Testing a Model of Role Assignment

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Introduction

ACT-R is a general theory of cognition (Anderson, 1993) which is capable of learning the relative usefulness of alternative rules. In previous work (Matessa and Anderson, 1997), a model utilizing this implicit procedural learning mechanism explained results from a concept formation task created by McDonald and MacWhinney (1991). The same model explains results from a role assignment task for artificial languages created by Blackwell (1995). By focusing learning on one cue at a time, the model predicted a blocking phenomenon where certain cues came to dominate and block learning of other cues. This prediction was supported by the data from both of the experiments. This abstract describes results from a role assignment experiment designed to further test the blocking prediction of the model.

What is role assignment? When trying to understanding a sentence, people assign nouns to linguistic roles such as actor, patient, and recipient. In order to do this assignment, cues of the language such as word order, noun animacy, and case inflection are used. These cues may or may not be present in every sentence, and one cue may conflict with another cue as to the correct role assignment. These conflicts are resolved by the cue dominance hierarchy of the language, and cues higher in the hierarchy are more reliable than those lower in the hierarchy.

Method

The role assignment task used three linguistic cues (animacy, case marking, verb agreement) with varying degrees of reliability (cue A being the most reliable, followed by cue B, then cue C). For each subject, the reliabilities of the linguistic cues were randomly assigned. In the first training phase of the experiment, only cues A and C were present. For example, in a sentence with a verb and two nouns, only one noun could have the same morphological suffix as the verb (verb agreement cue present) and only one noun could have a nominative marker (case marking cue present), but the nouns would be either both animate or both inanimate objects (animacy cue not present). In the next training phase, all cues were available, and in the testing phase, only cues B and C were available. The model predicts that the early use of the A and C cues could block experience with the B cue, with the consequence that in the testing phase, cue C may seem to be more reliable than cue B. In about half of the simulation runs with the same stimuli and amount of exposure as the experiment, cue B is seen as more reliable. In the other half, cue C is seen as more reliable and its use blocks the learning of the true reliability of cue B.

The experiment also had four instruction conditions. In the first, an explicit description of the three cues was given along with practice using the cues, and subjects were told there was no time limit for their decisions (practice/not-speeded). The second condition was the same as the first, but subjects were told that they should work as quickly and accurately as possible (practice/speeded). The third condition did not mention the three cues and subjects were told there was no time limit (no-practice/not-speeded). The fourth condition did not mention the three cues and subjects were asked to work as quickly and accurately as possible (no-practice/speeded).

Results and Discussion

Only half of the subjects in the three speeded or no-practice conditions preferred cue B over cue C in the testing phase. However, nearly all of the subjects in the one practice/not-speeded condition preferred cue B over cue C. These results support the prediction of the model that subjects using implicit learning (in the speeded or no-experience conditions) might not learn that cue B is more reliable than cue C. This is not due to subjects being insensitive to the reliability of the cues, since in all conditions subjects preferred the more reliable cue A over cue B and cue C over 89% of the time. The ability of one model to explain results from three different experiments suggests its learning mechanism is a useful explanation of learning in role assignment tasks.

References

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