

# Teaching without learning: Is it OK with weak AI?

Kristian Månsson & Magnus Haake LUCS (Lund University Cognitive Science)

## Summary

- Two different learning algorithms for a teachable agent were tested with respect to perceived intelligence, protégé effect, and learning in Swedish grade 5 and 6 students.
- A strong positive correlation was found between perceived intelligence and protégé effect, but no significant differences were found between the two different implementations of the learning algorithm.
- The results suggest that while the perceived intelligence of the agent relates to the induced protégé effect, this perceived intelligence might not correspond to the implemented intelligence algorithm – something for designers of teachable agents to consider.

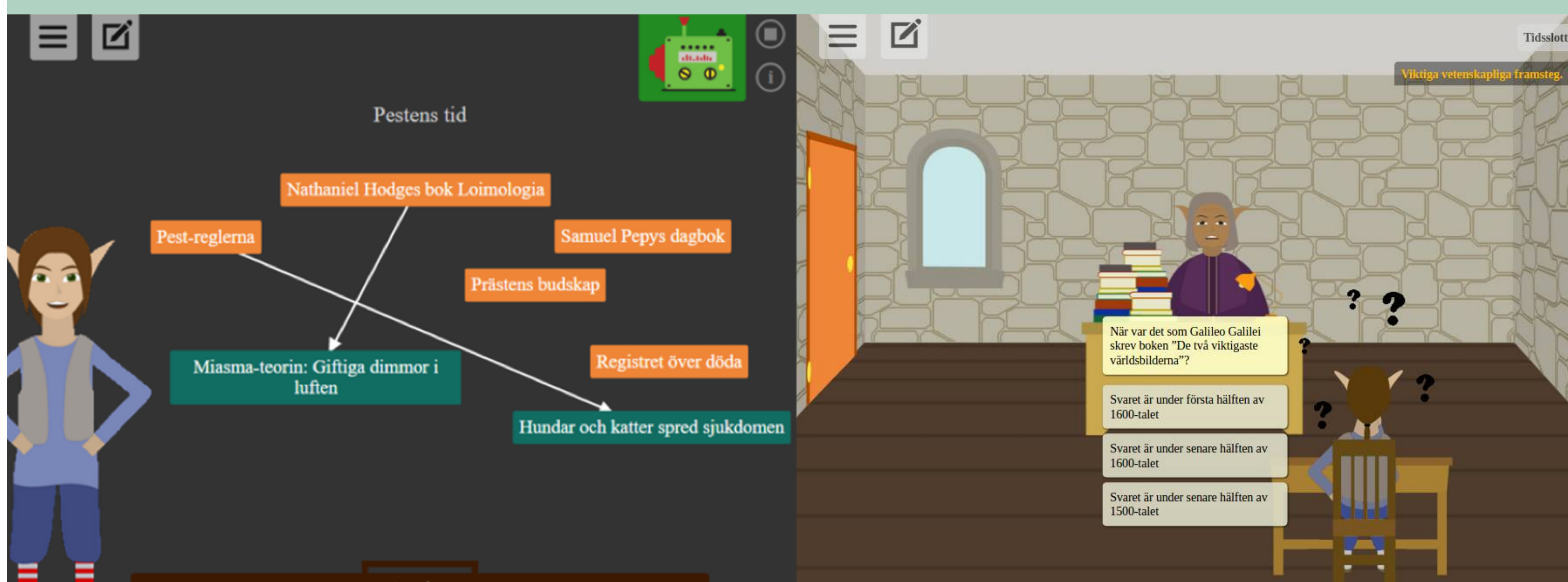
## Introduction

Studies have shown that the 'teachable agent' paradigm, i.e. 'learning-by-teaching' using teachable pedagogical agents in educational software, benefits learning by increasing students' sense of responsibility and supporting their metacognition. This effect, known as the *protégé effect*, is a

theoretical concept that describes the beneficial factors of the teachable agent paradigm in that students makes larger learning efforts when the goal is to teach an agent than when the goal is to learn for themselves (Chase, Chin, Oppezzo, & Schwartz, 2009).

## Discussion

- The behavior of the agent did not affect how the students experienced it.
- The strong correlation between perceived intelligence and the protégé effect indicates that either there is a common underlying cause or that they strengthen each other reciprocally. The underlying cause might, however, only be the students' general attitude towards the agent or the setting.
- This correlation also suggests that a teachable agent implementation doesn't need not focus exclusively on the learning algorithm of the agent.
- The low correlation displayed between the protégé effect and the learning outcome suggests that further validation of the measurement instruments should be undertaken.



## Experiment

**GUARDIANS OF HISTORY** is a teachable agent software aimed at middle school history education. The students are tasked with teaching a time elf (Timy) about history by first visiting historical scenes and persons and thereafter teaching the agent in so-called 'classroom activities'.

**TWO DIFFERENT ALGORITHMS** controlling agent learning were used: a simple recency algorithm where the teachable agent only 'knows' the latest facts that it has been exposed to, versus an associative learning model where the teachable agent becomes

gradually more certain of facts and behaves accordingly in different situations.

**A QUESTIONNAIRE** and a knowledge test were used as measurements for the protégé effect (adapted from: Kirkegaard, 2016), for perceived agent intelligence (adapted from: Bartneck et al., 2009), and for students' knowledge gains.

**A SWEDISH SCHOOL** was contacted for the experiment and 94 5th and 6th graders from 5 classes were recruited.

## Results

- No significant differences between the two agent algorithms could be established.
- There was a strong correlation ( $r = .64$ ,  $p < .001$ ) between perceived intelligence and the protégé effect.
- No correlation was found between protégé effect and score on the knowledge test.

## Further reading

### REFERENCES

- Bartneck, C., Kuli, D., & Croft, E. (2009). Measurement instruments for the anthropomorphism, animacy, likeability, perceived intelligence, and perceived safety of robots. *Int. J. of Social Robotics*, 1(1), 71-81.
- Chase, C., Chin, D. B., Oppezzo, M., & Schwartz, D. L. (2009). Teachable agents and the protégé effect: Increasing the effort towards learning. *J. of Science Education and Technology*, 18(4), 334-352.
- Kirkegaard, C., (2016). *Adding Challenge to a Teachable Agent in a Virtual Learning Environment*. Licentiate thesis, Linköping University, Sweden.