Learning interactions with artificial intelligences: a fallibilist perspective

Conference or Workshop Item

Learning interactions with artificial intelligences: a fallibilist perspective

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Abstract

After many false starts, the potential advantages of artificial intelligence for education are starting to appear. It remains in question, though, whether current theoretical frameworks are adequate for understanding processes of learning with artificial intelligence. This paper re-examines a recent study of children telling stories in collaboration with a virtual conversational agent, in which it was found that children who played with the agent told stories with more linguistically advanced characteristics than the stories of children who played with a friend. Conventional explanations in terms of "scaffolding" or that portray the agent as a "tool" seem to have limited predictive potential. It is argued that a fallibilist philosophy offers the potential of new insights and testable hypotheses in relation to such learning interactions with virtual peers.

Domain: Learning and Cognitive Science

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Aims

Artificial Intelligence has long been expected to offer the potential of huge advantages in education. While expectations of the imminence of general human-like artificial intelligence have scaled back considerably, there has been progress in the development of, for example, face recognition, speech recognition, speech output, location-awareness, and the chatterbot successors to ELIZA. The question arises, then, of how processes of learning with such artificial intelligences can be understood. This paper explores the question by re-examining a study of children telling stories in collaboration with a conversational agent.

The Sam study

Sam (Ryokai, Vaucelle & Cassell, 2003) is seen as an animated character aged about 6, projected onto a screen. In front of the screen is a physical toy castle (see the figure).

When a child arrives at the castle (detected with a motion sensor), *Sam* greets the child, waits for a response (detected using a microphone), and then tells a story involving a virtual figurine. At the end of the story *Sam* appears to put the figurine in the castle's tower, which contains a physical version of the figurine. The child is then encouraged to use the figurine to tell their own story. *Sam* appears to listen, watching where the child moves the figurine (using radio frequency identification), nodding, smiling, and occasionally prompting (e.g. 'And then what happens?'). Once the child returns the figurine to the tower, *Sam* tells another story. The child and *Sam* take turns as storyteller and listener. *Sam* uses developmentally advanced forms of linguistic expressions such as quoted speech, and temporal and spatial information.

In the study, eight five-year-old girls played individually with *Sam* and the castle, eight played individually with just the castle (i.e. without *Sam*), six played in pairs with *Sam* and castle, and six played in pairs with just the castle.

The researchers provide an example of a child taking turns with *Sam* to tell stories. The child's stories appeared to increase in complexity. To test this, the frequencies of spatial expressions, temporal expressions, and quoted speech in each child's stories were tallied and normalised with respect to the child's total storytelling time. The results suggest that these frequencies were significantly higher when *Sam* was present. Whether the children were alone or in pairs did not appear to make a difference. The researchers also suggest that *Sam* succeeded at eliciting more linguistically advanced stories from children over time, but that further research is needed to determine whether these behaviours were learned from *Sam* or whether *Sam* triggered pre-existing behaviours.

Conventional interpretations

Interpreting the role of the technology in this context as a "tool" does not seem greatly helpful. *Sam* is, of course, a research tool, and putatively a tool for developing children's linguistic skills. However, given the account by Ryokai *et al.* of the children's utterances and eye-gazes, it is plausible that the children were treating *Sam* as a peer, albeit an animated one.

In Activity Theory, if such agents are not tools, where do they fit? Seeing them as part of the "community" seems to go against Activity Theory's traditional emphasis on the asymmetry between humans and machines, and does not in itself explain the mechanisms by which children might be learning from *Sam*.

In Vygotskian ZPD terms, it is possible that *Sam* could be seen as a "more capable peer" that has the potential to scaffold learning. With this virtual peer, the children

might be learning "through their participation in activities that are slightly beyond their competence" (Ryokai *et al.*, p. 199). More specifically, the children reproduce *Sam's* superior linguistic behaviour and so enhance their own capabilities.

It could be argued, however, that while this hypothesis explains the putative increase in story sophistication, it does not explain *why* children reproduce *Sam's* linguistic behaviour; nor does it have much predictive power beyond testing the idea that changing *Sam's* behaviours might result in these behaviours being duplicated by the children.

A fallibilist interpretation

A contrasting approach is to analyse the interactions with *Sam* in a way that sees the children as engaged in a struggle to improve imperfect strategic theories in response to concerns (e.g. Aczel, 2006).

Firstly, what are the children's concerns? Rather than concerns of "acquiring literacy skills" or "collaborating effectively", it could be plausibly argued that the children's overriding concern is to produce entertaining narratives.

Secondly, what are the strategic theories? The kinds of linguistic expressions the children exhibit can be seen as strategic responses to this concern to produce entertaining narratives. So, for example, a strategy of using temporal references, spatial references, speech, names, variations in volume and pitch, and the like are all strategies for making stories more entertaining.

Thirdly, what opportunities are there to improve the strategic theories? Listening to a story provides me with an opportunity to observe my level of interest as the story progresses, and to try to discern what it is about the story or its telling that raises interest at different points. I can then try to deploy such narrative strategies in my own stories. Telling a story provides two kinds of feedback: I can listen to my own story as I tell it, to see how entertained I am by each narrative strategy; and I can observe the effect on the listeners.

This fallibilist interpretation immediately throws up some ideas to test. For example: Does lack of responsiveness from *Sam* have a dampening effect on the advanced linguistic expressions? Are children are simply copying *Sam* or do their stories show examples of narrative strategies that add to entertainment value even if *Sam* doesn't use them, or if *Sam* just listens, or if *Sam* simply facilitates turn-taking between pairs?

Fallibilist theory can also be applied more widely.

References

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