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Submitted

on September 20, 06:33 PM

for srcd2013

Proof

CONTROL ID: 1534556

PRESENTATION TYPE: Paper 1

TITLE: Reasoning by exclusion: faces & voices and searching for objects

ABSTRACT: Reasoning by exclusion requires a child to use what they currently know in order to eliminate possibilities and to construct new knowledge. Much emphasis has been given to how this kind of reasoning might help young children determine the referents of novel words in ambiguous contexts. Here, we demonstrate that children use similar reasoning to learn about new faces and voices and to determine the hidden location of familiar objects. Children's pointing and looking behavior showed that they are able to reason by exclusion across different domains.

In three experiments using a preferential looking procedure, participants were seated at a table and presented with two or more objects on each trial. After a measure of baseline looking preference, children were asked to find the target item. On critical trials, children could infer the target through reasoning by exclusion. We first aimed at replicating previous findings in the literature showing that children could infer that a new label must go with a novel object (i.e., "this object is called a 'ball', so that strange object there must be the 'dax'"). We then asked whether children could use similar strategies to map information about what someone looks like to information about what this person sounds like. When pictures of two faces were presented – one person that the child knew and one new person – and children heard a new voice speaking, they could infer that the new voice must belong to the new face because each person has only one voice (i.e., "that is not Charlie's voice I'm hearing, so it must be this new person who is talking"). We finally asked whether children could use reasoning by exclusion in a task with only familiar labels and objects, contrasting with the canonical referent-selection tasks involving novel words and objects. A new group of children were presented with an opaque hiding box that they knew held a particular animal (e.g., bear) and a second opaque hiding box they had not seen before and they were asked to find an animal they hadn't seen before (e.g., "can you find dog"). Children could reason via process-of-elimination to infer that the new animal (e.g., dog) must be in the new box (i.e., "the dog can't be in this box because I know that bear is already in there and dog wouldn't fit, so dog must be hiding in this new box").

In each experiment, participants' fixation times to both targets and distractors and their reaction times to change fixation were coded frame-by-frame from videotape. Both reaction time data and the course of looking throughout each trial revealed a pattern consistent with reasoning by exclusion. When asked to e.g., "point at the dax," participants systematically searched and rejected familiar object distractors before deciding to map the novel label "dax" to the novel object. Likewise for mapping faces to voices and finding hidden animals. Interestingly, the pattern of looking in each task was parametrically similar suggesting that, for preschoolers, reasoning by exclusion is a domain general learning strategy.

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