

Pravda a lož v evolúcii jazyka

Seminár z umelej inteligencie - leto 2014

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Prehľad

- 1 State of the art
- 2 Hypothesis and model
- 3 Simulation results
- 4 Analysis and discussion

Problem of deception

- information transfer: manipulation, exploitation, communication (Oliphant)
- animal communication:
 - efficacy + strategy cost (Zahavi)
 - social punishment (see Scott-Phillips)
- human language:
 - gossip/grooming (Dunbar)
 - ritual/speech, conspirational whispering (Knight)
 - tower of Babel (Pagel)
 - common trait: possibly adversary third-party

Human language vs animal communication

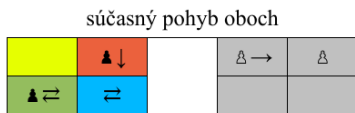
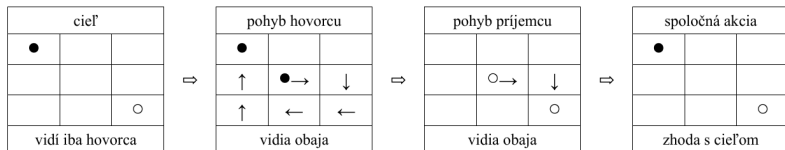
- complex grammar + detached representations (Gärdenfors)
- animal communication:
 - efficacy + strategy cost (Zahavi)
 - social punishment (see Scott-Phillips)
- human language:
 - gossip/grooming (Dunbar)
 - ritual/speech, conspirational whispering (Knight)
 - tower of Babel (Page)
 - possibly adversary third-party (Malinovsky)

Other considerations

- Gestural theory
- Imitation, cultural evolution
- Autism, speech development
- Mirror neurons

Peer-to-peer language game models

- Stag hunt (impure coordination)
- Prisoner's dilemma
- Pure coordination games
 - meaning -> utterance -> meaning
 - telepathic, embodied
 - computer simulations, human experiments



každý vidí iba svoje farby,
 ale aj cudzie pohyby



kontrola zhody farby

Hypothesis

- Higher degree of third-part adversariality causes
 - Constant language change
 - Higher code complexity
 - Lower strategy cost
- Extended grammaticalization
 - (pragmatics ->) semantics -> morphosyntax (-> phonetics)
 - by the side of -> besides
 - that -> the

Minimum broadcast language game model

- variable adversariality of third party
- S - R = pure coordination(s)
- (S+R) - A = zero sum game
- language = collective choice of coordination mode

| | | |
|-----------------|-----------------|-----------------|
| | A | |
| | A _{A0} | A _{A1} |
| S, R / A | A _{R0} | A _{R1} |
| A _{S0} | 1, 1 / 0 | 0, 0 / 2 |
| A _{S1} | 0, 0 / 2 | 1, 1 / 0 |

| | | | |
|-----------------|----------|-----------------|-----------------|
| | S, R / A | A _{R0} | A _{R1} |
| A _{S0} | 0, 0 / 2 | 1, 1 / 0 | 1, 1 / 0 |
| A _{S1} | 1, 1 / 0 | 0, 0 / 2 | 0, 0 / 2 |

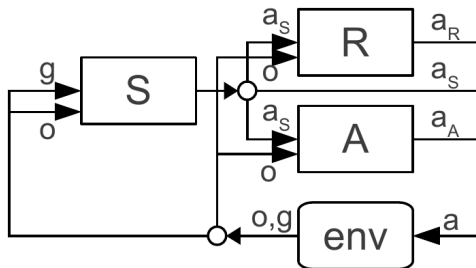
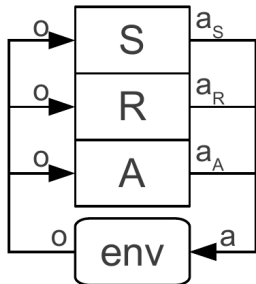
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| | | |
|-------------------|-----------------|-----------------|
| S+R \ A | A _{A0} | A _{A1} |
| A _{S0R0} | 2 \ 0 | 0 \ 2 |
| A _{S1R1} | 2 \ 0 | 0 \ 2 |
| A _{S0R1} | 0 \ 2 | 2 \ 0 |
| A _{S1R0} | 0 \ 2 | 2 \ 0 |

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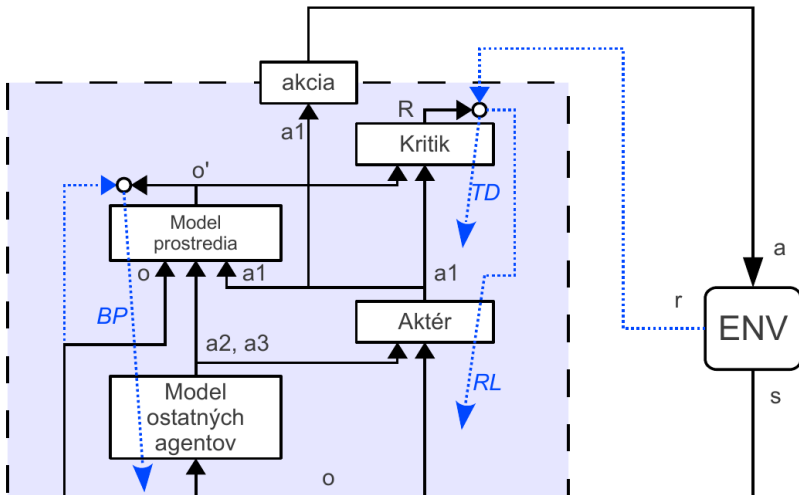
| | | |
|------------------|-----------------|-----------------|
| S+R \ A | A _{A0} | A _{A1} |
| A _{S=R} | 2 \ 0 | 0 \ 2 |
| A _{S≠R} | 0 \ 2 | 2 \ 0 |

Sequential vs simultaneous



Agent cognitive model

- Reinforcement learning
- Forward + inverse model



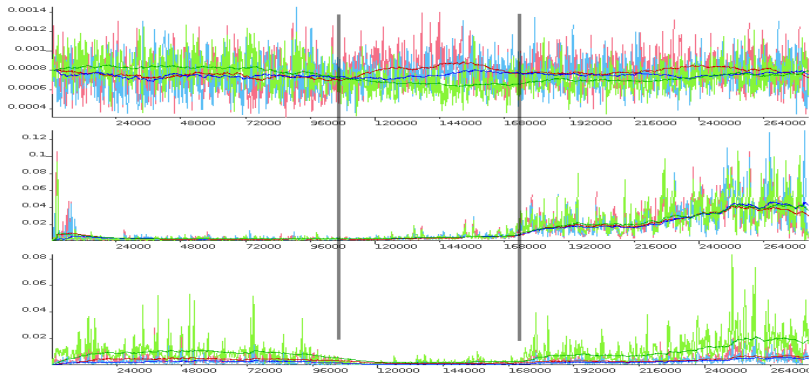
Example

- students - teacher (power)
- cheaters - cheated (sex)
- insiders - outsider (tribe)
- metaphors, idioms, symbols,
- we create and understand metaphors on the fly

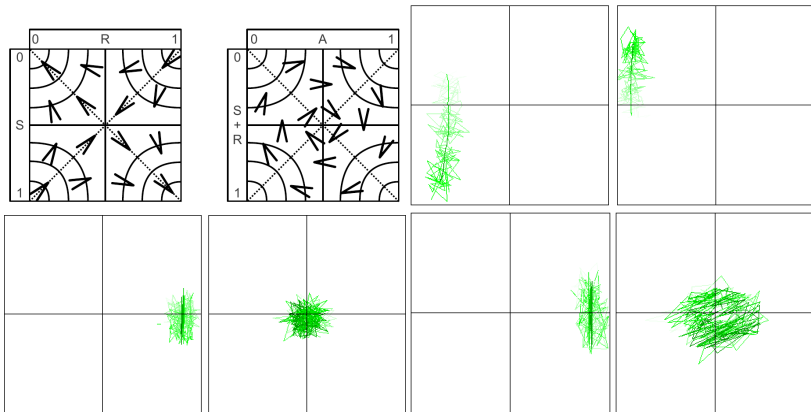


Phases of simulation

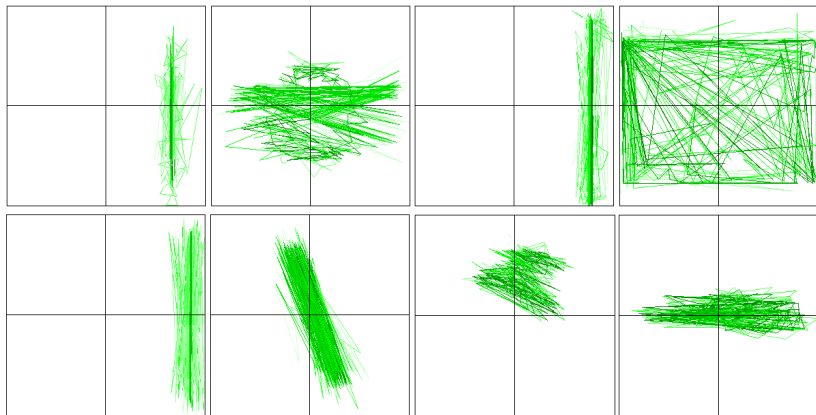
- initial action space exploration
- exploration near equilibrium
- complex behavior



Initial phases



Complex behavior



Analysis and Discussion

- similarity to XOR problem
- complexity measurement
- crypto/stegano techniques

- autism
- mirror neurons

Future prospects

- Embodied game
- Action-state separation
- Scaling
- Human experiments
- Unclear game, strategy cost, social punishment

Conclusion

- Complex behavior emerges
- Code switching emerges

Koniec

Ďakujem za pozornosť

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