

COSC421 2015 Assignment 3 (15%)

Infant word-meaning learning

There are two options for this assignment. The first is an implementation of one particular theory of word-meaning learning (an ‘associationist’ account called **cross-situational learning**). The second is an essay which compares the three main theories of word-meaning learning: associationist, constraint-based and social-pragmatic.

Option 1: an implementation of cross-situational word-learning

In this task, you should implement a model of the mechanism whereby an infant learns word meanings using **cross-situational learning**. You should assume that the infant already has a vocabulary of n ‘phonological’ word representations, and a set of n semantic concepts, which she can evoke from objects/actions in her environment. (Phonological words and semantic representations can be encoded however you like, provided there’s no inbuilt mapping between them to begin with.) You should model the infant’s environment as a **language**, and a set of **situations**.

- A language is a deterministic mapping between phonological words and semantic concepts. (This is what the child has to learn.)
- A situation is a pair: firstly, a sequence of semantic concepts, and secondly, a sequence of utterances. The semantic concepts reflect objects and/or actions which the infant chooses to observe in the situation. (Each situation only contains a subset of the infant’s total set of semantic concepts.) The utterances are sequences of phonological words which the child can hear being spoken by mature speakers of the language. In a given situation S , the words which feature in an utterance are more likely than chance to refer to semantic concepts in S .

Your word-learning system should learn the language by discovering the (noisy) mapping between words and semantic concepts in the set of situations you create. (N.B. You might find it useful to experiment with the notion of a phonological buffer, to allow each semantic concept to be associated with several phonological words, to speed up the learning process.)

For this task, you should also produce a report, introducing the cross-situational learning technique, describing how to run your code, and explaining how the code works.

Option 2: Essay

Write an essay with the following title:

Describe the **lexical-constraints**, **social-pragmatic** and **associative-learning** accounts of how infants learn the meanings of words. For each account, give an overview of some experiments which motivate the account. Which account do you think has most merit? Or is the data best modelled by some combination of these accounts?

Your main source for this essay should be the review in Chapter 3 of Ambridge and Lieven (2011). (You can email me for a PDF of this chapter.) But you should also look at some of the papers cited in this review, especially when outlining experimental evidence.

The essay should be around 3000 words (about 8 pages in a 12-point font).

Note: the Ambridge and Lieven chapter has a section at the end on ‘syntactic bootstrapping’. Syntactic bootstrapping is not a focus for this assignment, though you can discuss it if you wish.

Submission and marking

You should submit the assignment by email to me (alikh@cs.otago.ac.nz) by 5pm on **Monday of Week 11** (i.e. on **Monday 26th September**). 10% of available marks will be deducted for each day late. For the code assignment, I’ll give marks for code that performs the required tasks, and for a report which clearly introduces the tasks, explains how the code works, and evaluates the network’s performance. For the essay assignment, I’ll give marks for an essay which is well structured, and clearly presents and evaluates the relevant models.

References

Ambridge, B. and Lieven, E. (2011). *Child Language Acquisition*. Cambridge University Press, Cambridge, UK.