

Much second-rate research would likely not get reported. Poor science journalists would move into less-specialized fields. Good journalists would flourish and work faster.

Nobody would mourn the embargo. It's a wonder we editors still defend it. But which medical or science journal will move to erase the embargo first? Ah, there lies the rub.

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LINGUISTICS

Language Learning Through Selection

Jeffrey Lidz and Lisa Pearl

Everyone knows that language acquisition is a protracted process. It takes a child a minimum of 3 to 5 years to be able to talk, for the most part, the way everyone else does. The commonsense understanding of language learning is that children start knowing nothing about their language and gradually build up a system of knowledge that enables them to communicate.

The orthodoxy of generative linguistics, however, could not be more different from this commonsense view. Rather than building up a language from scratch, children bring innate knowledge of the space of possible languages to the learning task. Language learning, from this perspective, involves mapping experience from the language the child is exposed to onto this hypothesis space so that one language emerges. This perspective derives from two interrelated considerations. First, the range of variation found among the world's languages is surprisingly restricted. Viewed from a certain level of abstraction, languages vary along a finite set of parameters, each with a narrowly restricted range of values (typically two or three). Second, children's linguistic behavior appears to be restricted along these same dimensions. Although children obviously make many errors in the course of language learning, many of these errors mimic the variation found across the world's languages. Together, these considerations lead to the conclusion that the learning task consists primarily of selecting the set of parameter val-

ues that best fits the language the child hears.

What has been missing from the parameter-setting perspective on language learning is a theory of how learners use the input to identify the correct parameter values. In *The Infinite Gift: How Children Learn and Unlearn the Languages of the World*, Charles Yang offers a popularization of his ideas about how this is done.

Yang's central thesis borrows from population biology, where variation within a population is a fundamental feature. The insight underlying his approach is that a population does not need to be a population of organisms in order for the principles of natural selection to apply. Instead, Yang (a computational linguist at the University of Pennsylvania) argues that the mechanisms of natural selection can apply to a population of languages within the mind of a language learner, where a "language" is viewed as a set of parameter values.

To understand the application to languages, it is first necessary to remember some basic principles of Darwinian evolution. Population biology provides a formal basis for describing how variation within a

population of languages evolves by changing the probabilities of organisms over evolutionary time, so does the learner change the probabilities of languages over ontogenetic time. These probabilities shift in direct response to the useful data in the linguistic environment. The more successful a language is at analyzing data from the linguistic environment, the more it is rewarded; the less successful it is, the more it is punished. These lan-

guages are competing against each other, and the winner is ideally the one that provides the best fit to the language spoken around the child.

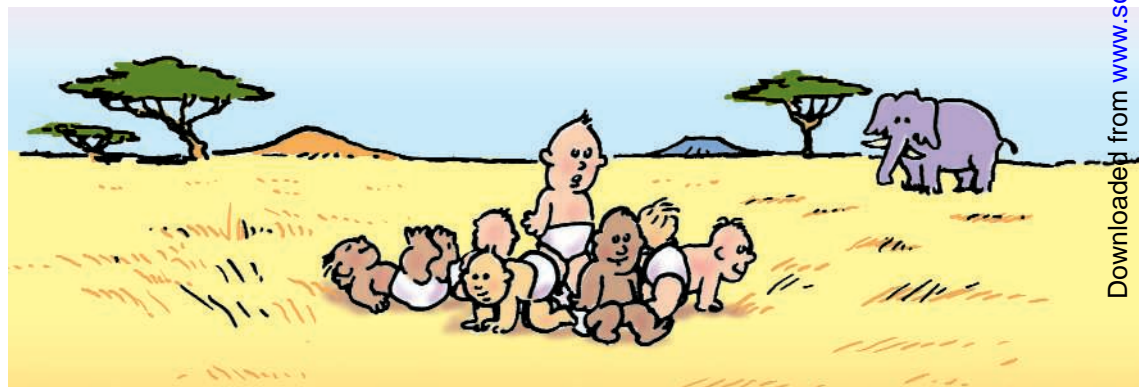
The book represents the first popularization of ideas coming from a new wave of research in cognitive science. That field has traditionally been divided between the representationalists, who propose that the mind is essentially a symbol-processing device, and the associationists, who propose that all behavior is driven by probabilities of distributed neural activity. The difference here lies in the existence of symbols as distinct mental objects. The new wave recognizes

The Infinite Gift

How Children Learn and Unlearn the Languages of the World

by Charles D. Yang

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population both exists and changes over time. Natural selection provides the driving mechanisms via quantified notions of reward, punishment, and competition. The key is Darwin's variational principle: individual members of the population differ from each other in some specified traits, and the population system as a whole evolves by changes in the proportions of the different members in the population. The proportions map directly onto the probability of finding an organism with a certain trait in the population at any given time. Over evolutionary time, these probabilities shift.

Yang applies the variational principle

that there is no inconsistency between symbolic computation and probabilistic computation. Yang's ideas illustrate how these two styles of computation can coexist in the same organism.

Much of *The Infinite Gift* is spent running through a set of standard arguments about the complexity of language learning, but the last two chapters represent the real strength of the book. In them, Yang provides an easy-to-read and insightful distillation of how acquisition of a symbolic system can take advantage of the tools of probability theory and natural selection.

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