

Search as a driver for the refinement of linguistic constructions

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Questions

- Where does new meaning come from?
- Where does grammar come from?
- How can grammar propagate in a population?
- Why does grammar change?

Functional Linguistics

- Q: Why is language structure the way it is?
- A: Because the language adapts to the needs/constraints of the language users.
- These kinds of explanations are called **Usage-Based**.
 - economy, clarity, social function, ...

Search during parsing

- Many grammatical features of language can be seen as optimising the parsing process.

Usage-Based explanations

- A usage-based explanation requires us to...
- ... show that at some stage problems occur that threaten the usability language.
- ... provide the mechanisms for diagnosing and repairing these problems.

Modelling linguistic communication

- Prerequisites:
 - multi-agent framework
 - language-processing framework
 - conceptualisation framework
 - joint attentional frame, shared motives, shared intentions

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* FCG is open source: <http://arti.vub.ac.be/fcg>

Modelling linguistic communication

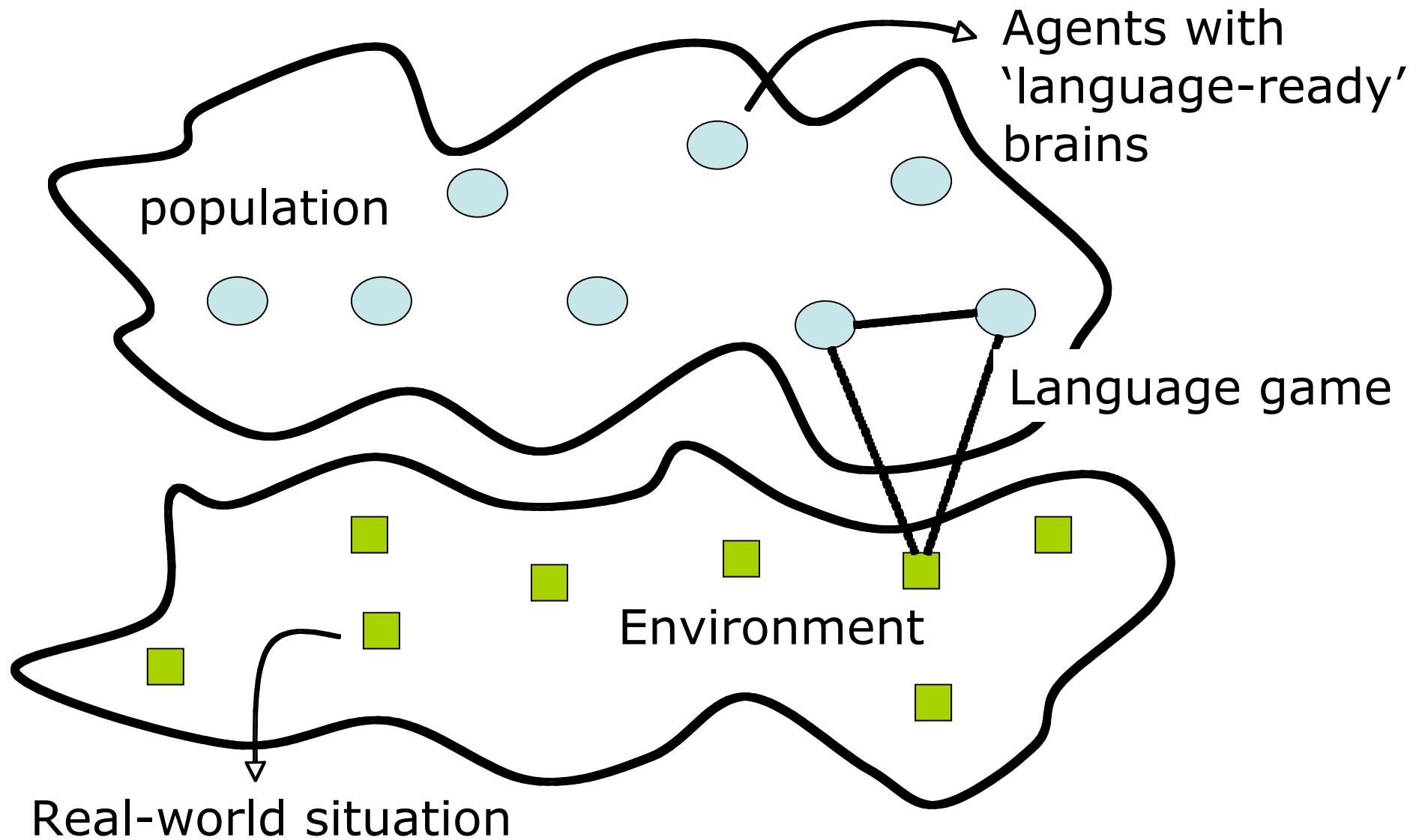
- Prerequisites:
 - multi-agent framework
 - Fluid Construction Grammar* (FCG)
 - Incremental Recruitment Language (IRL)
 - joint attentional frame, shared motives, shared intentions

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Modelling the interaction

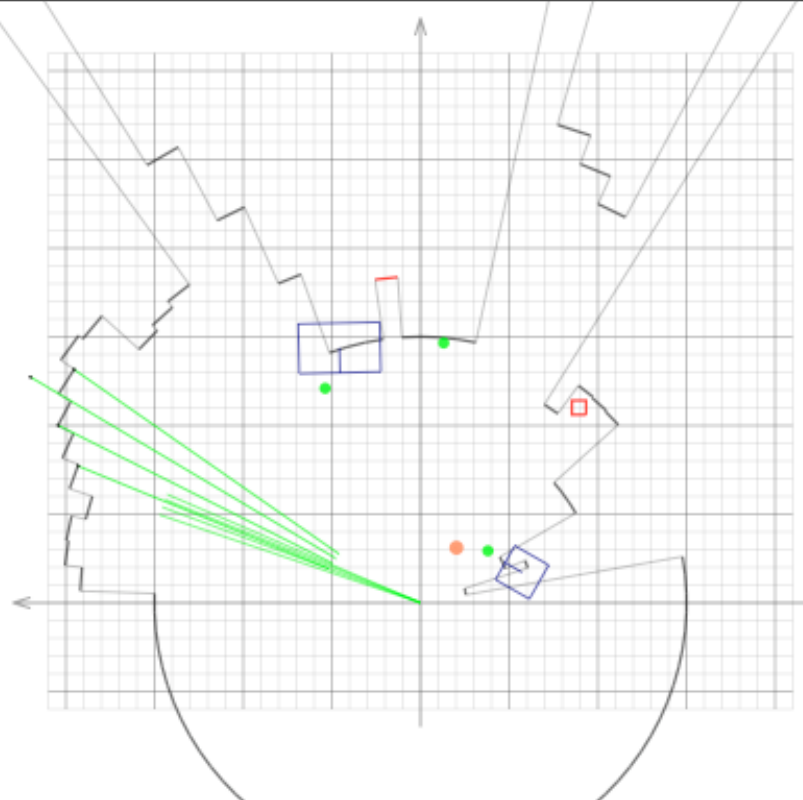
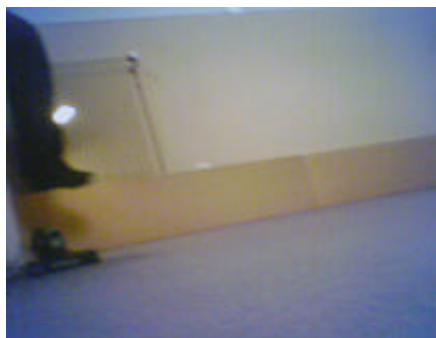
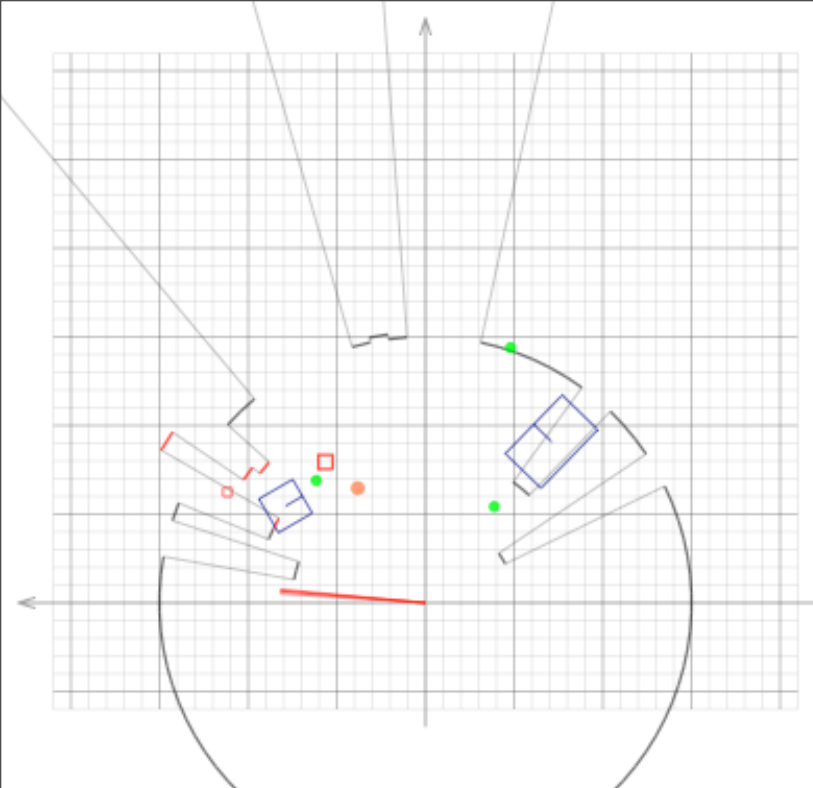
- A language game is a formalised interaction pattern between two or more agents.
 - Naming Game
 - Guessing Game
 - Description Game

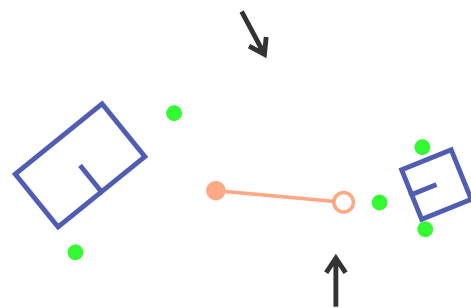
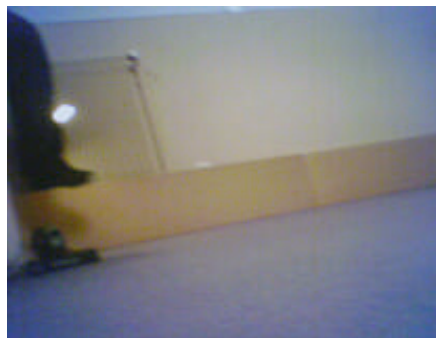
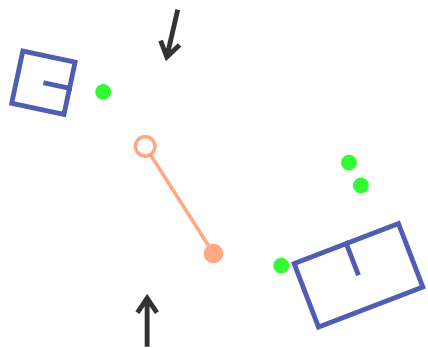
Language games



Modelling Usage-based learning

- Learning needs motivation
- To reflect the usage-based requirements we split up learning in two phases:
 - diagnosing of a problem
 - repairing (either inventing or adopting)





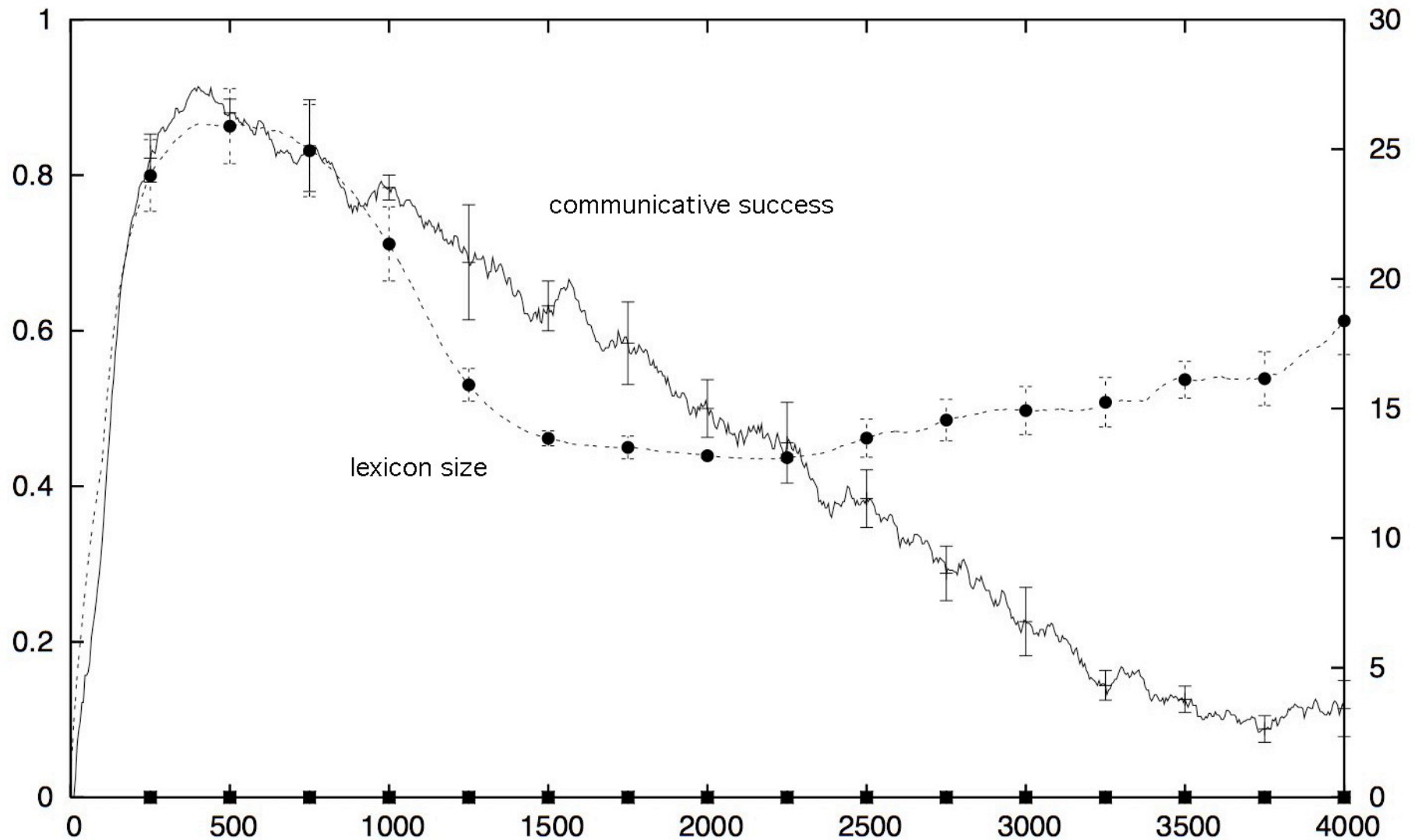
Experimental Setup

- Description Game:
 - Speaker describes a scene
 - Hearer interprets and forms a “mental representation” of the scene
 - Game is successful when the mental representation is very close to the described scene.
- Scenes become gradually more complex

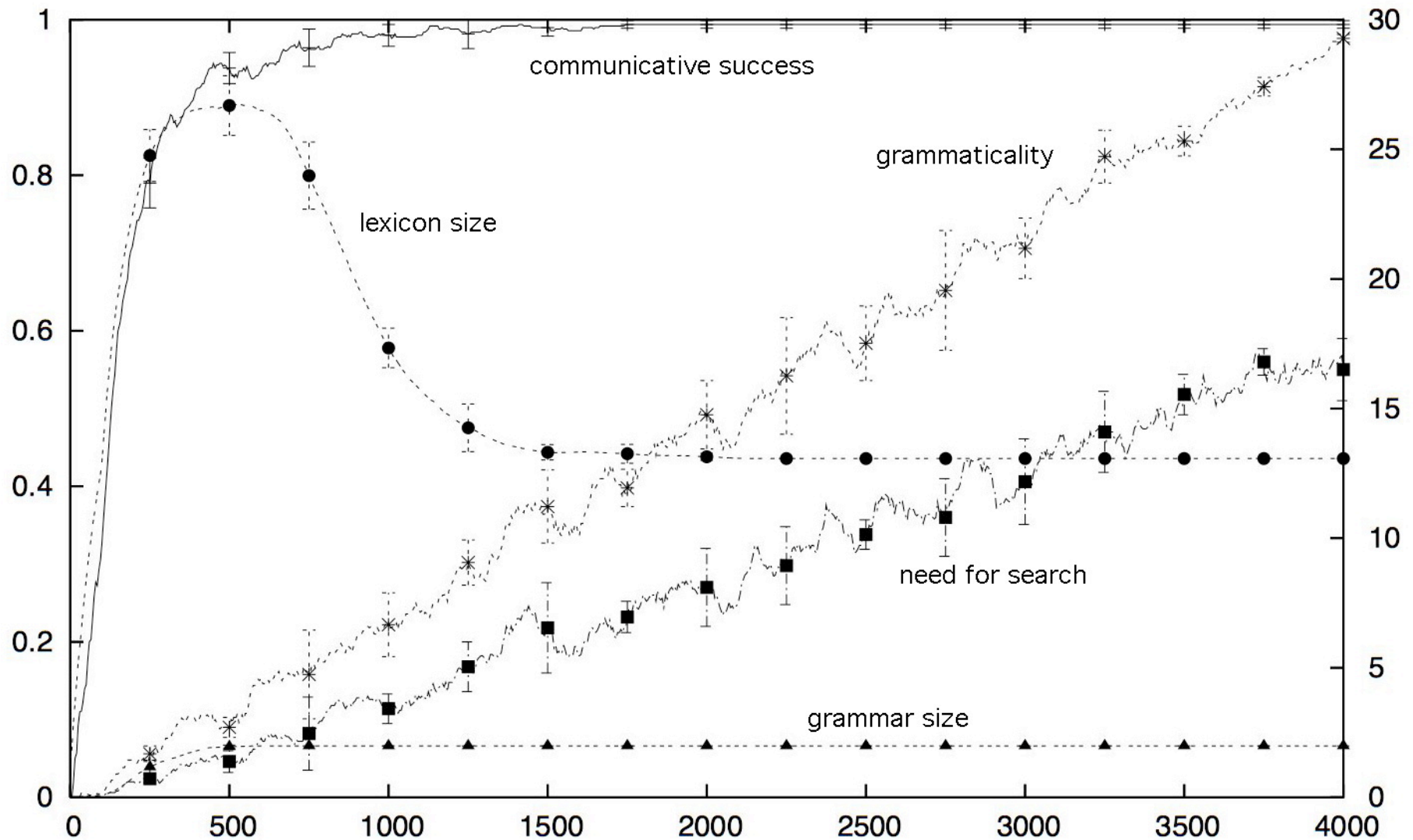
Experimental Setup

- Three stages:
 1. The agents can only introduce and adopt lexical constructions (words)
 2. 1 + the agents can introduce and adopt simple grammatical constructions.
 3. 2 + the agents can refine their existing constructions to minimize search in parsing.

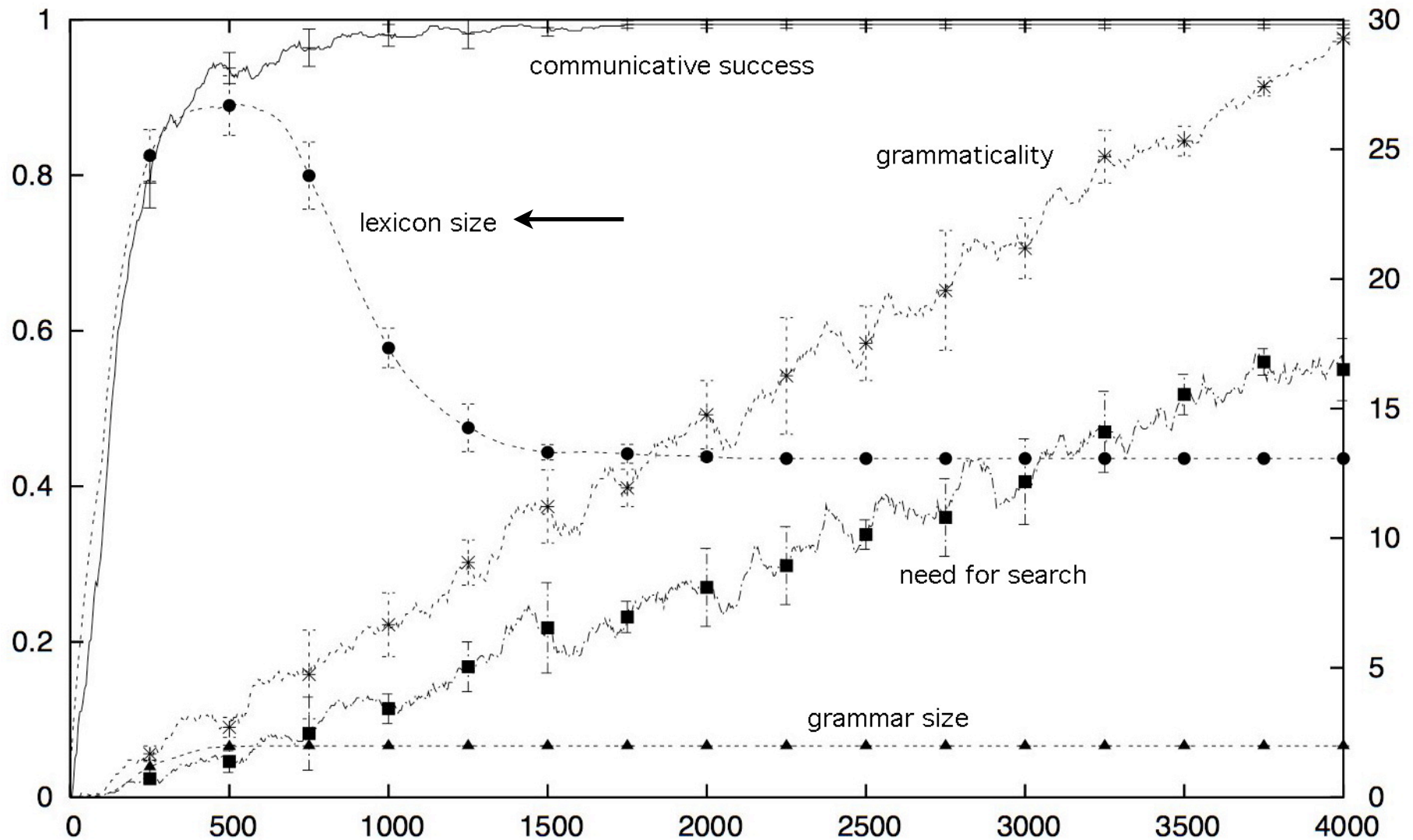
Results: Stage I



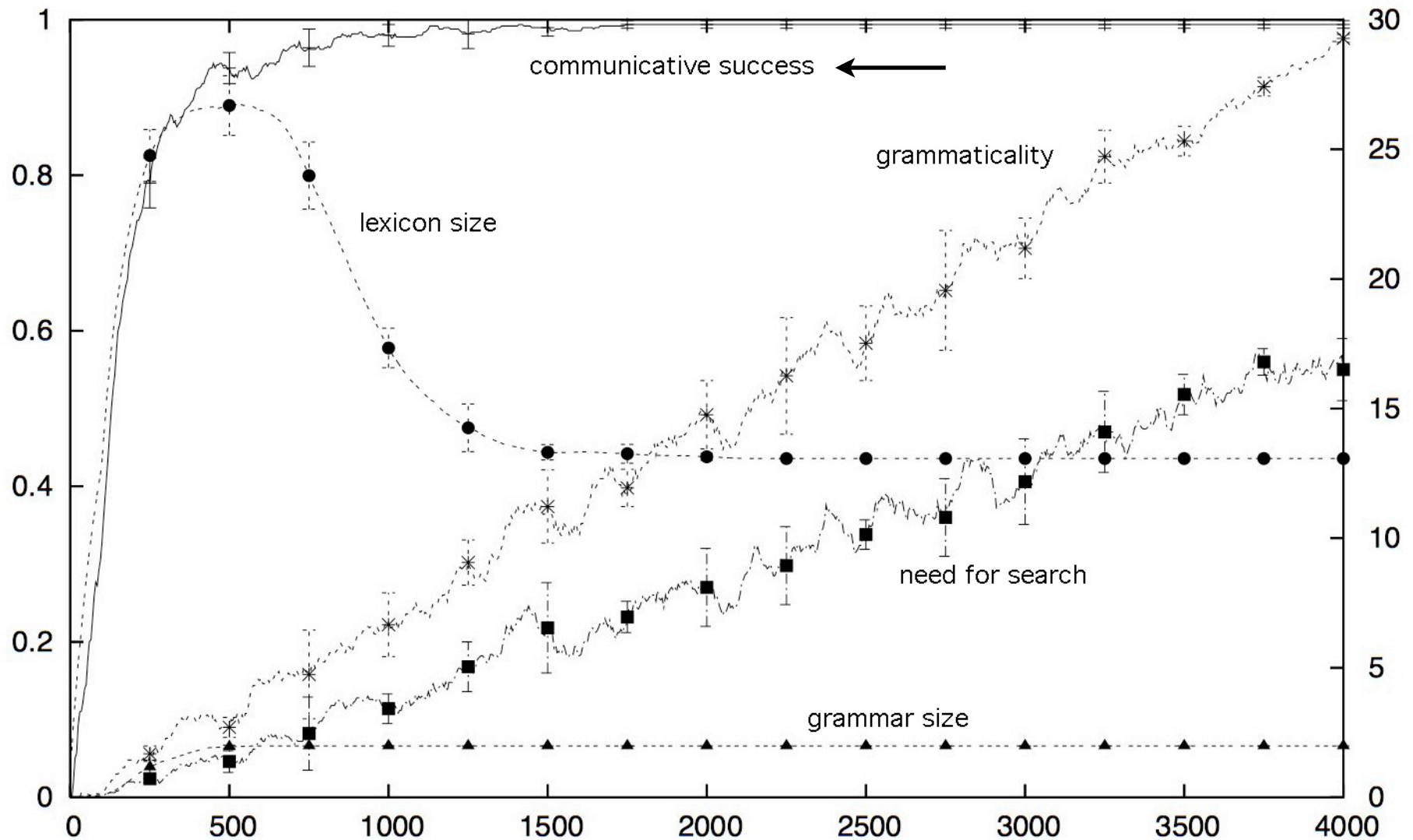
Results: Stage 2



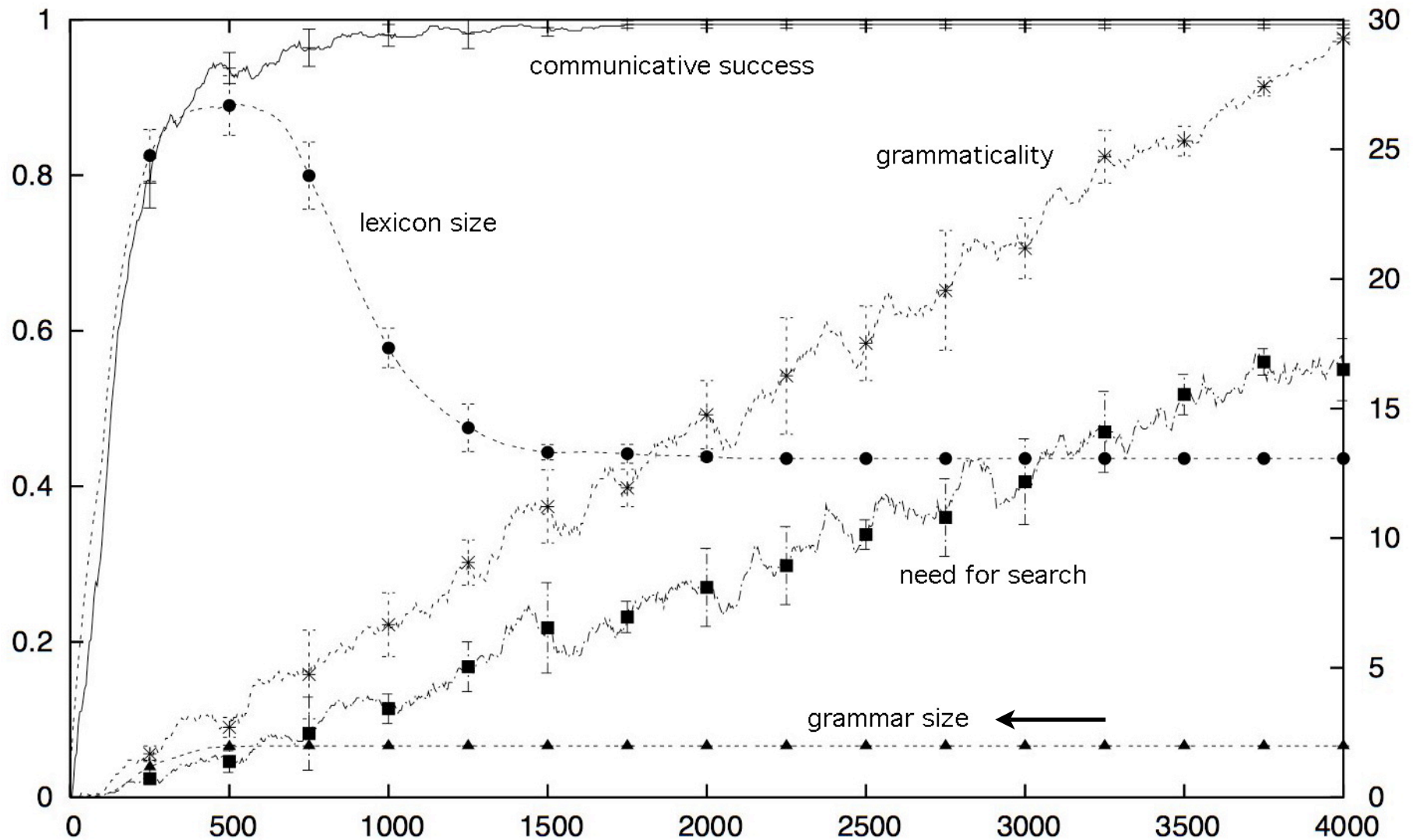
Results: Stage 2



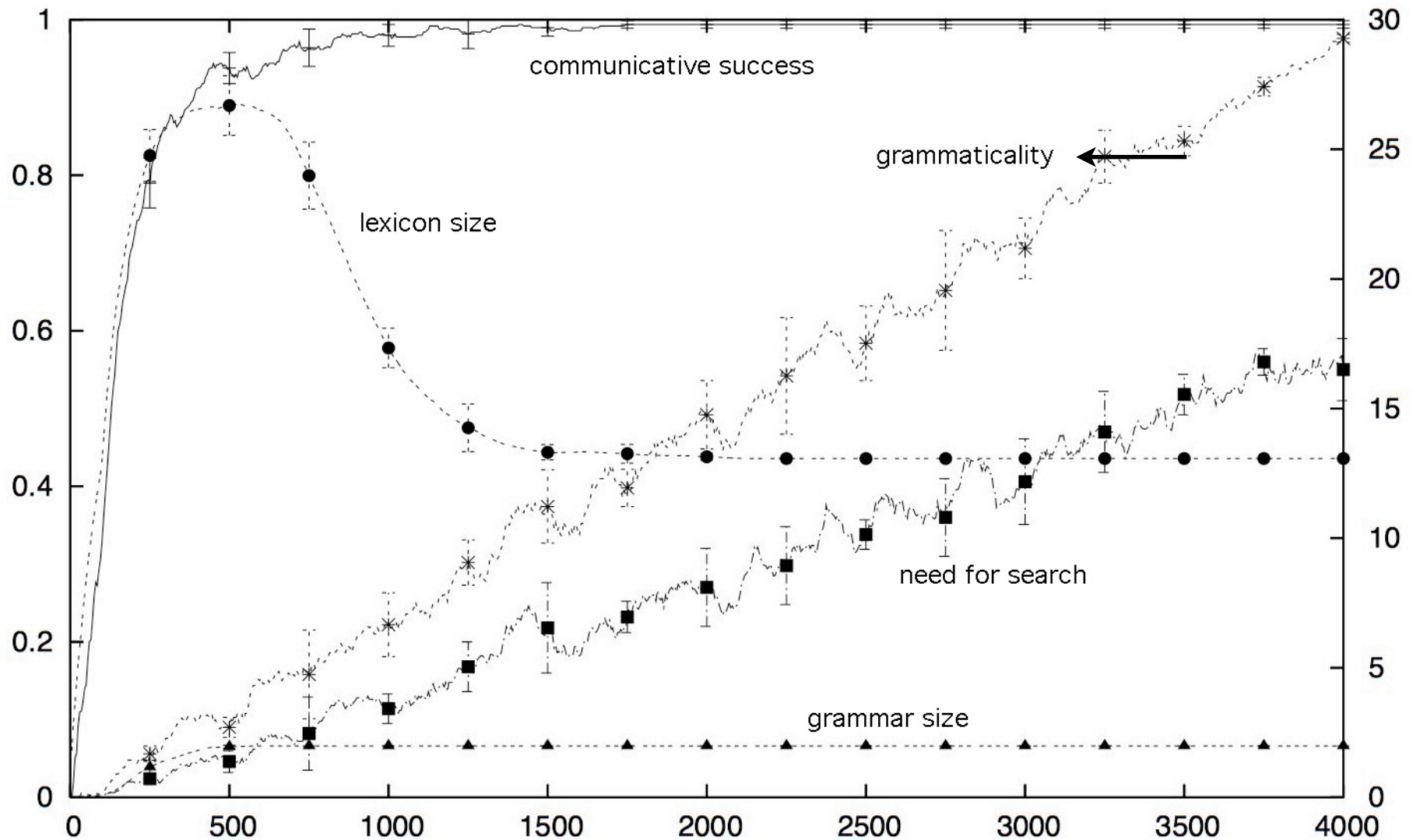
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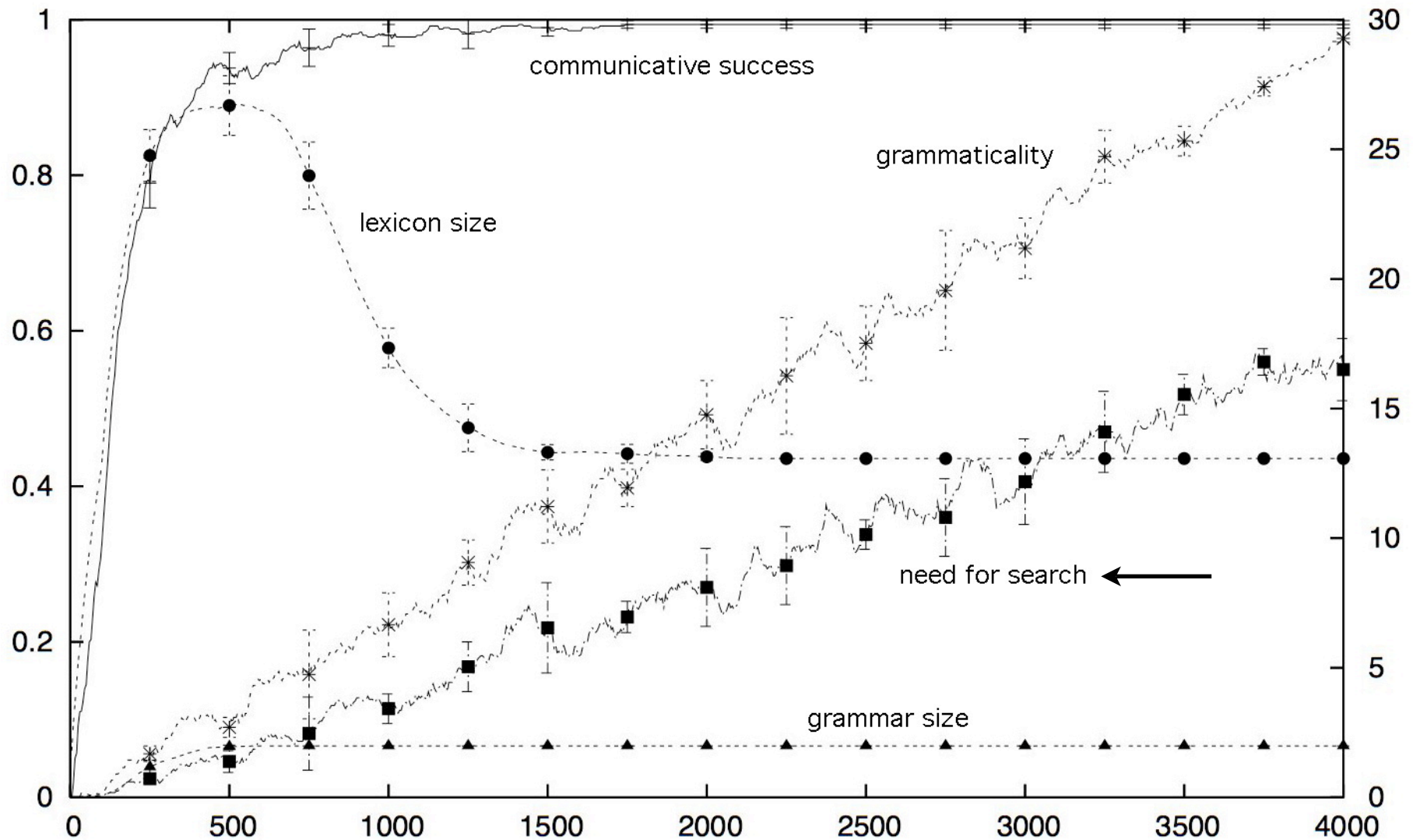
Results: Stage 2



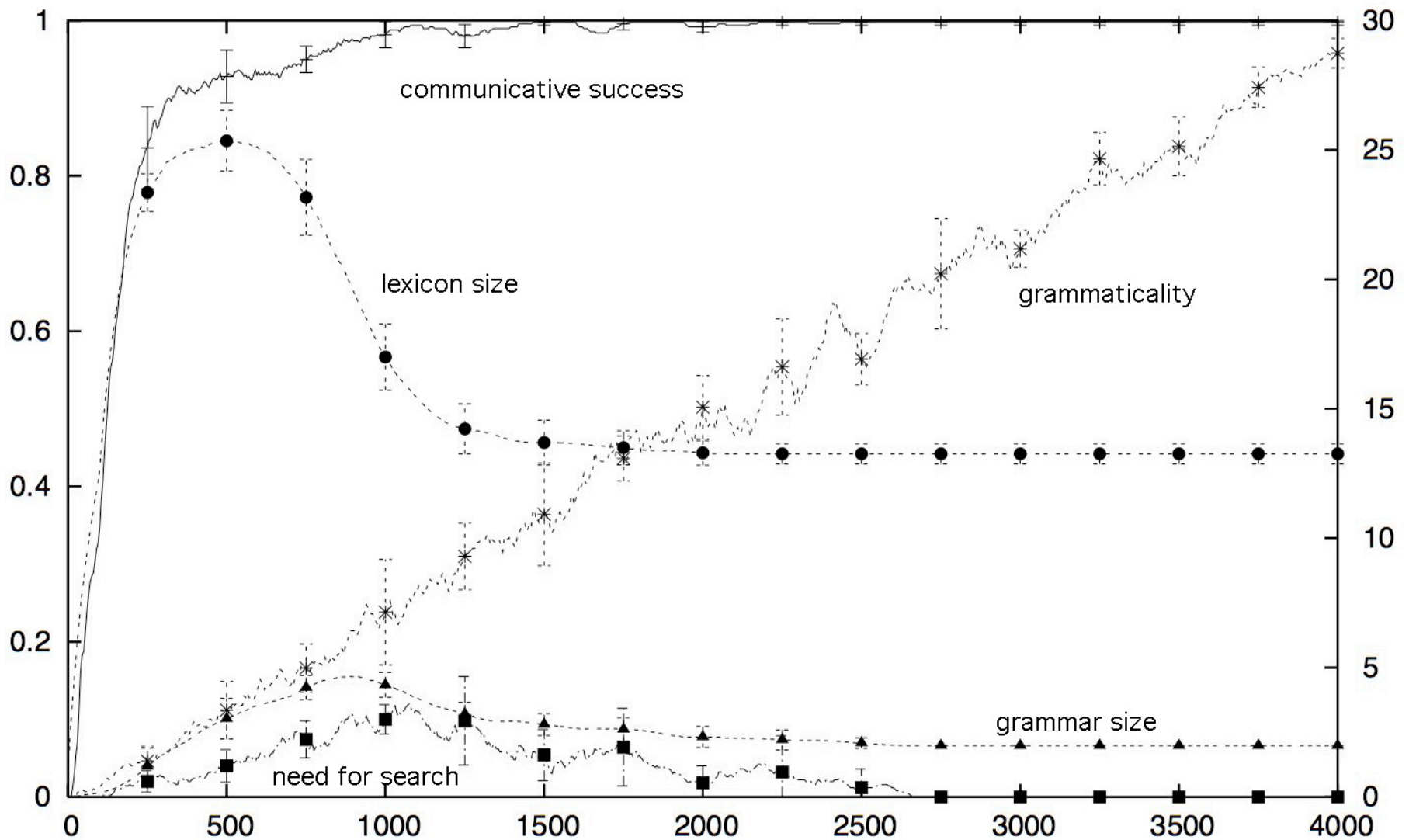
Results: Stage 2



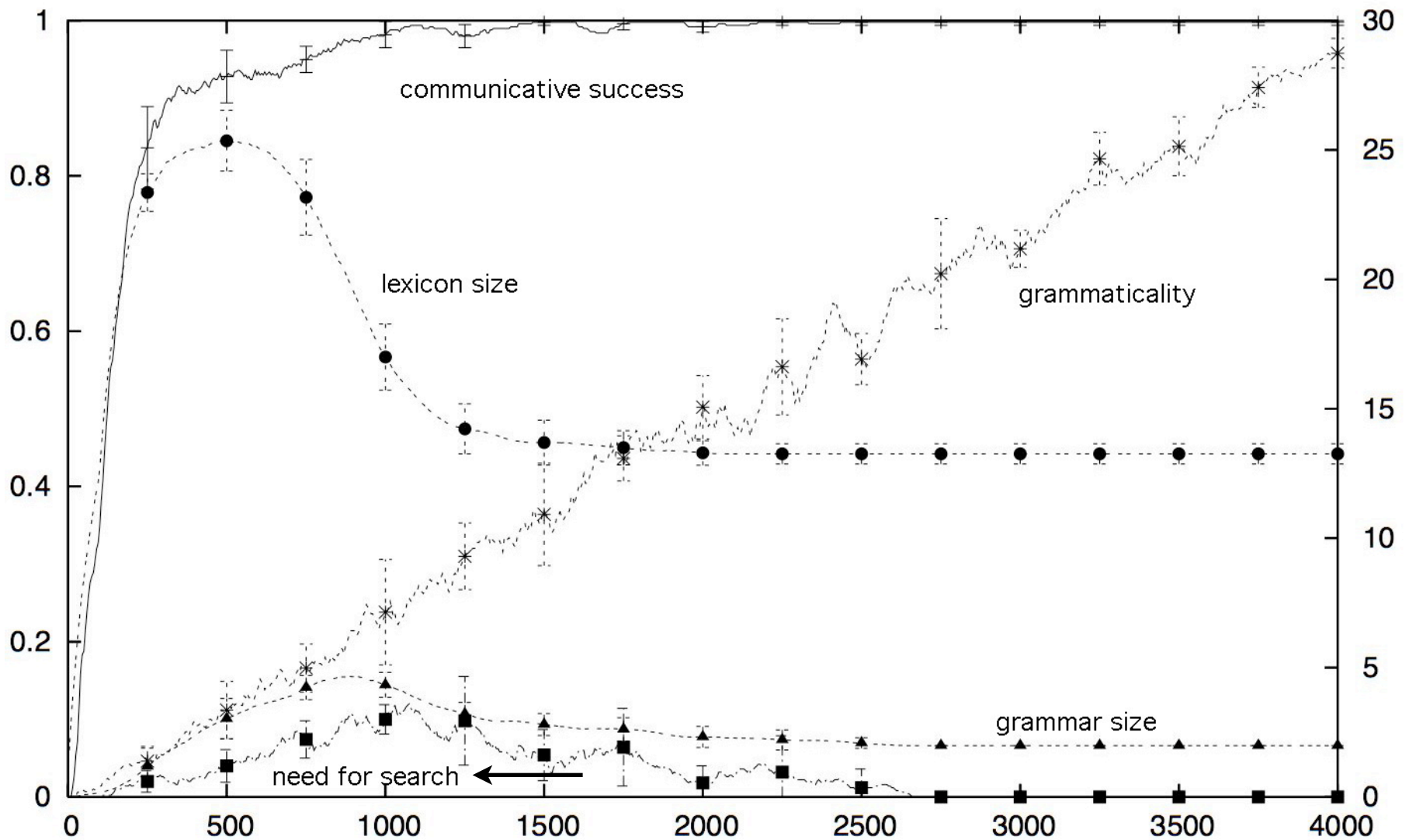
Results: Stage 2



Results: Stage 3



Results: Stage 3



Conclusion

- We started with a question
 - Why are grammatical constructions shaped the way they are?
- We proposed a hypothesis
 - Language users will optimize the constructions for minimising search during parsing.
- The experiment...
 - ... shows that even in very simple communication systems search in parsing becomes a problem
 - ... presents a model for solving these problems by refining the grammatical constructions.

Thank you



Thank you

Thank you

- The complete paper on the experiment:
 - Steels L. & Wellens P., How grammar emerges to dampen combinatorial search in parsing, Proceedings of the Third International Symposium on EELC, september 2006
- Links:
 - <http://arti.vub.ac.be> & <http://arti.vub.ac.be/~pieter>
 - <http://arti.vub.ac.be/FCG/>