The Evolution of Lexical Usage Profiles in Social Networks
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Background: The Problem of Lexical Change

• Lexical Change is typically messy (as opposed to grammaticalization):
  – influenced by changes in the world (technology, etc.)
  – influenced by random events (“big” history, behavioral micropatterns, etc.)
• It is not always clear whether changes are about meaning, or about prototypical usage patterns.

Language and Social Networks

• Humans are an unusually social and cooperative species (for primates). As a consequence, all language learning (and most of language use) takes place in social networks.
• Network analysis is flourishing in the Social Sciences (see, e.g., Jackson, 2008), and is emerging in linguistics (see, e.g., Mühlenbernd and Franke, 2012). A convergence is developing between game theory, social network analysis, and fairly old explanations developed by Hermann Paul in his Prinzipen der Sprachgeschichte.

Reinforcement Learning with Polya Urns

Learning in Behaviorism

Learning = shifting the probability of some behavior in an agent

Polya Urns provide a mathematical model of reinforcement learning.
Randomly draw a ball from the urn.
If the ball corresponds to the correct answer, a further ball will be added to the urn.

The probability of drawing “white” mas from 0.5 to 0.6

Learning Internally Differentiated Lexical Items

• I assume internally differentiated lexical representations like Pustejovsky’s “quaila-structure.
  The basic theoretical commitment boils down to independently ponderable submeanings.
• Motivation: meaning shifts generally follow patterns of polysemy
• Scenario:
  – We have two words that are absolute synonyms (see Skyrm, 2010): any draw = success
  – Each submeaning is an independent Polya urn (balls correspond to Words & Wordz)
  – Speaker draws a word, and signals to hearer
  – Hearers updates the weight for the chosen word (and maybe the speaker, too)

Complete Networks: Contact Creates Uniformity

Within a simulation run in a complete network, the lexical usage profiles of the agents are extremely similar, even though they can be very dissimilar across simulation runs.

Complete Networks: Lexical Differentiation and Network Size

Definition: Lexical Differentiation between Words and Wordz at Submeaning

is the absolute difference of submeaning, of Words and submeaning, of Wordz or:
|submeaning, (Words) – submeaning, (Wordz)|

Lexical Distance Reflects Network Structure

Definition: Lexical Distance between Agents and Agents

The lexical distance between two agents is the sum of the absolute differences of their respective pondered submeanings, or: Σ(|submeaning, (Agenti) – submeaning, (Agentj)|)

Acknowledgements & Sample References

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All simulations have been performed with libCommonLib, using the graph library by Eric Schaff (https://git.shej.com/eric/schaff/Graph). Networks have been drawn with graphviz (Gansner and North, 2000). Data analysis has been performed with R (R Development Core Team, 2006).