Functional pressures in (artificial) language learning

Why do languages share structural similarities? The functionalist tradition has argued that linguistic universals reflect the pressures on language use: languages have evolved to suit the needs of their users (e.g. Bates & MacWhinney 1982; Hawkins 2004). The exact mechanisms of this process are, however, unclear. Evidence from acquisition supports the idea that language structures may be shaped by learning biases (Newport & Aslin 2005; Culbertson & Smolensky 2009). We investigate whether the biases operating in language acquisition are at least partially driven by functional pressures.

We address this question in a series of artificial language learning experiments, which assess the extent to which learners (efficiently) reduce ambiguity in a language. In **Experiment 1** participants learned one of two verb-final languages (in 4 sessions distributed over 4 days) that differed in the presence of case-marking on the object. Subjects were never case-marked. In both languages, all objects were animate and subject-before-object order was dominant (SO, 63%) compared to object-before-subject order (OS, 37%). Thus, the actor was ambiguous in the non-case-marking language. The languages contained 10 verbs in 4 subcategorization classes, differing in their precise proportions of SO- to OS bias. Learners tended to generalize to the dominant word order in both comprehension and in production, suggesting that, in the absence of case-marking, language learners reduce ambiguity in the language by fixing the word order. This effect is not due to arbitrary mistakes since participants *did* learn verb biases accurately. This trend in acquisition offers an account of natural phenomena such as the loss of free word order from Old to Modern English.

In the no-case languages in Experiment 1, *all* sentences were potentially ambiguous. **Experiment 2** assessed whether learners reduce ambiguity even when it is limited to certain types of sentences. Participants learned a language with 10 verbs and 15 nouns. SOV order was dominant (80% SOV, 20% OSV). Unlike in Experiment 1, 50% of the sentences contained inanimate objects, so that they were always unambiguous. Case-marking was optional (no case-marking for subjects, 60% case-marking for objects, independent of animacy and word order). As expected if learners have a rational bias against systematic ambiguity, case markers were more likely to be retained for otherwise ambiguous sentences with two animate referents. This pattern mirrors differential case-marker systems (Aissen 2003; Lee 2006). We also observed partial word order freezing as typical in obviation systems: Case-marking was almost categorically present in learners' productions when the marked OSV order was chosen.

The data from these two experiments suggest that biases in acquisition are reflected in typological grammatical patterns and might account for structural similarities found in natural languages. These biases seem to be at least partially functional in nature: Even if other alternatives were allowed in a language, the participants in our experiments learned the structures that reduced systematic ambiguity more readily.

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