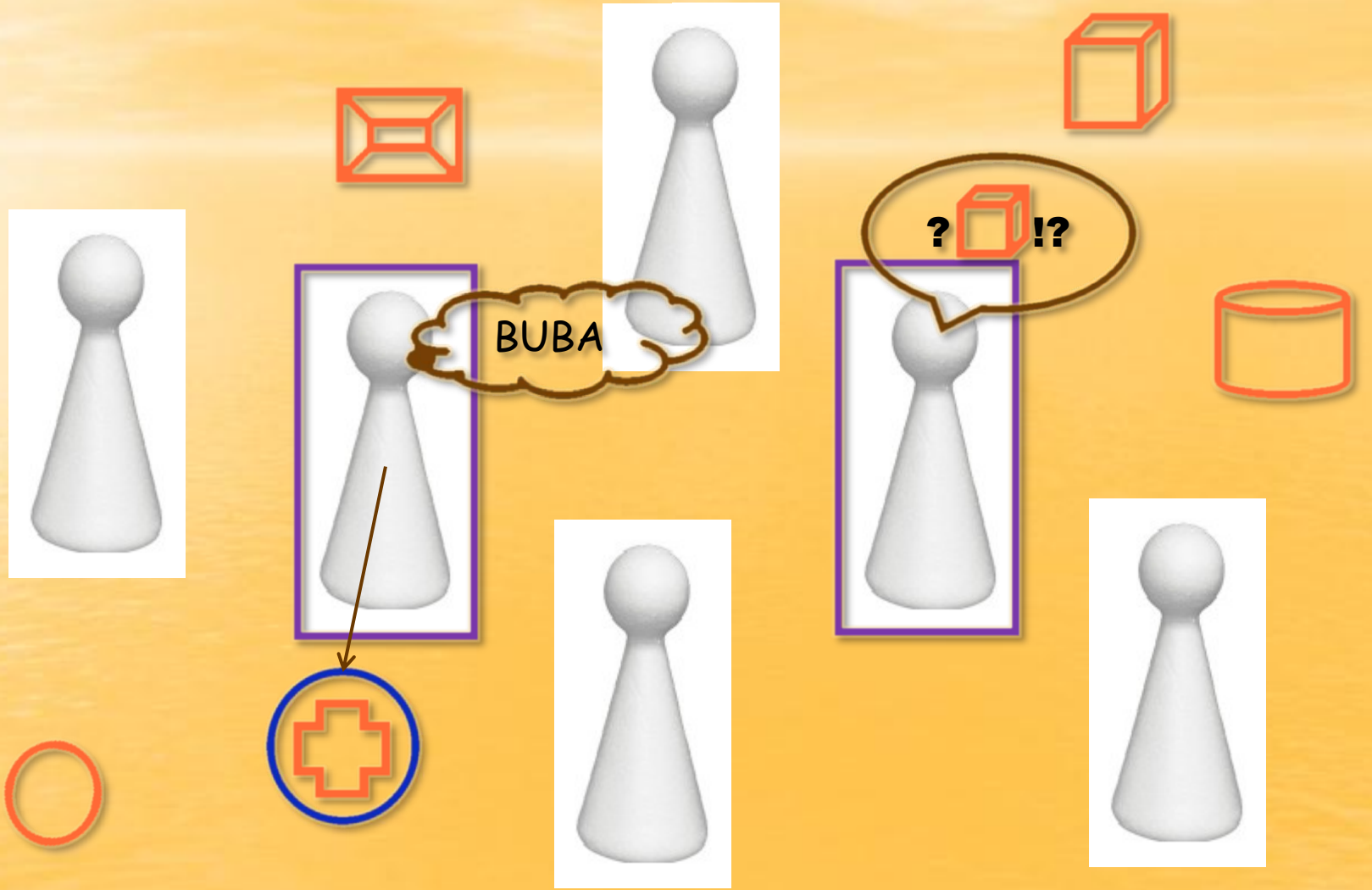
  - LAD – "monolithic innatism"
  - coevolution of language and brain
  - the Baldwin effect – not directly on the language faculty

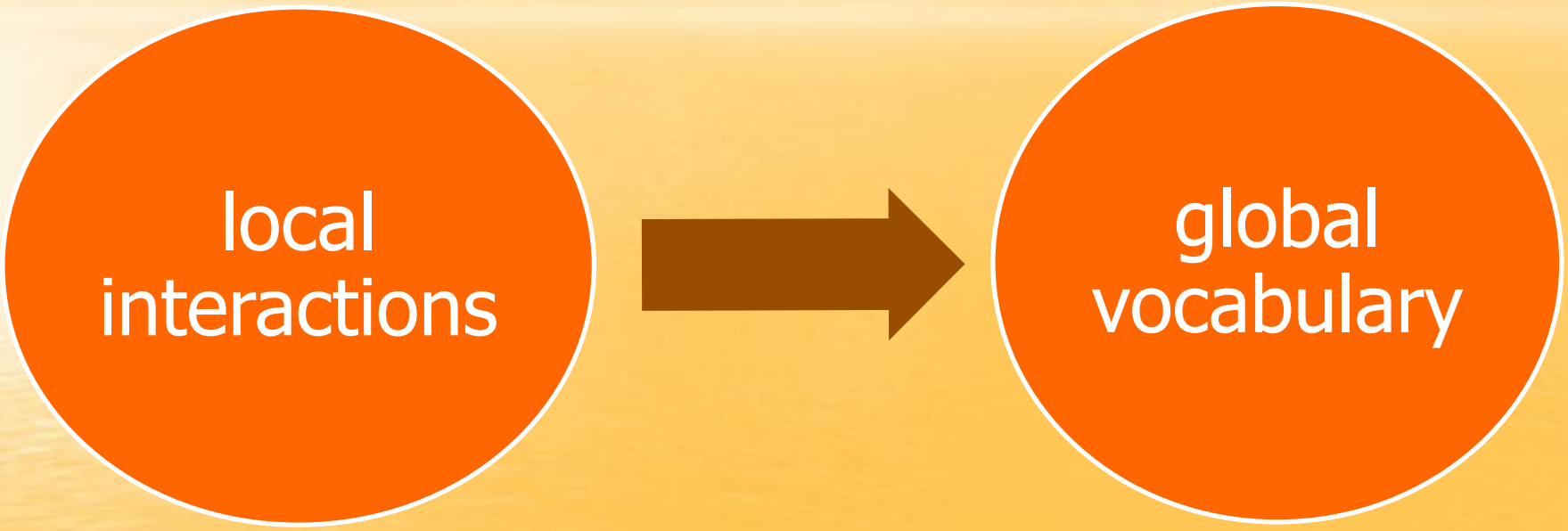
- Frederick J. Newmeyer
  - cost of learning
  - acquisition failure
  - Universal Grammar constraints



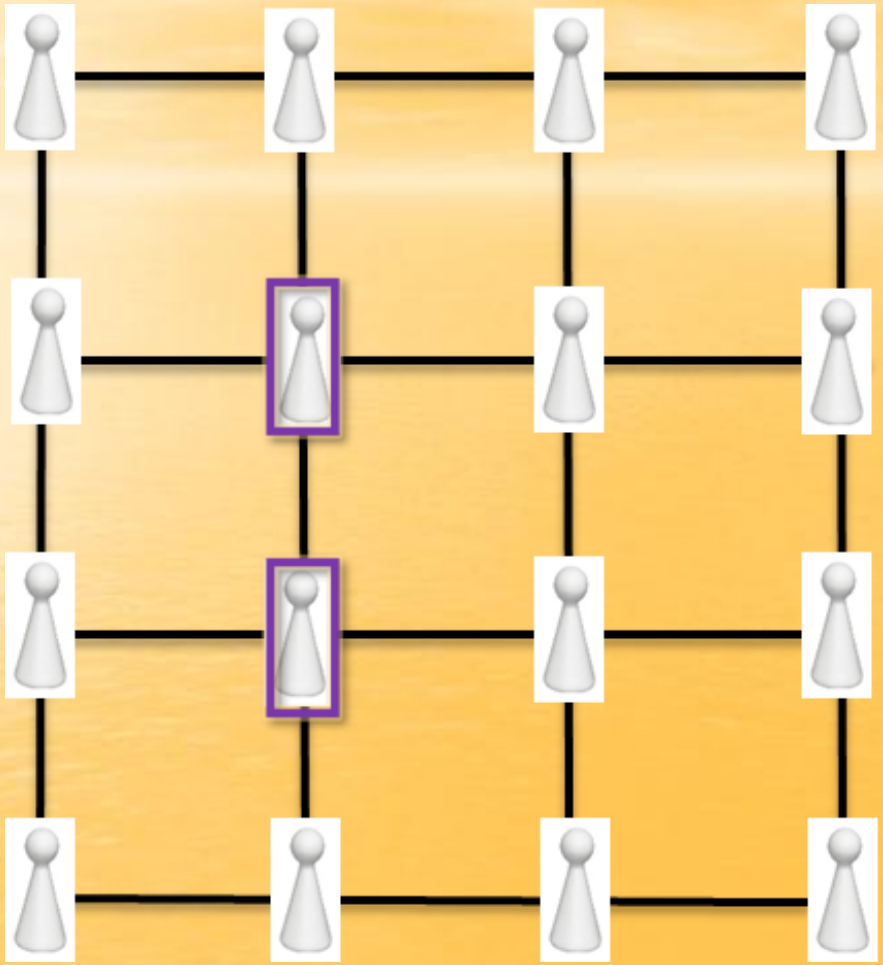
- unresolved problems
- stable environment
- Christiansen & Chater (2008)
  - language adapted to brain
- lack of rigorous theory
- reconsideration

NAMING GAME (Steels, 1995)





(STEELS, 1995; BARONCHELLI *et al.*, 2006; DALL 'ASTA *et al.*, 2006)



weights of words $(w > 0)$

learning abilities of agents $(0 < l < 1)$

success

- agents increase the weights

failure

- listener adds the word
- speaker decreases the weight

communication probability

survival probability

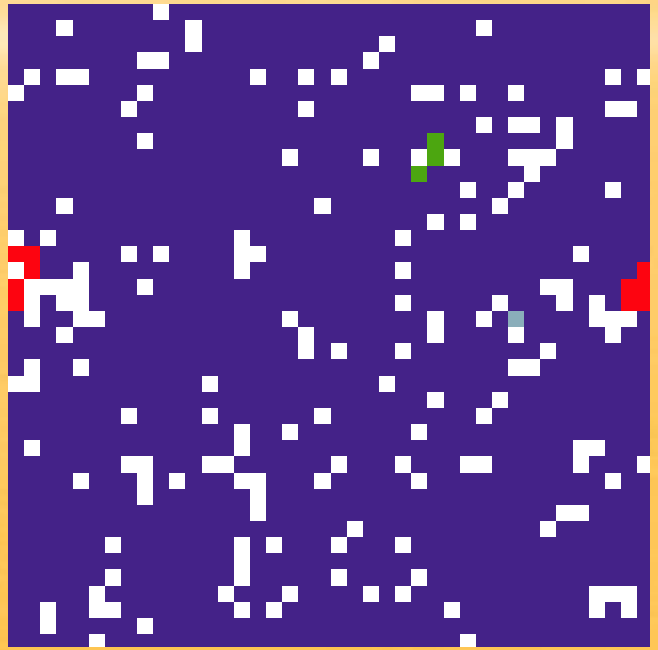
- age
- linguistic performance

mutation probability

- learning ability
- main word

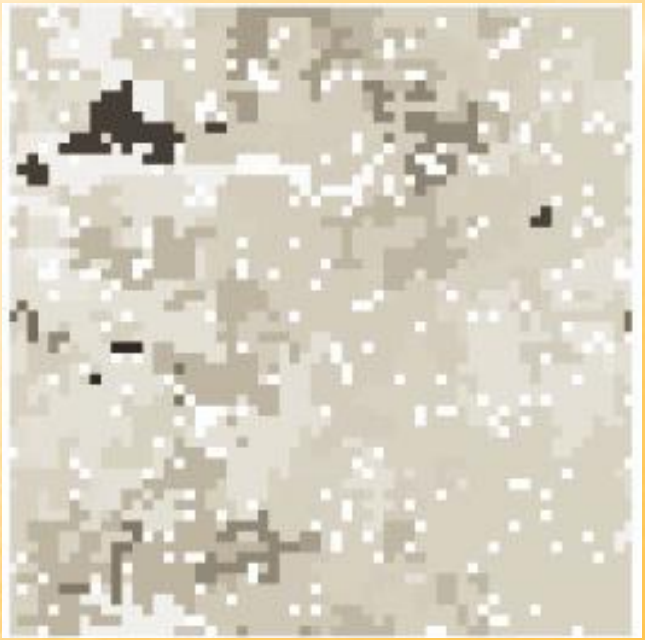
LANGUAGES

p=0.15



p=0.30

LEARNING ABILITIES



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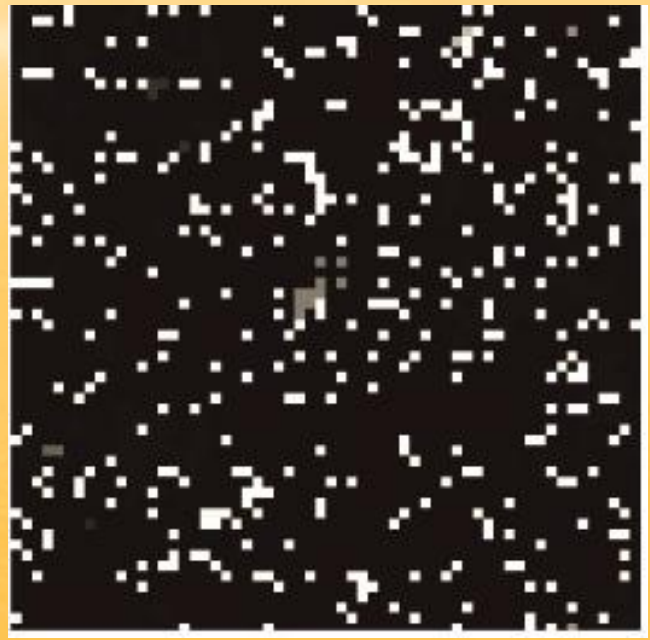
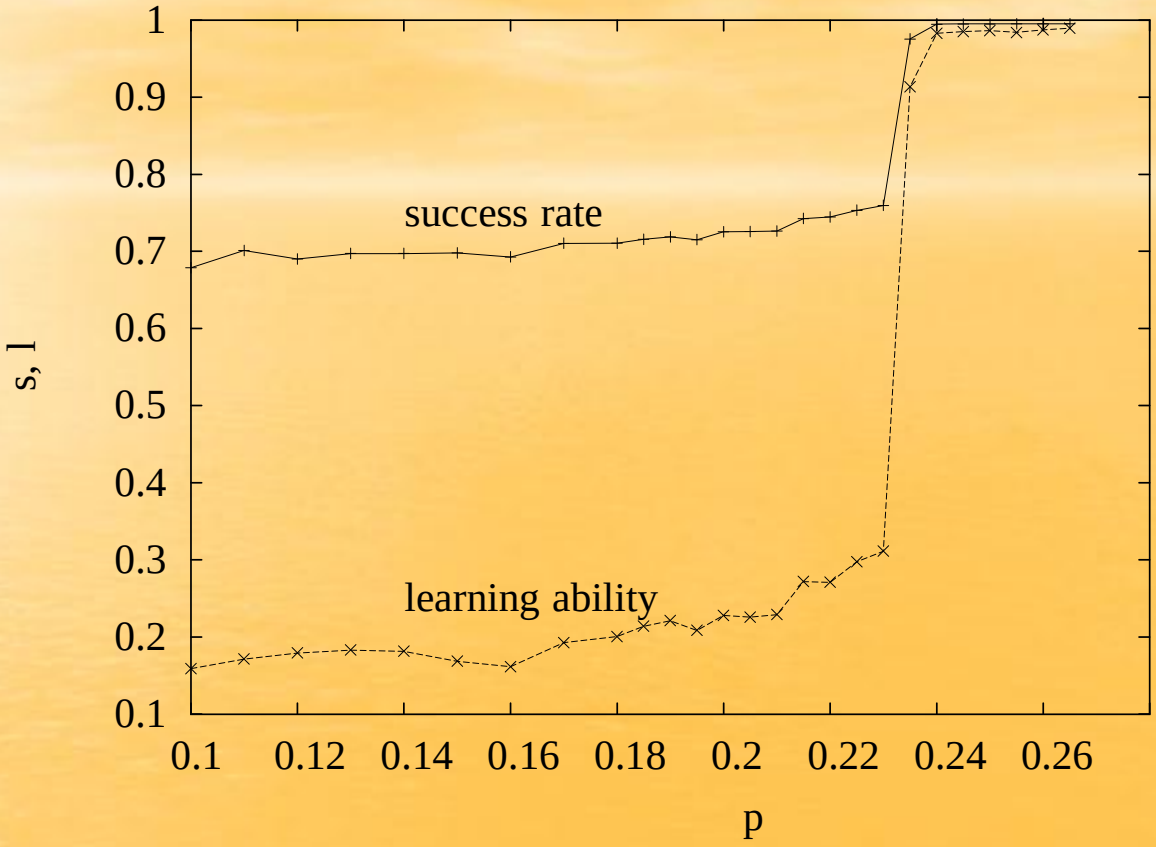


p=0.30



Success rate s and learning ability l
as a function of communication probability p.

learning get coupled with evolutionary traits

the Baldwin effect

niches directing evolution

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