

## REPLY TO PIANTADOSI AND KIDD: Endogenous content

Jeffrey Lidz<sup>a,1</sup>, Chung-hye Han<sup>b</sup>, and Julien Musolino<sup>c</sup>

Piantadosi and Kidd (1) raise three important issues concerning the mismatch between the grammars of children and their parents, and the role this mismatch plays in arguing for learner-internal factors shaping grammatical development. First, in other domains, a lack of correlation between children and adults would be taken as evidence for exogenous factors. So why should we conclude in this case that such a mismatch provides evidence for endogenous factors? Second, Piantadosi and Kidd argue that an apparently random selection of a grammar could not provide evidence for endogenous forces. Third, Piantadosi and Kidd observe that many nonparental sources of information could play a role in shaping language outcomes, including differences wholly unrelated to language structure. We address these issues in turn.

Language, unlike other cognitive systems, is used for communication. This creates instrumental pressures for learners to acquire a language that reflects the language of their community. In light of these pressures, there are two ways to identify endogenous sources of linguistic structure. The first, often associated with Chomsky's argument from the poverty of the stimulus (2), is to show that the acquired structure is richer than what can be gleaned from the environment alone. The second is to show that children project beyond their input in ways that are constrained, but that are not a pure reflection of the input. This is what our paper (3) shows.

Indeed, the constrained projection we observed answers Piantadosi and Kidd's (1) second concern. We (3) report on two negative constructions and their interpretations with quantificational objects. Absent any

constraints, there are three options for each construction: wide scope negation, narrow scope negation, and ambiguity. Because there were two constructions, this means nine possible ways to generalize. But we did not find either adult or child Korean speakers distributed among these nine options. Instead, we found only two grammars: the ones that followed from the theory of verb-raising we discuss in our report. Moreover, the two constructions were strongly correlated, which is unexpected if learners generalized randomly. The high correlation across the two constructions (and within individuals, across time) thus provides evidence for endogenous linguistic content that restricts how learners generalize beyond the input.

Finally, Piantadosi and Kidd (1) observe that there are many extralinguistic factors that could contribute to which grammar children chose, some sociolinguistic, others psychological. We agree. However, we note first that these children come from a relatively homogenous speech community and were all enrolled at the same preschool, so factors associated with sociolinguistic variables or with the influence of peers or teachers are not very likely to have contributed to the variability. Second, there could be variability arising from factors like memory, attention, or executive function; but these factors could only contribute to which choice the learners made, not to defining the constraints on generalization within which this choice is made. The endogenous structure lives in the linguistic content of the acquired grammars. It is the constraint on the kinds of generalizations learners can reach, not the mechanisms for reaching a particular generalization from that set.

**1** Piantadosi ST, Kidd C (2016) Endogenous or exogenous? The data don't say. *Proc Natl Acad Sci USA*, 10.1073/pnas.1600603113.

**2** Chomsky N (1975) *Reflections on Language* (Pantheon, New York).

**3** Han C-h, Musolino J, Lidz J (2016) Endogenous sources of variation in language acquisition. *Proc Natl Acad Sci USA* 113(4):942–947.

<sup>a</sup>Department of Linguistics, University of Maryland, College Park, MD 20742; <sup>b</sup>Department of Linguistics, Simon Fraser University, Burnaby, BC, Canada V5A 1S6; and <sup>c</sup>Department of Psychology, Rutgers University, Piscataway, NJ 08854

Author contributions: J.L., C.-h.H., and J.M. wrote the paper.

The authors declare no conflict of interest.

<sup>1</sup>To whom correspondence should be addressed. Email: jlidz@umd.edu.