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Comment

Linguistic diversity and individual variation: Comment on “Rethinking foundations of language from a multidisciplinary perspective” by T. Gong et al.

Pablo Contreras Kallens^a, Rick Dale^b, Morten H. Christiansen^{a,*}^a Department of Psychology, Cornell University, Ithaca, NY, United States of America^b Department of Communication, UCLA, Los Angeles, CA, United States of America

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In their comprehensive review article, Gong, Shuai and Wu argue that theorizing about the foundations of language requires taking evolution into account—in particular, the cultural evolution of linguistic structure. We wholeheartedly concur with this point [2,9]. In this commentary, we further emphasize two features of language that support this account: linguistic diversity and individual variation. These are critical to bringing theories of language in line with evolutionary considerations.

Variation fuels evolution—without it, no *adaptive* changes are possible (though other types of change may occur due to non-adaptive processes such as random drift). Fortunately, as noted by Evans and Levinson [12], human language is perhaps unique among animal communication systems in its sheer diversity. There are currently between 6,000 and 8,000 different languages spoken in the world [12,15,21], and these vary substantially along every imaginable linguistic feature.

However, this diversity is not randomly distributed. On the contrary, there are statistical trends that govern these patterns [7,12,20], be it geographical [14], morphological [4], lexical [25,17], phonological [11,13], among others. As the target article shows, there has been substantial progress towards understanding the mechanisms that allow for language to emerge. However, there has been significantly less progress in determining both the general processes that allow languages to be diverse, and the specific processes that produce the patterns detectable in that diversity.

One of the better-studied processes that could drive diversity is the adaptation of language to the cultural community that speaks it. On a timescale of generations, a language culturally evolves to be learnable and usable [6,8]. However, different communities of language users are not necessarily homogeneous. They may have systematic differences in their processing and production mechanisms. Some of the relationships between these differences and language diversity have been explored. For example, Dediu et al. [11] hypothesize that slight but systematic differences in the vocal tract could underlie some of the phonological patterns such as the appearance and maintenance of click consonants.

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* Corresponding author.

E-mail address: christiansen@cornell.edu (M.H. Christiansen).

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Moreover, communities may also vary in their social and demographic features. For example, population size has been linked to linguistic patterns [18,24,17,19,22,26]. In general, these studies have shown that population size is inversely correlated with morphological complexity and positively correlated with lexical diversity. The proposed mechanism driving this particular pattern is the *Linguistic Niche Hypothesis* [18,10]: language adapts to the particular social structure of language learners. Thus, languages spoken in relatively isolated communities can remain morphologically complex because first-language learners (infants) have no difficulties learning them. In contrast, communities that span more territory, have a bigger population, or come into contact with communities where different languages are spoken more frequently, have a higher probability of being learned by adults. This creates a pressure for simpler structures that are easier to learn by adults. A clear historical example of this is provided by Bentz and Christiansen [3] with the gradual simplification of the case system of Proto Indo-European in both its Germanic- and Latin-derived descendants.

Although not as well-explored, relationships between linguistic patterns and the structure of the environment have been documented. Iterated learning experiments have shown that varying environments in communication tasks produces differently structured linguistic systems after an evolutionary process of several generations [23,27]. All of these languages allow the participants to communicate efficiently, but they take on distinct forms in a manner adapted to their environments. Christensen et al. [5] specifically test the syntactic structure of languages resulting from iterated learning. They found that different environmental and social-interaction pressures shape the word order (either SVO or SOV) of the gestural languages that emerge out of the interaction of their participants. These experiments are consistent with the large scale analysis carried out by Regier et al. [25] showing, after very rigorous statistical control, that higher temperatures are correlated with the tendency to use the same term for ice and snow.

These studies of linguistic diversity all presuppose another kind of variation: differences in linguistic abilities within a particular population. This kind of individual variability is rarely, if ever, explored directly—but without it linguistic divergence may not be possible. Indeed, computational simulations by Baronchelli et al. [1] have demonstrated that only a learning-based foundation for language acquisition (allowing for individual variation) is compatible with linguistic diversity. Fortunately, again, psycholinguistic studies of both children and adults have demonstrated that language users within a given speech community vary substantially in their language skills, from phonology and morphology to syntax and pragmatics [16], thus providing the needed within-population variance to fuel the cultural evolution of language.

We agree with the evolutionary emphasis of Gong and co-authors. Here, we have highlighted that mapping the sources of variation—across and within language communities—offers continuing challenges to getting specific about the cultural evolutionary forces shaping the languages that we observe today.

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