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Noam Chomsky and Andrea Moro on the Limits of Our Comprehension

An excerpt from Chomsky and Moro's new book "The Secrets of Words."

In their new book "The Secrets of Words," influential linguist Noam Chomsky and his longtime colleague Andrea Moro have a wide-ranging conversation, touching on such topics as language and linguistics, the history of science, and the relation between language and the brain. Moro draws Chomsky out on today's misplaced euphoria about artificial intelligence (Chomsky sees "lots of hype and propaganda" coming from Silicon Valley), the study of the brain (Chomsky points out that findings from brain studies in the 1950s never made it into that era's psychology), and language acquisition by children. Chomsky in turn invites Moro to describe his own experiments, which proved that there exist impossible languages for the brain, languages that show surprising properties and reveal unexpected secrets of the human mind.

Chomsky once said, "It is important to learn to be surprised by simple facts" — "an expression of yours that has represented a fundamental turning point in my own personal life," says Moro. This is something of a theme in "The Secrets of Words." Another theme, explored in the excerpt from the book featured below, is that not everything can be known; there may be permanent mysteries, about language and other matters.

Andrea Moro: There is something you wrote, back when you gave the "Managua Lectures," and actually you rephrased it in a very articulated fashion in the talk you gave at the Vatican. It is an expression of yours that has represented a fundamental turning point in my own personal life, but also — I am sure — for all the students who heard it. You once said: "It is important to learn to be surprised by simple facts." Considering it carefully and analyzing it word by word, this sentence contains at least four different foci, so to speak: first, it makes note of the importance of the thought expressed ("it is important"); second, it refers to a learning process, an effort rather than to a personal inherited talent ("to learn"), and by doing so it emphasizes the importance of the responsibility to teach; third, it refers to the sense of wonder and curiosity as the very engine of discovery, and to an awareness of the complexity of the world that is, an observation that goes back to Plato and the origin of philosophy ("to be surprised"); finally, fourth, arguably the most striking and innovative observation, it states that simple facts make a difference ("by simple facts").

The sudden awareness of something that calls for an explanation, once the fog of habit has lifted, seems to be the real stuff revolutions' sparkles are made of: from Newton's legendary

falling apple to Einstein's elevator, from Planck's black body problem to Mendel's pea plants, the real force comes from asking questions about what all of a sudden doesn't seem to be obvious. Of course, it could be that one is exposed to a certain fact by chance, but, as Pasteur once put it, "In the fields of observation chance favors only the prepared mind," and this is why we need to learn how to be surprised.

Actually, certain simple facts can be visible to the mind's eye rather than to our direct vision. Owen Gingerich once made me realize how Galileo reached the conclusion that all bodies fall to the Earth at the same speed even if they have different weight, besides the obvious restrictions due to their shape: Galileo never amused himself by throwing objects from the Tower of Pisa. Instead, he reflected that if a heavy object fell faster than a light one, then when the two objects are tied together we would face a paradox: The lighter object should slow down the heavier one, but together they should fall faster since their total weight is greater than that of the heavier object on its own. Galileo, surprised by this simple mental fact, came to the fundamental conclusion that the only possibility is that these two objects had to fall at the same speed and

then, generalizing it, that all objects fall at the same speed (disregarding friction with the air due to their shape). And this without having to climb the tower other than to enjoy the panorama.

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And the second thing I would like to highlight from your synthesis: At a certain point you said that it is impossible to build a machine that talks. Obviously, I cannot but agree, but there's one important thing that I want to emphasize: There is a fundamental distinction between simulating and comprehending the functioning (of a brain but also of any other organ or capacity). It is, of course, very useful to have tools, which we can interact with by "speaking," but it is certainly clear that those simulations cannot be used to understand what really goes on in the brain of a child when they grow and acquire their grammar. Of course, we can always stretch words so that they become felicitous to mean something different from what they used to mean. This reminds me of the answer Alan Turing gave to those who repeatedly asked him if one day machines could think. We can read his own words and substitute think with talk, which I think leaves the essence of Turing's idea valid:

"I propose to consider the question, 'Can machines think?' This should begin with definitions of the meaning of the terms 'machine' and 'think.' The definitions might be framed so as to reflect so far as possible the normal use of the words, but this attitude is dangerous. If the meaning of the words 'machine' and 'think' are to be found by examining how they are commonly used it is difficult to escape the conclusion that the meaning and the answer to the question, 'Can machines think?' is to be sought in a statistical survey such as a Gallup poll. But this is absurd. . . . The original question, 'Can machines think?' I believe to be too meaningless to

deserve discussion. Nevertheless I believe that at the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted."

There is one question I would like to ask you. The way that you have depicted the relationship between chemistry and physics in the history of science allows us to reflect on the relationship between linguistics and neuroscience. My personal view, which doesn't count, obviously [laughs], and which is why I want to ask you, is that linguistics cannot be, must not be ancillary to what we currently know about our brain; but if anything, we have to change and grow toward, perhaps, a unification — provided that we dare to use the term "mystery" in the way that you used it. In other words, it is not out of the question that humans may never end up understanding creativity in language, namely the capacity to express a verbal thought independently of one's physical environment. Indeed, it could well be that we must just stop short of "the boundaries of Babel," that is, the limits of variation that may affect human languages as given independently of experience. Equivalently, one could consider the boundaries of Babel as the infants' "stem mind," or "stem brain," that is, the potentiality to acquire any language within a certain amount of time since birth. The discovery of this amazing link between language structure and the brain is so revolutionary that it can be expressed by reversing the 2,000-year-old traditional perspective and arriving at the surprising conclusion that it's flesh that became logos, not vice versa. I would like you to comment a little on this.

Noam Chomsky: I'm kind of a minority. The two of us are a minority. [Moro laughs.] There may indeed be a mystery. Let's take a look at, say, rats, or some other organism. You can train a rat to run pretty complicated mazes. You're never going to train a rat to run a prime number maze — a maze that says, "turn right at every prime number." The reason is that the rat just doesn't have that concept. And there's no way to give it that concept. It's out of the conceptual range of the rat. That's true of every organism. Why shouldn't it be true of us? I mean, are we some kind of angels? Why shouldn't we have the same basic nature as other organisms? In fact, it's very hard to think how we cannot be like them. Take our physical capacities. I mean, take our capacity to

run 100 meters. We have that capacity because we cannot fly. The ability to do something entails the lack of ability to do something else. I mean, we have the ability because we are somehow constructed so that we can do it. But that same design that's enabling us to do one thing is preventing us from doing something else. That's true of every domain of existence. Why shouldn't it be true of cognition? We're capable of developing — humans, not me — humans are capable of developing, say, advanced quantum theory, based on certain properties of their mind, and those very same properties may be preventing them from doing something else. In fact, I think we have examples of this; plausible examples. Take the crucial moment in science when scientists abandoned the hope for getting to an intelligible world. That was discussed at the time.

"It is not out of the question that humans may never end up understanding creativity in language."

David Hume, a great philosopher, in his "History of England" — he wrote a huge history of England — there's a chapter devoted to Isaac Newton, a full chapter. He describes Newton as, you know, the greatest mind that ever existed, and so on and so forth. He said Newton's great achievement was to draw the veil away from some of the mysteries of nature — namely, his theory of universal gravitation and so on — but to leave other mysteries hidden in ways we will never understand. Referring to: What's the world like? We'll never understand it. He left that as a permanent mystery. Well, as far as we know, he was right.

And there are other perhaps permanent mysteries. So, for example, Descartes, and others, when they were considering that mind is separate from body — notice that that theory fell apart because the theory of body was wrong; but the theory of mind may well have been right. But one of the things that they were concerned with was voluntary action. You decide to lift your finger. Nobody knows how that is possible; to this day we haven't a clue. The scientists who work on voluntary motion — one of them is Emilio Bizzi, he's one of MIT's great scientists, one of the leading scientists who works on voluntary motion — he and his associate Robert Ajemian recently wrote a state-of-the-art article for the journal of the American Academy of Arts and Sciences in which they describe what has been discovered about voluntary motion. They say they'll put the outcome "fancifully." It's as if we're coming to understand the puppet and the strings, but we know nothing about the puppeteer. That remains as much a mystery as it has been since classical Greece. Not an inch of progress; nothing. Well, maybe that's another permanent mystery.

There are a lot of arguments saying, "Oh, it can't be true. Everything's deterministic," and so on. All sorts of claims. Nobody truly believes it, including those who present reasons (two thermostats might be hooked up to interact, but they don't take the trouble to work out reasons). Science doesn't tell us anything about it. Science tells us it doesn't fall within science, as currently understood. Science deals with things that are determined or random. That was understood in the 17th century. It's still true today. You have a science of events that are random, of things that are determined; you have no science of voluntary action. Just as you have no science of the creativity of language. Similar thing. Are they permanent mysteries? Could be. Could be that it's just something that we'll never comprehend.

Something similar might hold for some aspects of consciousness. What does it mean for me to look at the background that I see here and see something red? What's my feeling of red? You can describe what the sensory organs are doing, what's going on in the brain, but it doesn't capture the essence of seeing something red. Will we ever capture it? Maybe not. It's just something that's beyond our cognitive capacities. But that shouldn't really surprise us; we are organic creatures. It's a possibility.

So maybe the best that we can do is what science did after Newton: Construct intelligible

theories. Try to construct the best theory we can about consciousness or voluntary action or the creative use of language, or whatever we're talking about. The miracle that so amazed Galileo and Arnauld — and still amazes me, I can't understand it — how can we, with a few symbols, convey to others the inner workings of our mind? That's something to really be surprised about, and puzzled by. And we have some grasp of it, but not a lot.

When I started working on the history of linguistics — which had been totally forgotten; nobody knew about it — I discovered all sorts of things. One of the things I came across was Wilhelm von Humboldt's very interesting work. One part of it that has since become famous is his statement that language "makes infinite use of finite means." It's often thought that we have answered that question with Turing computability and generative grammar, but we haven't. He was talking about infinite use, not the generative capacity. Yes, we can understand the generation of the expressions that we use, but we don't understand how we use them. Why do we decide to say this and not something else? In our normal interactions, why do we convey the inner workings of our minds to others in a particular way? Nobody understands that. So, the infinite use of language remains a mystery, as it always has. Humboldt's aphorism is constantly quoted, but the depth of the problem it formulates is not always recognized.

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Chomsky and Moro are co-authors of "The Secrets of Words," from which this article is excerpted.