How Words Get Special

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Words seem to have a special status among perceptual signals. Having a label for an object changes the way it is categorized for both adults and children. For example, when asked to generalize an object name to new instances, children and adults generalize by shape. However, when asked to find an object that "goes with" another, they choose by overall similarity. A label also makes children's choices shift from thematic to taxonomic and from surface to more conceptual similarities.

Recent studies by Woodward and Hoyne (1999) and Namy and Waxman (1998) suggest that the power of words is not there at the beginning of development but rather that it emerges. At 13 months of age, babies seem willing to pair objects with any kind of signal, such as gestures and non-linguistic sounds. However, by 20 months of age children are more constrained in what they will take as a label, only taking words as labels for objects. This paper is concerned with how this special status of words develops. We propose that words get their special status by virtue of being systematically used for labeling categories. We present a connectionist model of this process and test a prediction that derives from the model.

The Model

We use a simple settling network to model an abstract version of Woodward and Hoyne's results. The network has an Auditory Signal Layer and a Visual Signal Layer connected through a Hidden Layer.

The training set consists of 20 "words" and their corresponding "objects". The words are presented on the Auditory Signal Layer and the objects on the Visual Signal Layer. We assume words are drawn from a constrained space of the possible values of the auditory dimension. The training set is constructed by randomly generating "words" and their corresponding "objects"; the pairings of words to objects are, thus, arbitrary. At the start of learning, words (that is, input from the constrained portion of the auditory space) have no special status over other inputs that may be paired with objects. During training, the word and its corresponding object (plus noise) are presented together and weights are updated using Contrastive Hebbian Learning. So, during training individual objects are systematically paired with words and unsystematically paired with other auditory or visual inputs.

After the network has reached 90% accuracy in the training set, the network is trained on novel word—object pairs and novel non-word—object pairs. Like the older children in Woodward & Hoyne (1999), the network shows an advantage when learning novel word-object pairs, that is when pairing objects to patterns in the Auditory Signal layer which are within the constrained space of words.

In this model, all that matters for achieving "special status" is the systematic pairing of objects with points in a constrained region of auditory space. Thus, any signal that correlates systematically with any feature becomes subsequently easily associated with it. Such systematic correlations do exist in the input to children, beyond words as labels for objects. For example, animals make sounds, so animals (animate features) should become easily associated with (animal-like) sounds. In the following experiment we test this prediction.

The Experiment

This study follows Woodward and Hoyne's procedure, except that the objects used are all unusual animal toys. Thirty-six 13 month-olds and thirty-six 20 month-olds were shown an animal and the animal was labeled for them. In the Word condition the object was labeled with a novel word (i.e. "Look! Dax See? Dax"). In the Animal Sound condition, the object was labeled with a non-linguistic vocal sound (i.e. "Look! Yeep yeep yeep See? Yeep yeep"). In the Arbitrary Sound condition a non-linguistic, non-vocal sound (i.e. a clap) was used instead. Between training trials, the babies were shown and allowed to play with toy animals that later served as distracters during the test phase.

During the test phase, children were presented with the target object and a distracter on a tray. The child was then asked, "Can you get the <label>?". The baby's choice was coded as the object that he or she removed from the tray.

The results show that while 13 month-olds in all three labeling conditions learn the label-animal correspondences, 20 month-olds only learn the associations in the Word and Animal Sound conditions. This result suggests that it is the systematicity of prior learned pairings that determine which associations will be formed.

References

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