A cross-linguistic experimental investigation of Universal 20

Alexander Martin[1], Theeraporn Ratitamkul[2], Klaus Abels[3], David Adger[4], & Jennifer Culbertson[1]

[1]Centre for Language Evolution, University of Edinburgh
[2]Chulalongkorn University
[3]University College London
[4]Queen Mary University of London

Of the 24 possible orderings of the nominal modifiers Demonstrative, Numeral, Adjective and the Noun, two specific patterns dominate the typology: Dem Num Adj N (as in English) and its mirror order N Adj Num Dem (as in Thai, Greenberg, 1963). This has been argued to follow from a universal underlying structure in which Adj forms a constituent with N first, Num scopes over that constituent, and finally Dem takes widest scope (Abels & Neeleman, 2012; Cinque, 2005; Culbertson & Adger, 2014). It turns out that Dem Num Adj N, N Adj Num Dem and the six other linearisations which preserve this constituent structure are much more common cross-linguistically than those which do not (e.g., N Dem Num Adj, as in Kitharaka). We will call the former *scope-isomorphic* patterns.

Previous experimental work has suggested that learners spontaneously assume that new languages they learn will be scope-isomorphic. Culbertson & Adger (2014) taught English-speaking participants a new version of English where individual modifiers follow rather than precede the noun. When asked how postnominal modifiers should be ordered relative to one another in two-modifier noun phrases (which they were not trained on), nearly all participants chose scope-isomorphic word orders (e.g., Adj Dem) rather than following the surface order of their native language (e.g., Dem Adj).

Interestingly, the typological evidence points to a particularly strong preference for scope isomorphism in *pre*nominal orders; while some (albeit few) non-scope-isomorphic languages with *post*nominal modifiers exist (e.g., Kitharaka's N Dem Num Adj), no attested languages violate scope isomorphism *pre*nominally (e.g., Adj Num Dem N). Indeed, a blanket ban on all such prenominal orders is built into a number of theoretical accounts of nominal modifier order (e.g., Abels & Neeleman, 2012; Cinque, 2005). In the present study, we set out to test the robustness of the effect reported in Culbertson & Adger (2014), and to extend it by exploring whether the preference for scope-isomorphic orders is stronger when learners are taught a new system with *pre*nominal modifiers.

Experiment 1 was a replication of Culbertson & Adger (2014), with similar materials and an identical design. Participants' task was to translate noun phrases from English into a new language. They were exposed to two types of nominal modifiers, creating three experimental conditions (viz. Demonstratives and Adjectives, Demonstratives and Numerals, or Numerals and Adjectives). During the training phase, participants were shown single modifier noun phrases in English (e.g., 'green chairs' or 'these pineapples') and heard a speaker of the new language translate the phrases, with all modifiers occurring *post*nominally (e.g., 'chairs green' or 'pineapples those'). Immediately after training, participants took part in a test phase. A subset of these trials contained a single modifier phrase and were used as a measure of baseline performance. Participants whose accuracy on these trials was under 85% were excluded from data analysis. The critical trials contained noun phrases with two modifiers (e.g., 'these green chairs' or 'those two pineapples') and participants were asked to guess which word order the new language would use.

A total of 104 participants were recruited from the University of Edinburgh, and were split randomly among the three conditions. All the participants surpassed the 85% threshold set for single-modifier trials. Performance is illustrated in the left panel of Figure 1.

Participants chose postnominal scope-isomorphic orders reliably above chance level in all conditions (Dem-Adj: $\chi^2(1) = 15.4$, $p < 0.0001$; Dem-Num: $\chi^2(1) = 13.1$, $p < 0.0001$; and Num-Adj: $\chi^2(1) = 13.2$, $p < 0.0001$). We thus replicated the results of Culbertson & Adger (2014), suggesting that scope isomorphism is indeed preferred postnominally.

In Experiment 2, we focused on the hypothesis that the preference for scope isomorphism is stronger for prenominal modifiers. To test this, we thus turned to a language with a postnominal scope-isomorphic noun phrase word order: Thai. Using the same procedure as detailed above, but using Thai language stimuli, we taught Thai participants a new language with *pre*nominal modifiers.

A total of 107 participants were recruited from Chulalongkorn University in Bangkok, and were split randomly among the three conditions. One participant was excluded because they did not reach the 85% performance threshold on single-modifier trials. Performance is illustrated in the right panel of Figure 1. As in English, Thai participants chose scope-isomorphic word orders reliably above chance level in all conditions (Dem-Adj: $\chi^2(1) = 71.5$, $p < 0.0001$; Dem-Num: $\chi^2(1) = 42.6$, $p < 0.0001$; and Num-Adj: $\chi^2(1) = 34.6$, $p < 0.0001$). This result reinforces the claim that scope-isomorphic orders are preferred.

To test the relative strength of the preference for scope isomorphism prenominally vs postnominally, we merged all three conditions in each experiment. We thus compared the proportion scope-isomorphic choice (prenominal for Thai speakers, postnominal for English speakers) of the 107 Thai participants to the 104 Scottish participants. We found that Thai participants did indeed show a stronger preference for scope isomorphism ($\chi^2(1) = 10.1$, $p < 0.01$), suggesting the possibility that prenominal orders which violate scope isomorphism are particularly dispreferred.

To summarise, here we have provided additional evidence that language learners infer scope-isomorphic patterns, and therefore that a cognitive bias for such patterns may underlie their typological frequency. We found this both in learners of a new language with postnominal modifiers (English speakers), and in learners of a new language with prenominal modifiers (Thai speakers). We also found possible evidence to support the hypothesis that the preference for scope isomorphism is stronger when the new language modifiers are prenominal, again tracking the typology closely. However, we will also discuss the possible influence of L2 knowledge (specifically Thai speakers' knowledge of English) on these results, and outline future studies designed to tackle this issue.

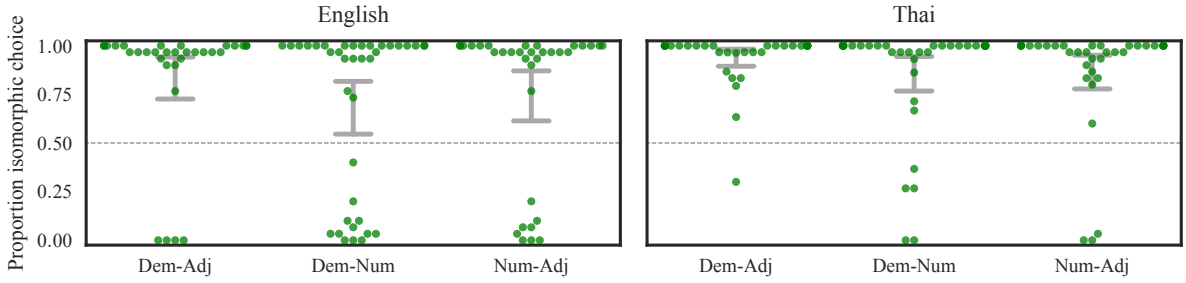

Figure 1: Average proportion scope-isomorphic choice by English speakers (left) and Thai speakers (right) on two-modifier trials. Each point represents a participant. The error bars represent standard error of the mean and the broken line represents chance-level performance.

References

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