Chomsky's Universe

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Why is Noam Chomsky such a towering figure in linguistics today? He asked a very simple question that no one had ever asked before, and then discovered that the answer was unexpected and highly complicated. He asked what capacity a language user needed to have in order to be able to learn to use a language (any language) grammatically. Questions about grammar had of course been asked (and answered) before. The standard grammatical rules of English, French, Latin, Chinese or any other well-studied language are known. Speakers learn them either by *induction* -- imitation and trial-and-error experience, with corrections from other speakers -- or they are taught them, through formal, explicit *instruction* (especially when they are learning a second language). But the capacity to learn these "ordinary grammar" rules was not what Chomsky was asking about: He was asking about *the capacity to learn any language at all*. This is a capacity that all other animals, some brain-injured humans, and all machines built or programmed so far lack.

This uniquely human capacity to learn language also turned out to be universal, yet unfamilar: universal, because it was the very same capacity in every person, for every possible language, but unfamiliar, in that the rules of this "universal grammar" (UG) bore very little resemblance to the rules of ordinary grammar that were already known. The way the rules of UG were gradually discovered was by trying out guesses as to what might be a rule of UG, and then testing the candidate rule to see whether it gave rise to grammatical or ungrammatical sentences. What was remarkable was that speakers of any language could immediately say whether a new sentence was or was not grammatical, even though the rules that were being tested were not the rules of the ordinary grammars that they had been taught (or had learned by induction).

If it had stopped there, the discovery of the rules of UG would have been an important and original contribution to linguistics, and the only surprise would have been that these rules had existed all along, yet no one had noticed them, because we were all following them unconsciously, perhaps the way we execute athletic skills without knowing the rules our bodies are following. Yet – apart from some basic primate mechanisms of movement that are inborn as a result of our evolutionary history – athletic skills are learned, whether through instruction or through induction. So if UG is not learned by explicit instruction, is it learned implicitly (unconsciously), by trial-and-error induction?

The answer was the second and by far the biggest surprise: The rules of UG are unlearnable by trial and error induction, based on what the language-learning child says and hears, *unless most of the rules are already inborn*. (What the child can learn through imitation, trial-and-error induction and error-correction from adults are some minor options among these inborn rules, because these options, unlike UG itself, vary from language to language.)

The impossibility of learning UG itself by induction applies only to the language-learning child's database: everything the child hears and says while learning to understand and speak. It obviously cannot be impossible to learn the rules of UG from any database at all through induction, otherwise Chomsky and the generations of linguists since his discovery could not have learned the rules of UG either. But linguists learn UG collectively, collaboratively and cumulatively, and their database is being continuously updated on the basis of years and

decades of this trial and error experience, based on testing candidate UG rules against speakers' judgments (often the linguist's own) at to what is and is not grammatical.

In contrast, the language-learning child only hears speech that complies with UG; and, surprisingly, after a very brief initial period that falls short of any grammar at all, the child only *produces* UG-compliant speech. So there are never any UG errors to correct. (There are plenty of errors of ordinary grammar, and those do get corrected, but they are not UG errors, and hence do not explain how the child manages to speak UG-compliantly, hence how the child "knows" the rules if UG, even if only unconsciously.)

Chomsky has called this insufficiency of the language-learning child's database for the learning of the rules of UG "the poverty of the stimulus." He has pointed out that this is an extreme form of *underdetermination* of theory by data. All nontrivial theories are underdetermined by data: That's why it's not obvious what the underlying rules generating the data are. In natural science, the "rules" are the laws of nature, and the data are what we can observe by observation and experiment. It is not immediately obvious that, say, objects attract one another with a force that is proportional to the product of their masses and inversely proportional to the squared distance between them, but Newton's universal law of gravitation, though underdetermined, was discoverable via induction (and genius), and Newton did indeed discover it. Hence the underdetermination was not so great as to make the law of universal gravitation unlearnable from the data available.

But to see how it is impossible for the language-learning child to learn the rules of UG from the data available to the child, you do not even need to know the technical details of what the rules of UG are: It would be like trying to learn a (nontrivial) category based on "positive evidence" alone: The only thing you ever encounter is *members* of the category: never a *non-member*. How are you to learn what distinguishes the members from the non-members?

It is important to set aside the trivial case: If you lived in a world in which every object you encountered was white, and you had to call them all "white," and then you saw something black for the first time in your life, you would perhaps hesitate about whether or not to call it "white." But the rules of UG are not a simple black/white matter, where positive evidence alone (plus an innate black/white perception system) might be enough to make the distinction -- between perceiving (or producing) a UG-compliant utterence and a non-UG-compliant utterance -- obvious. Learning to speak UG-compliantly is more like trying to figure out the rules of chess from viewing many chess games, all played by the rules (no errors), and then, on the basis of that sample of positive evidence alone, becoming able to play chess rulefully, with no need for error-correction, never having seen or made an error. Under those conditions one would have to conclude that the rules of chess had been inborn.

Now we know that the rules of chess are not inborn: they are learned (hence learnable) via observation, imitation, trial-and-error induction, error correction and instruction. In other words, we have plenty of both positive evidence and negative evidence (errors and error-corrections) from which to induce the rules (and even explicit instruction to speed up the learning). Hence no poverty of the stimulus for chess.

But if the rules of UG are inborn because they cannot be learned on the basis of the one-sided data accessible to the language-learning child, *how did those rules get into our brains*? There are plenty of unproblematic examples of biological traits – both structures and functions,

including behavioral capacities – in which a plausible evolutionary explanation can be given of how the trait was shaped by "trial and error" across evolutionary time. This is the usual Darwinian scenario of genetic variation and selective retention, based on advantages (or disadvantages) for survival and reproduction.

But it is not at all obvious what the Darwinian variation and advantages would be in the case of the evolution of UG by trial and error. Some have taken this as an empirical mark against the plausibility of UG. However, no one has provided any evidence that the rules of UG are learnable after all (i.e., there is no evidence against the poverty of the stimulus: no evidence that the language-learning child turns out to have sufficient negative evidence after all). Nor has anyone provided an alternative to UG: an alternative that, like UG, provides rules that give people the capacity to generate all and only the utterances that are universally judged to be grammatical and to distinguish those from the ones that are ungrammatical, but, unlike UG, is either learnable by the language-learning child or has a plausible Darwinian explanation for how it would have been selected by evolution because of its advantages for survival and reproduction.

Chomsky has often described himself as a Cartesian: a proponent of Descartes' theory of innate ideas. But perhaps he is closer to being a Platonist, in that the innateness and universality of the ideas is not a result of evolutionary selection but of the natural laws of the physical universe and perhaps even the universal laws of formal logic and mathematics.

Grammar (syntax), however, is not "ideas" but just the form or shape of symbols. In mathematics, the rules are based on the shapes of the symbols alone, not their meanings. In language, however, the symbols (words) are inseparable from their meanings. They express thoughts. Chomsky's own intuition as to the relation ("interface") between meaning and syntax is that language is what makes it possible for us (or anyone) to think at all; and that the possibility of thinking itself comes with certain Platonic constraints, which, in turn, result in the rules of UG. The structure of UG is bound by the structure of thought. UG-non-compliant utterances are either ill-expressed thoughts or unthinkable thoughts. All (and only) thinkable thoughts can be expressed UG-compliantly. Unlike the theory of UG itself, however, this further intuitive idea about constraints on the nature of thought is neither an empirically testable theory nor a mathematically provable theorem -- so far.

Chomsky's theory of UG itself, if it is true, definitely poses problems for evolutionary biology; but it is not clear that these are problems for *linguistics*. If the grammaticality judgments that provide the data for hypothesis-testing about the rules of UG are reliable and universal, then the only way to challenge UG (if one feels there are grounds for challenging UG) is to construct a rival theory – a theory that can likewise provide the rules for generating all and only what is universally judged grammatical and distinguishing it from what is not, but with rules that can, after all, be learned by the child, or, failing that, can plausibly have been evolved biologically, by our species.

If one cannot find a rival theory that does the job but whose rules are either learnable or evolvable then one can challenge the data supporting UG by showing that grammaticality judgments are not reliable or universal, but variable and malleable. If so, then there is no universal capacity that needs to be explained, hence no UG, nor any need for it.

All these competing strategies and critiques (and more) to show Chomsky to have been wrong have been attempted, many, many times over, so far without success. It is a separate question why so many people in so many fields are motivated to try to show that Chomsky is wrong. Perhaps it's because everyone speaks language, but not everyone speaks mathematics, so we are ready to challenge linguists but not mathematicans, even if we do not understand the technical work of either of them. Perhaps it's because Chomskian linguistics is so different from the rest of linguistics, and so technical. Or because it is so counterintuitive that there may be constraints on our language and thought of which we are not aware. Or perhaps it's just ambitions of self-aggrandizement through giant-killing.

So far, Chomsky himself has easily and rigorously answered all challenges. But there is no doubt that he has been and remains the giant in the field he created. And now that his remaining years are increasingly devoted to the other project in which he also looms larger than any mortal on the planet – saving the world – there may be no one left to stave off the lilliputians bent on levelling the unique and towering structure that he has sculpted (or unearthed).