NAMING GAME

AS

VIRTUAL EXPERIMENT

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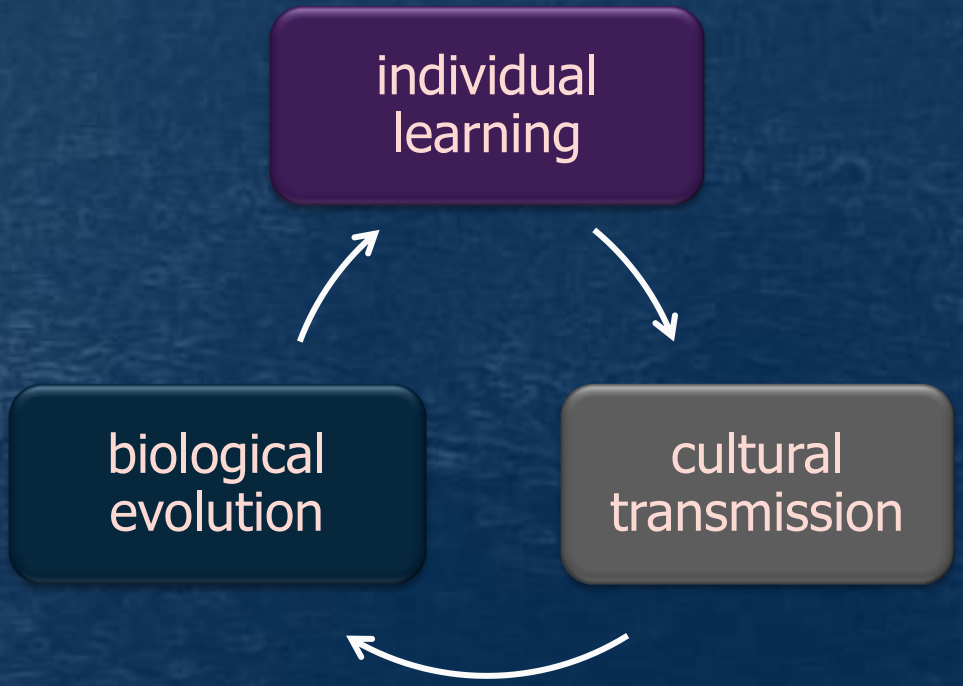
- no „fossils”
- empirical studies ?
- computational simulation

COMPLEX ADAPTIVE SYSTEM



virtual laboratory

multiple experiments

testing different values of parameters

isolated factors

set of conventions

emergent phenomenon

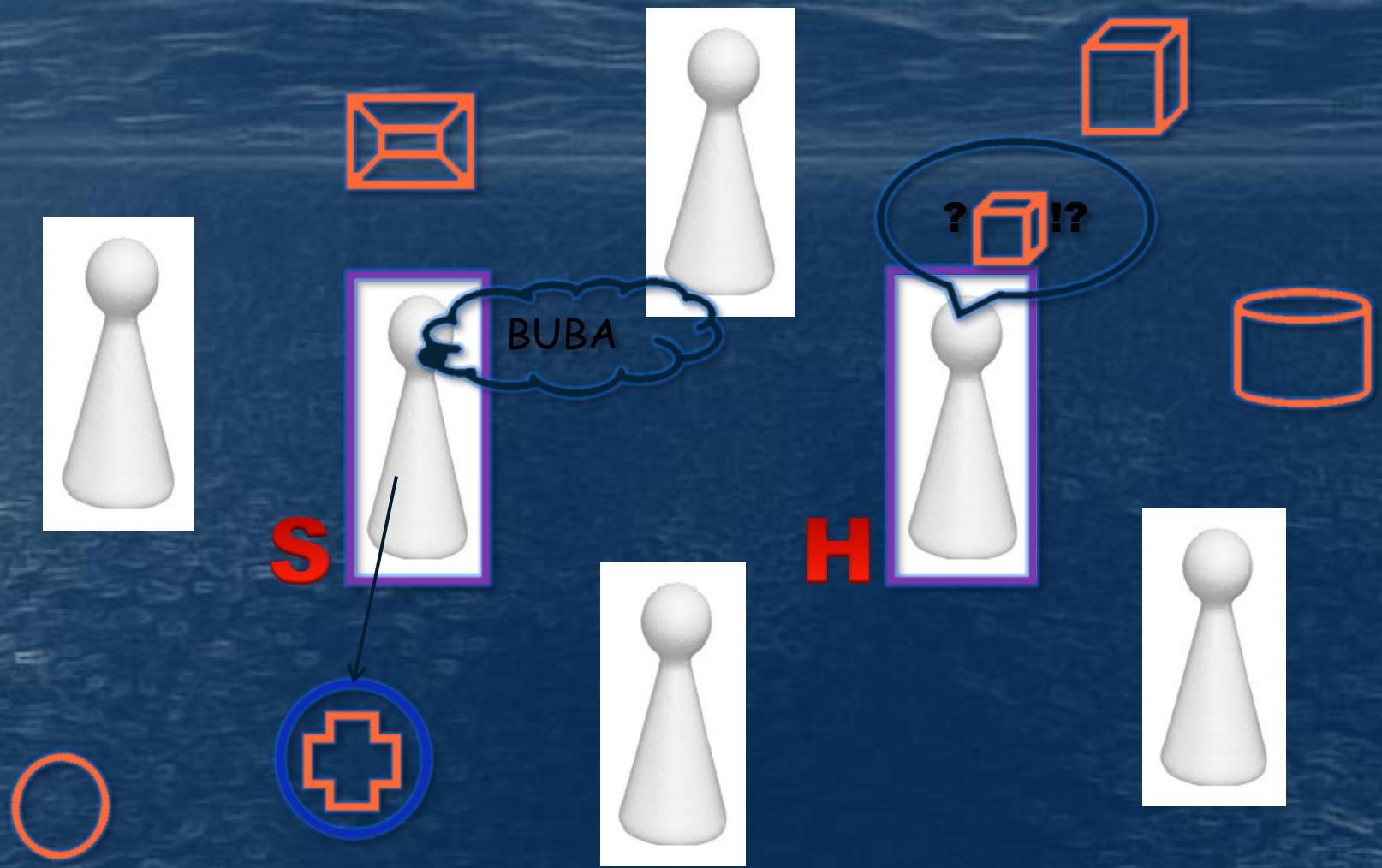
local interactions

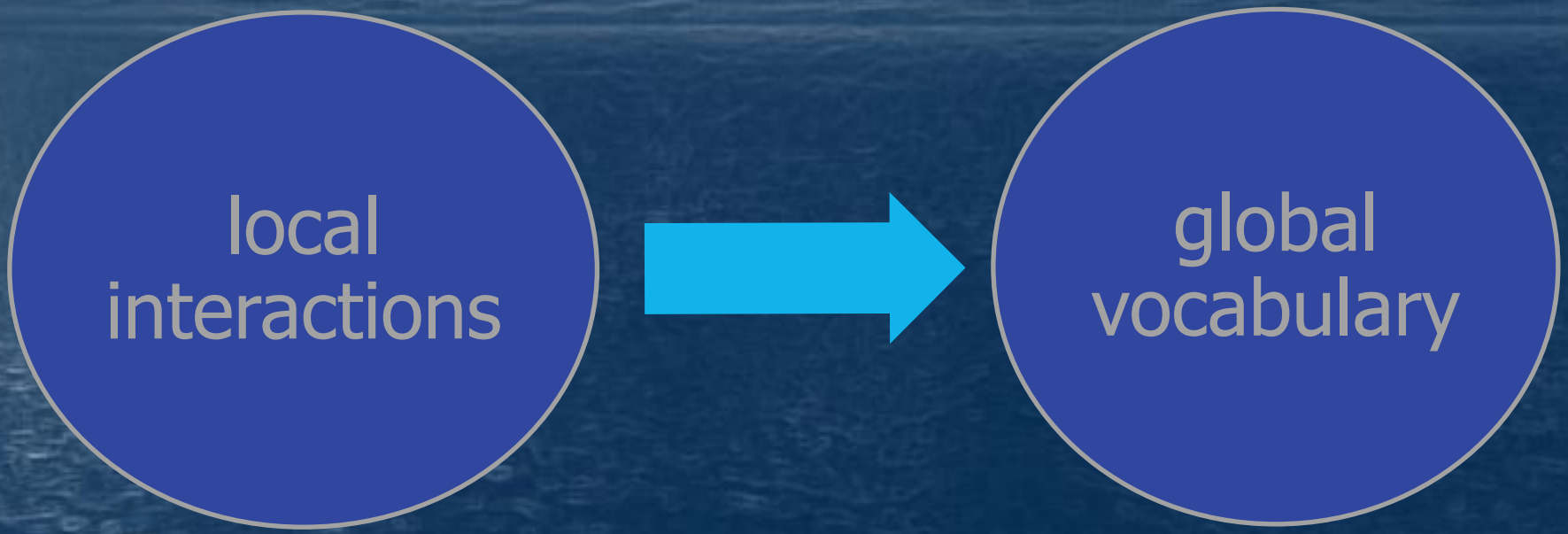
no global control

multi-agent systems

bottom-up

NAMING GAME (Steels, 1995)




local
interactions
global
vocabulary

- minimal naming game
- frequency-based naming game
- scaling laws
- agent-network structure

- synonymy is rare

There is no such thing as a true synonym

(L. Urdang 1979)

- homonymy is common

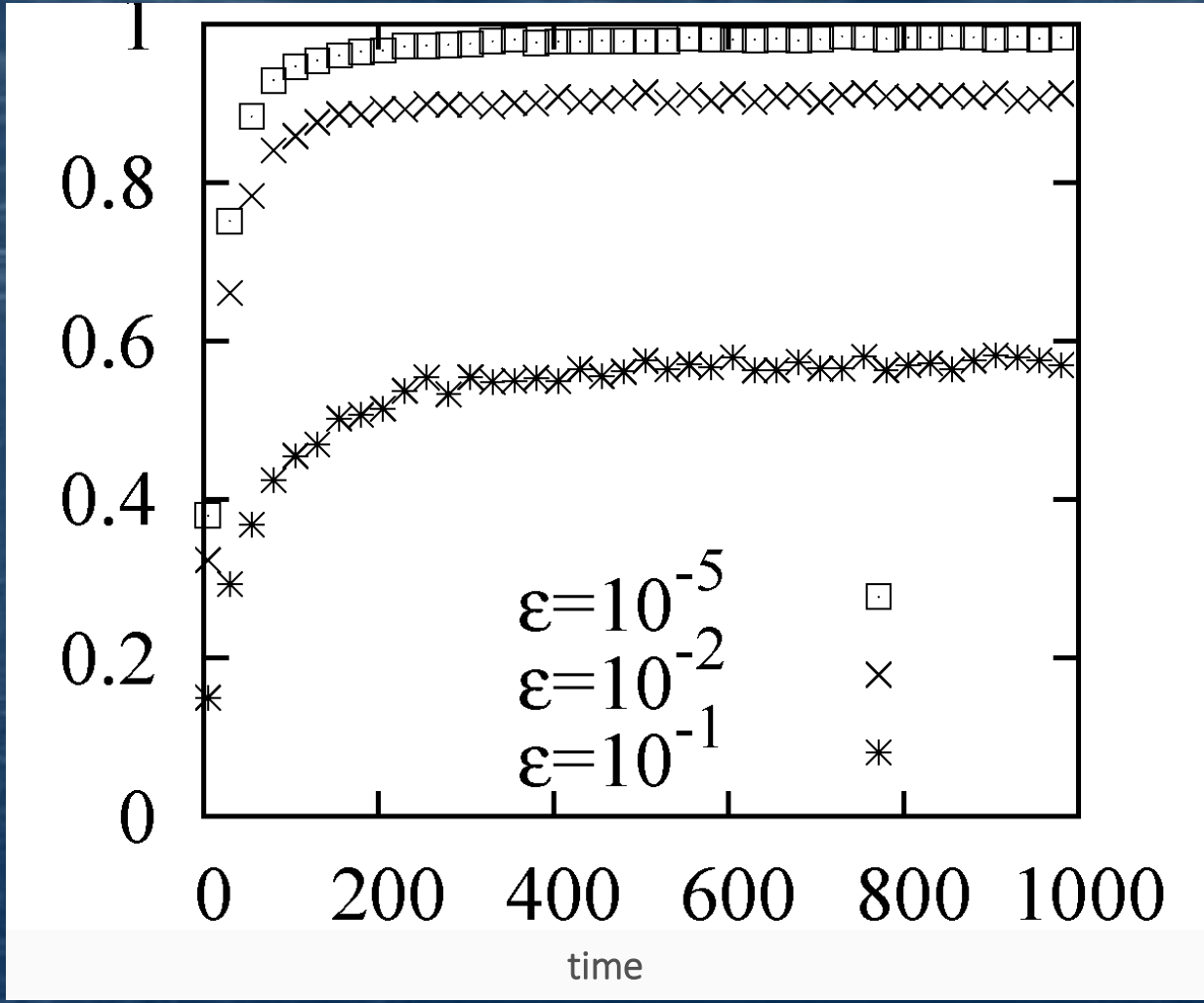
- homonymy – synonymy puzzle
  - synonymy does not disturb communication
  - homonymy gives rise to misinterpretations
- computer languages
  - synonyms allowed
  - no homonyms

Homonyms and synonyms in the naming game

- many objects
- two agents (speaker and hearer – in turns)

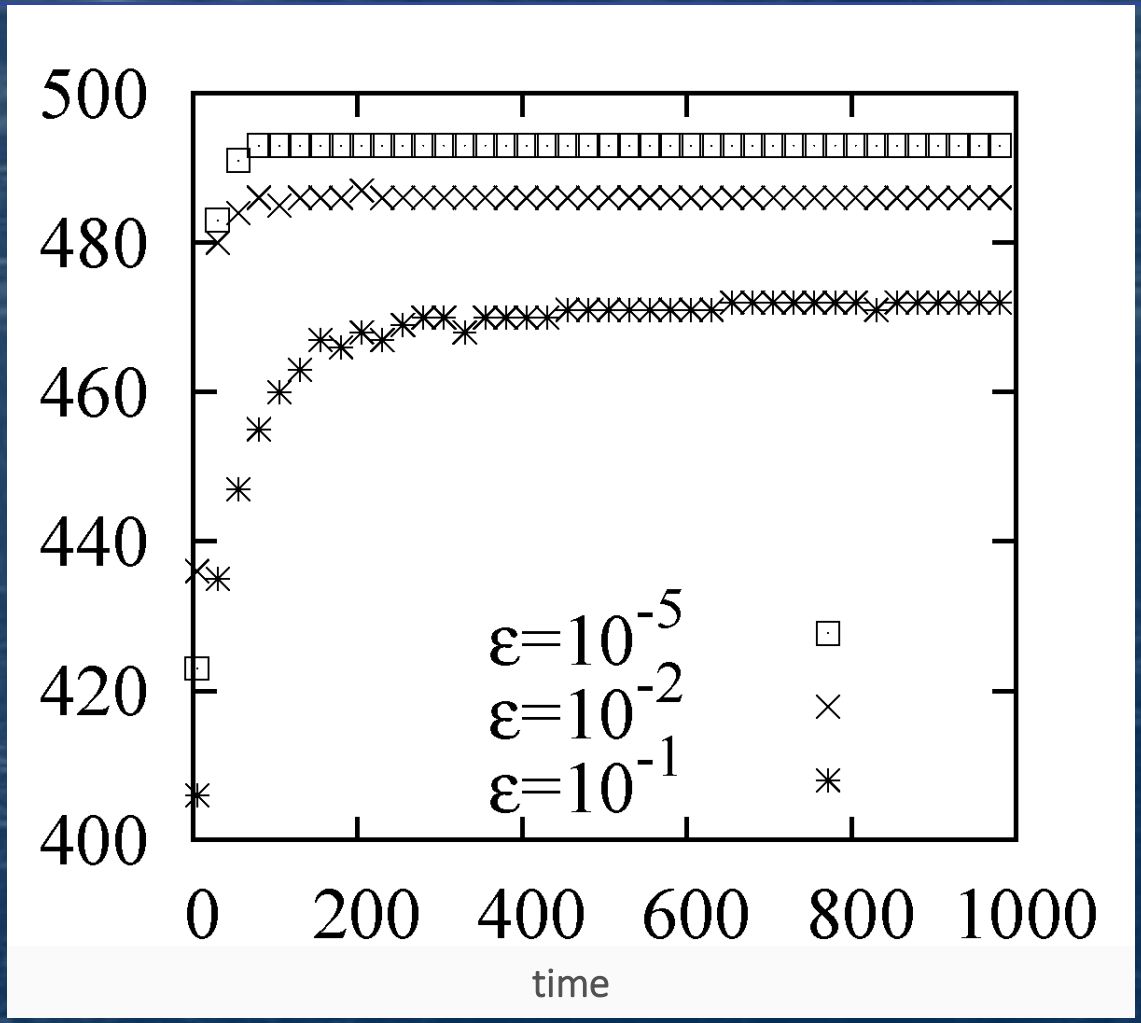
- agents have lists of words
  (one list for each object)
- words have weights
- stochastic processes
  - selecting words
  - decoding meanings


1244
5678
7890
1122
5458
3609
7823
5678
9751
1134
9974
5001
7890
?
!?
1244
5667
1221
6658
7892
7890
7823
1230
1244
9751
9342
2381

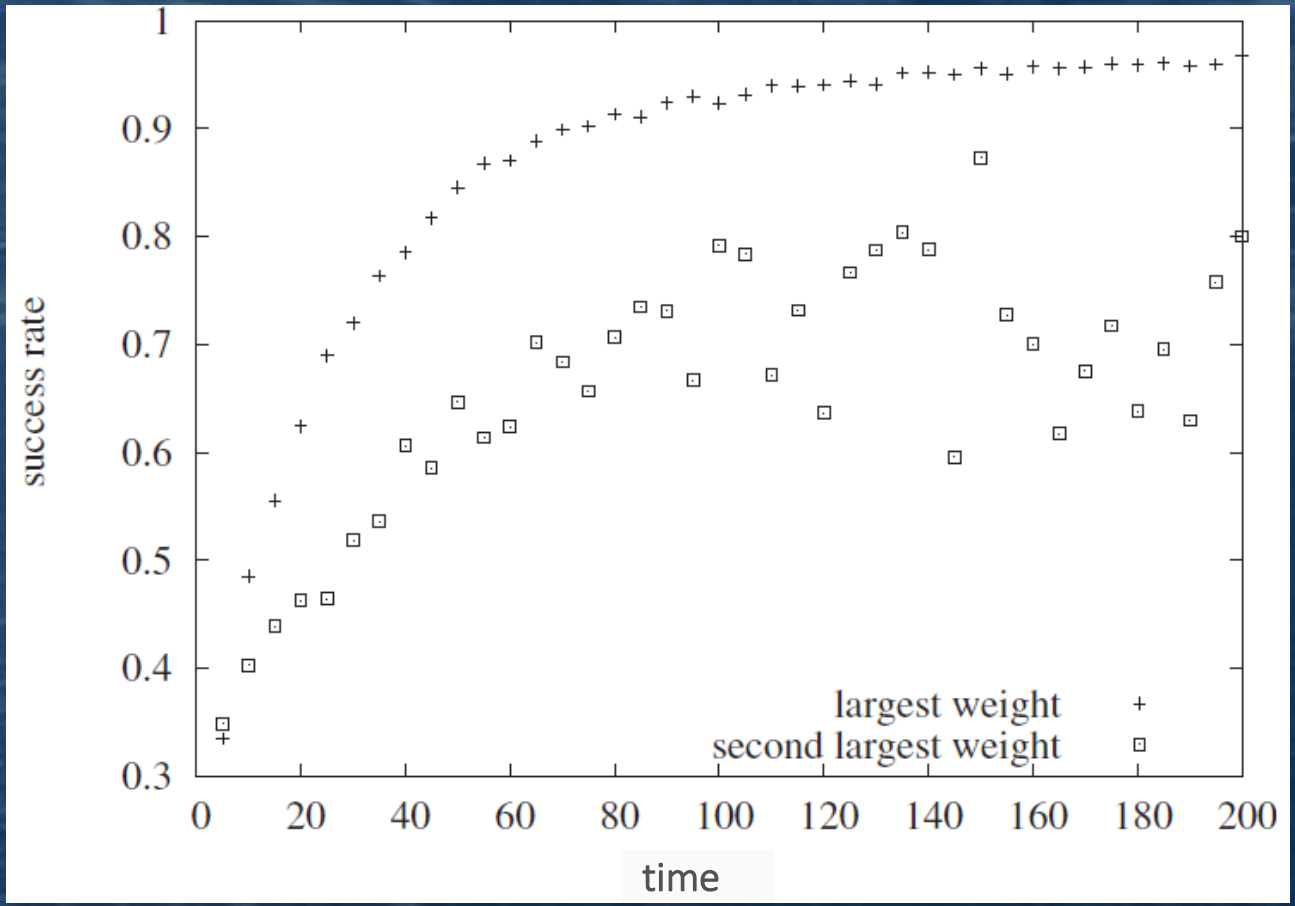


The time evolution of the success rate

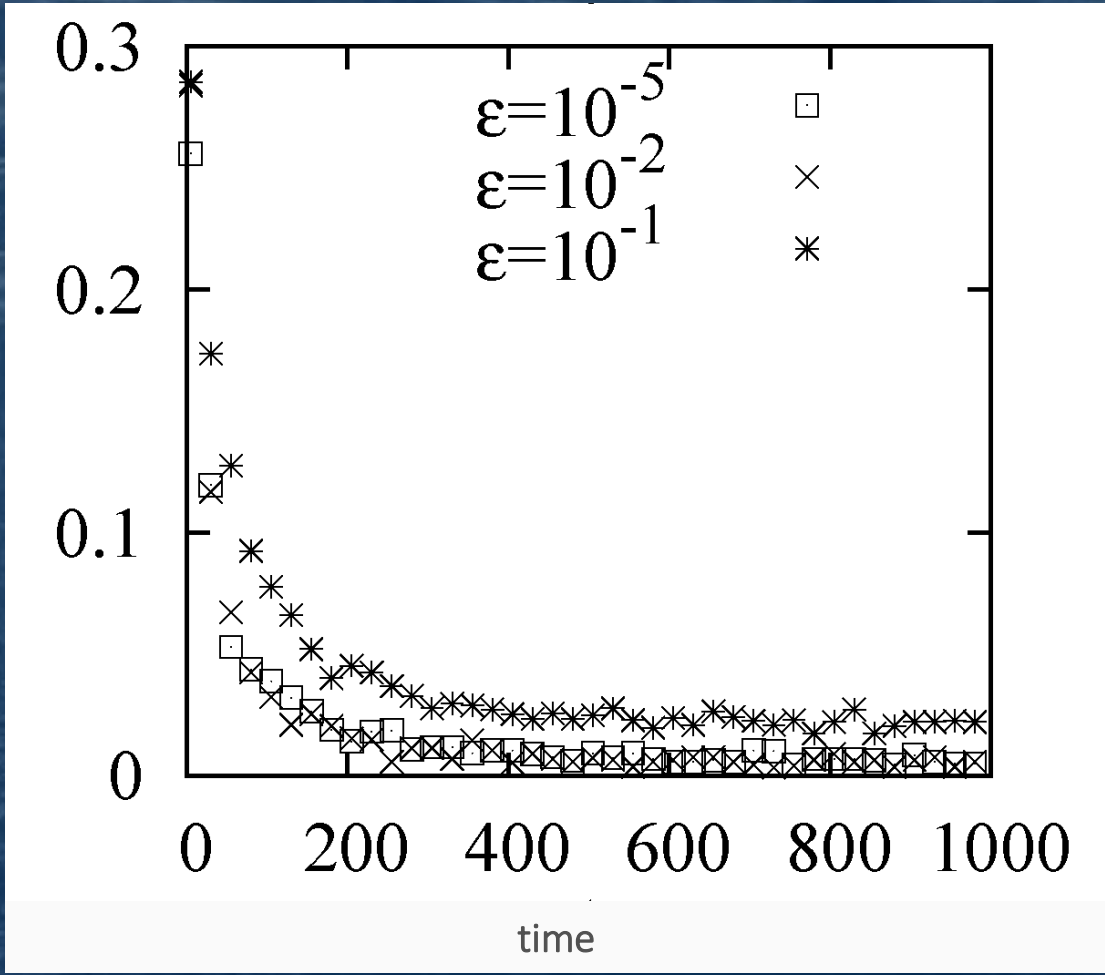
(n=500, l=10, r=1000)



The time evolution of the number of different largest-weight words



The time evolution of the success rate of utterances with largest- and second-largest-weight words

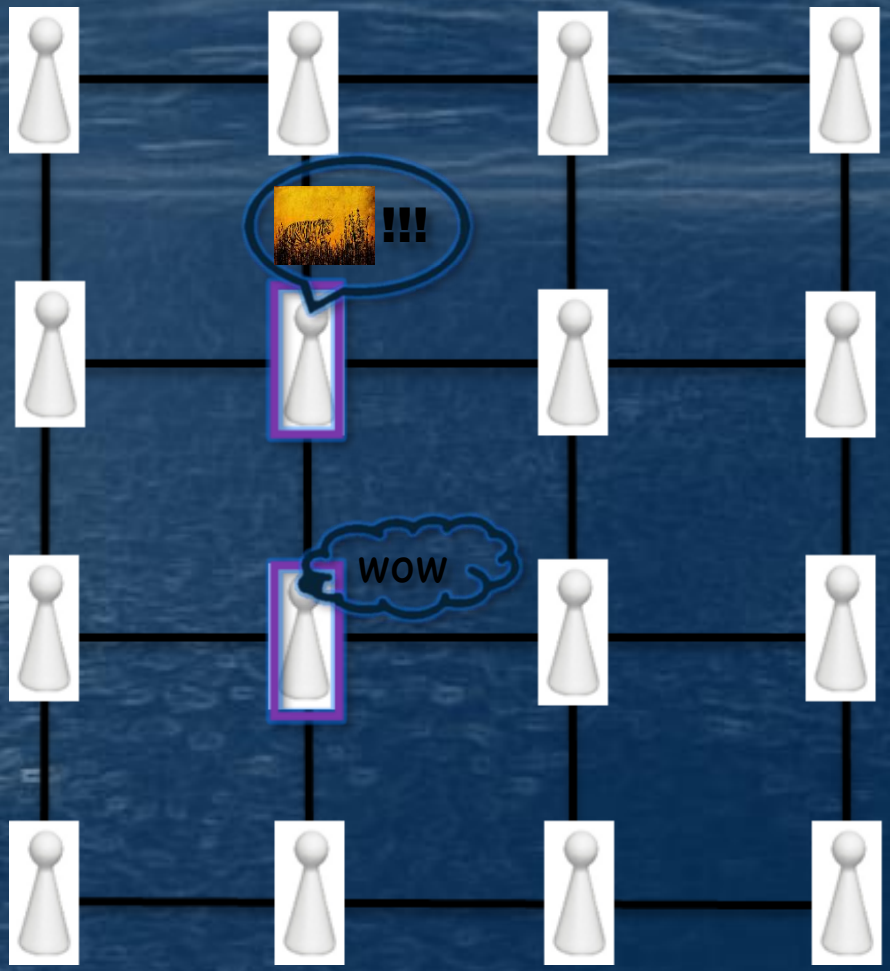


The time evolution of the fraction of second-largest-weight utterances

Asymmetry between homonymy and synonymy can thus be explained within a fairly simple

naming game model

EVOLUTIONARY NAMING GAME



0,2 **L**

wow 1,4
goo
oj

0,5 **S**

wow 5,5
bad
ole
uma

EVOLUTIONARY NAMING GAME

communication probability

survival probability

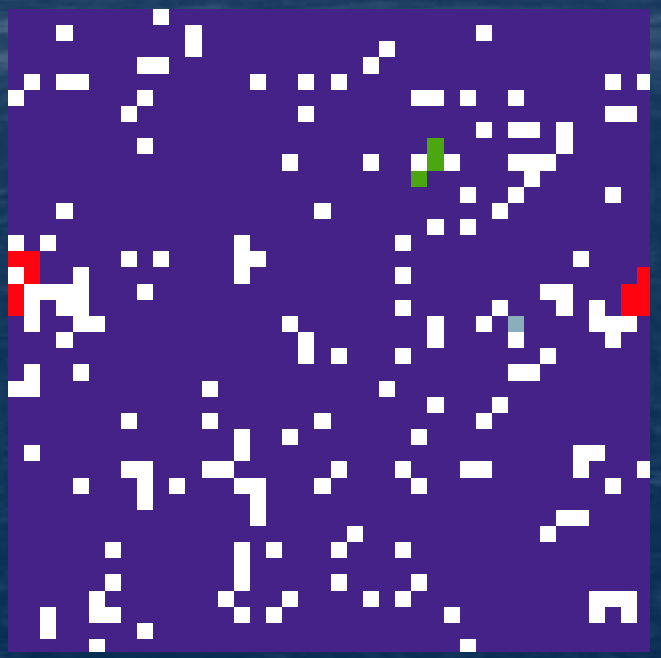
- age
- linguistic performance

mutation probability

- learning ability
- main word

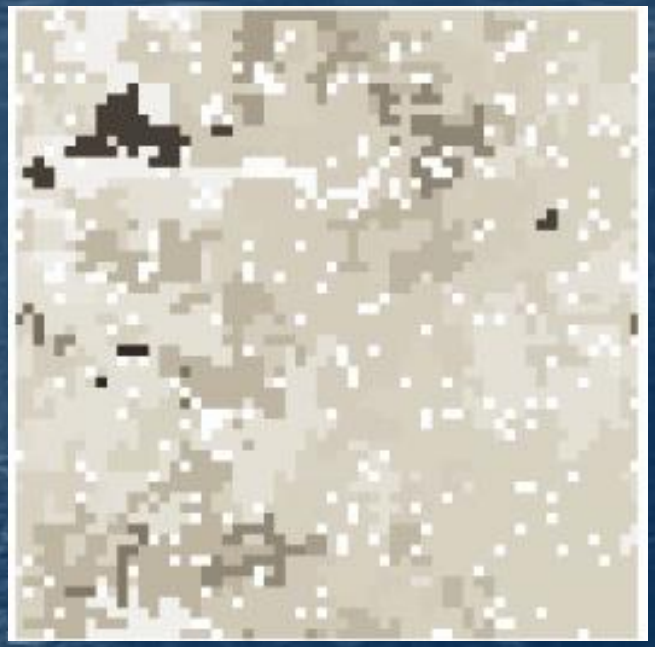
LANGUAGES

p=0.15

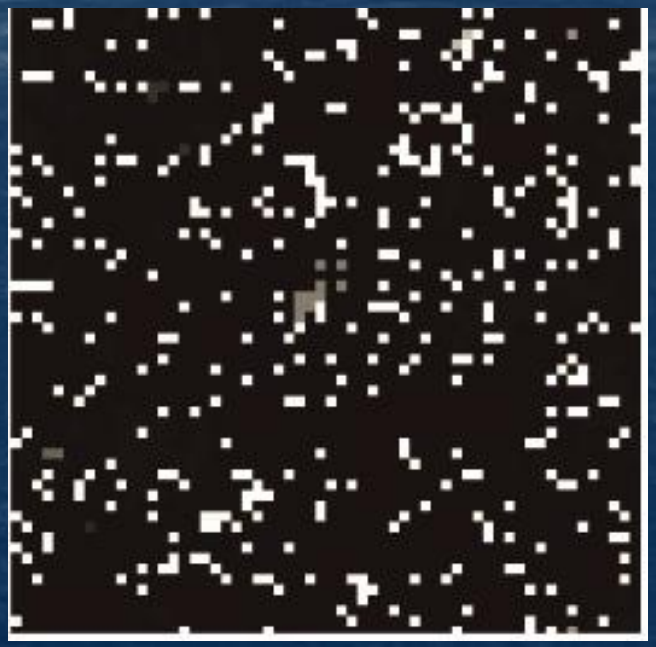


p=0.30

LEARNING ABILITIES



p=0.15



p=0.30

Success rate **s** and learning ability **l**
as functions of communication probability **p**.

learning get coupled with evolutionary traits

the Baldwin effect

niches directing evolution

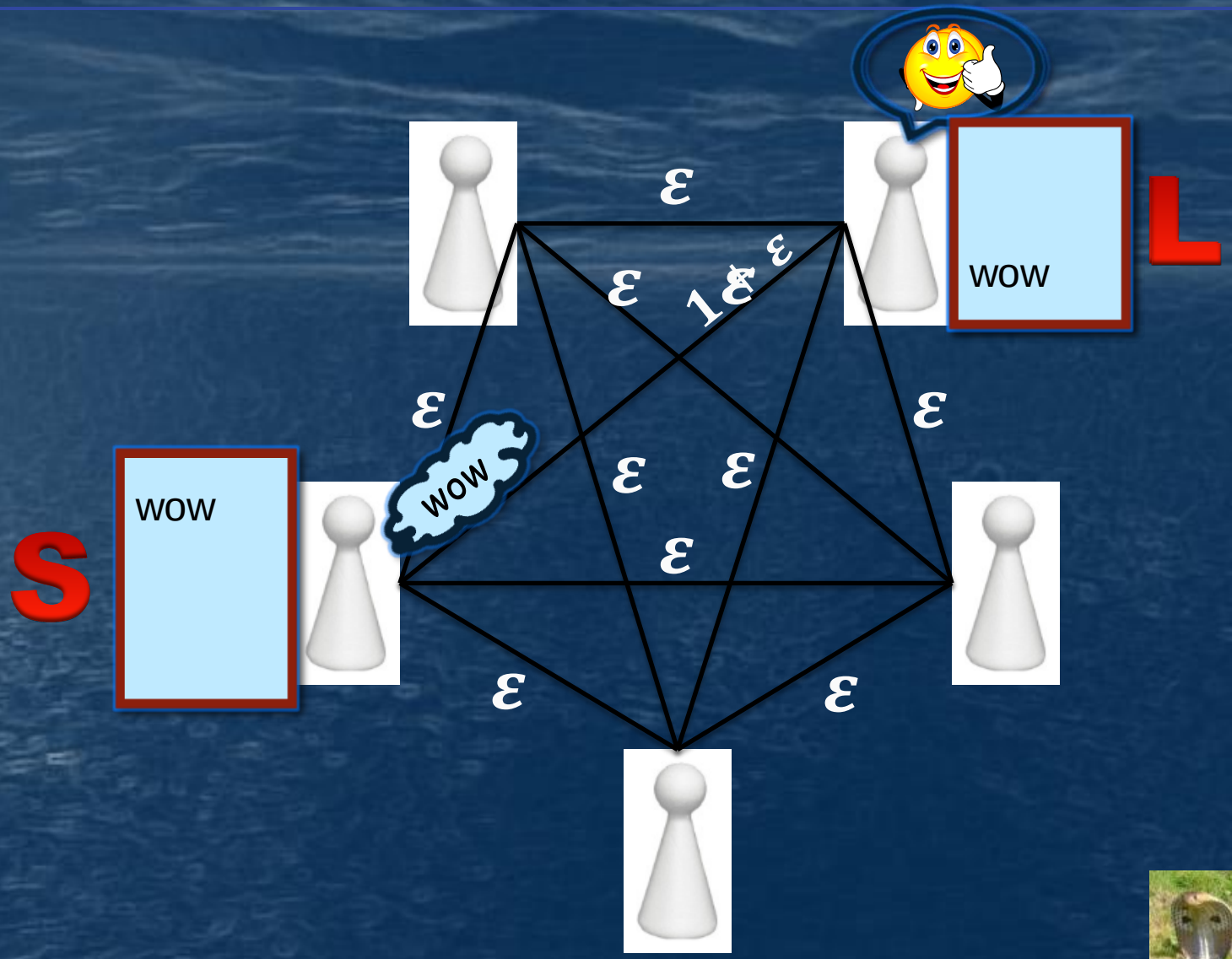
NAMING GAME ON ADAPTIVE NETWORK

preference for better-communicating interlocutors

weights of links

- determine the probabilities of communication
- change along with the communicative success

NG on a graph — complete, weighted, adaptive — complex dynamic structure


ε
ε
ε
ε
ε
ε
ε
ε
ε
ε
WOW
L
WOW
S
WOW

clusters of agents

linguistic synchronization –
the same language

dynamic structure of the network

preference weak enough

one cluster

- communicative success rate $\rightarrow$ 100%
- number of different words $\rightarrow$ 1
- number of users of a dominant language $\rightarrow$ N

preference strong enough

many clusters

- communicative success rate $\rightarrow$ 100%
- number of users of a dominant language $\ll N$
- number of different languages > 1

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THANK YOU FOR YOUR ATTENTION

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