Learnability effects in children: are more structured languages easier to learn?

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Cross-linguistic differences in morphological complexity could have important consequences for language learning. A recent study by Raviv et al. (2021) showed that adults learn highly systematic artificial languages faster and more accurately than semi-, or non-structured artificial languages, suggesting that some languages may be acquired faster than others. However, these findings are limited in two ways. First, they are based only on adult learners, despite the fact that children are the most prototypical language learners in real-world situations and may differ in their learning biases from adults (e.g., Culbertson & Newport, 2015; Hudson Kam & Newport, 2005, 2009; Newport, 2020; Schuler, 2017; Tal & Arnon, 2022). Since children are often seen as the agents of language emergence (Senghas et al., 2004), their performance is thus a necessary test case for the hypothesis that languages with more regular, compositional, and transparent grammars are easier to learn, and that children may introduce more structural innovations during generalization. Second, it remains unclear how individual differences in learning-related cognitive capacities such as working memory and selective attention may impact these effects. For example, learners with better working memory might benefit less from the existence of more regularity, as they may be better able to remember all unique forms, without the need to rely on regularities. Addressing these limitations is important for refining theories on language evolution and the origin of linguistic diversity. Therefore, in this pre-registered study we extend previous findings to child learners, as well as test for the role of individual differences. The full pre-registration can be found at https://osf.io/w89ju.

Participants (105 adults and 105 children aged 8-11 years, all native Dutch speakers) first learn one of three child-friendly artificial languages, based on three artificial languages used in Raviv et al. (2021) (for details, see pre-registration). These child-friendly languages consist of 12 scene-label pairs, and vary in their level of compositional structure, i.e., the degree to which similar meanings were systematically expressed using similar strings: ranging from highly systematic languages (structure score 0.86), medium structured languages (structure score 0.67), to unstructured languages (structure score 0.36). After training, participants are tested on their knowledge of the language they learned and then complete an additional generalization test, where they are asked to produce labels for six new scenes not included in the training. Finally, we assess participants' working memory and selective attention using a Digit Span Backward test (Semel et al., 2010) and the Map Mission subtest (Manly et al., 2003; Robertson et al., 1994).

Data collection is still ongoing, but preliminary results from N=36 children and N=46 adults (Figure 1) show that adults outperform children during test and generalization – in line with previous artificial language learning experiments (Ferman & Karni, 2010; Perry et al., 2016; Raviv & Arnon, 2018). Both children and adults seem to show a learning and generalization advantage for more structured languages, supporting our prediction that the positive effect of systematicity is based on general principles of compressibility (Kirby, 2002; Zuidema, 2003) and should thus hold across one's lifespan. While working memory and selective attention may modulate this effect, we have not yet looked at individual differences given the relatively small size of the current dataset.

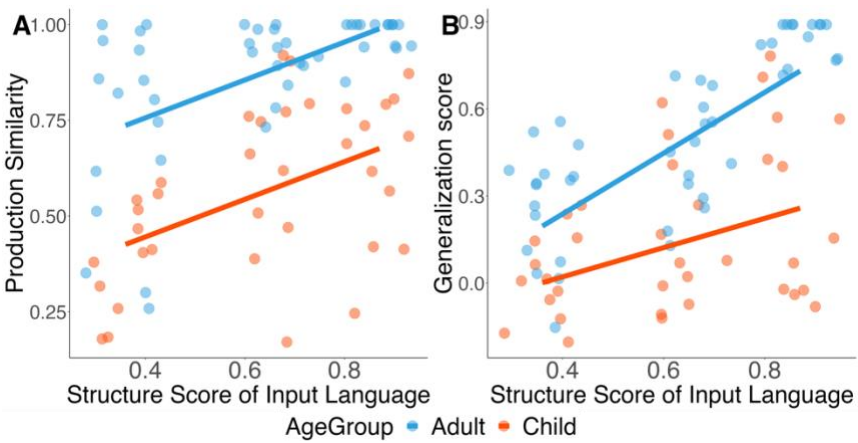

Figure 1 (A) production accuracy at test and (B) generalization scores for unseen items as a function of the language's structure score and age group. Each point represents the average of a single participant. The thick line represents the group average.

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