Summary of content:
This paper reports the combination of a computational model and a behavioural study with children and their parents. The behavioural study was also covered in Cheung et al. (2019), so there is some overlap; however, this paper contains the modelling we did to look at our predictions for the study, and includes more details about the behavioural study that we did with families.

Background: One of the issues surrounding how children learn language is how they learn a particular word and object belong together. For example, when a child sees an apple for the first time, and hears the word 'apple', how do they know the word refers to the fruit, and not the bowl it sits in, a part of the apple, or perhaps even the colour? Children manage to pick up language in very complicated environments with lots of different sources of information (e.g. a preschool classroom full of toys, wall hangings, people, other children, etc.), and they do this very quickly. This process seems to depend upon how children as 'learners' use the information available to them, and how parents as 'teachers' package that information for them.

We used a computational model to simulate how a 'child' or learner might learn words when information is packaged for them in a certain way. We asked the model to learn new words when there was one, two, or six possible objects for that word. We also changed how much information it got through a gesture cue. This used something called backpropagation, which allows a computational model to check learning as it goes along, by checking that what comes out of the model matches what we put in. The model learnt best when it was given gestures to help, but also surprisingly, learnt better with two or six objects (as opposed to when there was just one).

Using a computational model means we can simulate whether certain ideas will work in real life. However, it also means we have to check if these ideas translate to the real world, and this is what the behavioural study with children aged 18 – 24-months-old and parents allowed us to do.

We tested this model in families, examining whether parents might change their behaviour when teaching their child new words by asking them to teach their child a new word when there was one, two, or six possible objects for that word. In particular, we looked at how parents might use gestures such as pointing differently. We then looked at how well children learnt these words after their parents had taught them. Surprisingly, children did best when there were two or more possible objects - even more so than when there was just one. When teaching, parents also produced the most gestures for their children when there were more objects. This was very similar to the learning patterns that the computational model showed.

More broadly, this paper considers whether having some sort of comparison is useful for learning, how parents will help their children learn by using gestures to make sense of this comparison, and how learning might be best when there is some variety in the environment.

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