Andrea Moro at the speed of 60

A bit of personal history.
Academically speaking, Andrea is like a son to me. We first met in person in my office at MIT (in the then lovely building 20, all in wood) when he came to see me. He says I was barefooted in an office full of cigarette smoke. We proceeded to lunch in the cafeteria of the nearby Broad Institute. We talked about a million things, linguistic and non-linguistic.

Back to Italy, in 1994, when I had the freedom and the means to hire distinguished scholars for the newly (by me) created DIPSCO (Dipartimento di Scienze Cognitive) at the San Raffaele Scientific Institute[1], Andrea was my first hire. He and I went to meet the all-powerful Presidente of the San Raffaele Don Luigi Maria Verze', Andrea said the right thing (to this day, I do not know whether he realized he did say THE right thing): "Ho studiato il verbo essere da oltre dieci anni" (I have been studying the verb to be for more than ten years"[2] Don Verze' pictured himself as a consummate theologian and was delighted to hear about a study of the verb "essere".

Andrea was instantly hired and became a member of the "cenacolo", a small group who met regularly to discuss religious and theological issues, chaired by Don Verze'. I was told that Andrea took this venture very seriously (he always takes things very seriously) and started questioning Don Verze' about his writings. Andrea had noticed some incompatibilities between passages published in previous writings and other passages found in later writings. Don Verze' had sort of forgotten what he had written and tried his best to answer Andrea's questions.

The origin of a crucial experiment.
At DIPSCO first, then at the San Raffaele University, we regularly invited distinguished linguistic and cognitive scholars to give lectures and spend some time with us, planning new research. I have a special memory of one visit that, in due time, turned out to be the seed of one of the most important of Moro's publications, the only brain datum that Noam Chomsky ever cites.

The distinguished British linguist Neil Smith gave a lecture about having taught British Sign Language to the savant Christopher (Smith, Tsimpli et al. 1993, Smith and Tsimpli 1995, MORGAN, SMITH et al. 2002). It was a success, though not a complete success, because Christopher is extremely shy, never looks people in the face, but facial expressions are very important in sign languages (mostly conveying prosody, topic, focus and more). In spite of this limitation, Christopher learned BSL and was able to hold conversations in it. He had no doubt that BSL is a "full" language. He is fluent in 7 languages and has a substantial knowledge of another ten or so. His general intelligence is, otherwise, very limited. He cannot cross a street on his own, cannot

---

[1] It then became Universita' Vita-Salute San Raffaele and Andrea was appointed professor of linguistics.
[2] In fact, he published a whole delightful book a few years later, on exactly this topic. Moro, A. (2010). <u>Breve storia del verbo essere: Viaggio al centro della frase</u>, Adelphi.
, Moro, A. (2010). <u>A Brief History of the verb TO BE</u>. Cambridge MA, The Mit Press.

prepare a cup of tea, cannot clip his fingernails and never ever was able to learn the rules of even the simplest games, such as Tic-Tac-Toe.

Neil Smith told us about having taught Berber to Christopher, with full and fast success, but never having been able to teach him an "impossible' language, using the words of Berber. An artificial language called EPUN. (Smith, Tsimpli et al. 1993). The invented impossible language has the following rules: rearrangement of the typological order, verb movement for negation, object raising for past tense and more. Christopher never learned such impossible language.

Well, Andrea and I had a brilliant idea: let's try this with ordinary subjects. Teach them a real new language and also an impossible language, with the words of the real language (in this case Italian). The subjects were chosen to be strictly monolingual German speakers from the former Eastern Germany. They (poor things) had never been in Italy, had never watched Italian movies, never listened to Italian radio. Therefore, Italian really was a NEW language to them.

To cut a long story short, after relatively few sessions these subjects did learn the essential rules of real Italian and also, separately, did learn the rules of impossible Italian. They were able to check whether the test sentences obeyed the real rules and, separately, whether the different test sentences obeyed the impossible rules. It is of crucial importance that, unlike Christopher, normal subject do learn the impossible rules and can monitor whether they are obeyed in suitably chosen sentences. The task is NOT cognitively impossible, not even especially hard, but it is not a linguistic task. The data from functional MRI revealed that Broca's area is activated when subjects are monitoring real rules of real Italian, but is slightly suppressed when monitoring impossible rules of impossible Italian. Other brain areas are activated, generally speaking, areas related to problem solving.

When the paper was submitted for publication, I am told that a referee objected that Italian and German are rather similar (sic, no comment) and that therefore the data are not significant. Andrea and collaborators, to their chagrin, decided to repeat the experiment with Japanese, expecting to find identical data, as they did. Many weeks of further work. The paper was finally accepted (Musso, Moro et al. 2003) and is to this day one of foremost publications in neuro-linguistics. It is undisputable experimental evidence that language is, indeed, special and that structure-dependent syntactic derivations are biologically rooted, not the result of conventions, nor of linguistic history.

On anti-symmetry

Andrea's many important papers and books on copular sentences, the raising of predicates and dynamic anti-symmetry speak for themselves. In recent years, he has expanded his work on neuro-linguistics (Moro 2013), including a study of language in schizophrenia, and has dealt with linear compression as a trigger for movement (Moro 2013).

Some issues involving the nature and the locus of anti-symmetry have emerged in the last few months. Richard S. Kayne, in a beautiful lecture he gave in the Fall 2022 course on biolinguistics[3], raised several important issues.

According to Chomsky, External Merge is unconstrained and has no order. Ordering and symmetry emerge as interface processes, when Narrow Syntax (NS) meets externalization (essentially the SM system). But in a recent publication (Kayne 2022), Richard Kayne suggests an alternative: he stresses that "Core syntax can explicitly have X precede Y without having any subpart of X precede any subpart of Y." Then Kayne continues: "In general, empirical arguments that support antisymmetry also rest on more than just observations concerning the relative order of simple pairs of elements. Often, they involve cross-linguistic gaps (in the study of syntax, it is essential to also see and examine what is not there); on this empirical side, antisymmetry can be thought of as grouping together a substantial set of Greenbergian cross-linguistic generalizations and providing a single theoretical account for all of them". Reaffirming the validity of his momentuous 1994 LCA (Linear Correspondence Axiom), Kayne suggests that Core syntax has partial, though not total, linear ordering, that Pair Merge is preferable to simple Merge. He concludes that: "Antisymmetric linear order is part of core syntax. There are implications for externalization and in the longer run for the evolution of the language faculty".

Noam and I were left with some perplexities. In essence, summarizing an exchange I have had with Noam in October 2020, these are the central issues:

Linearization and I-Language.
Powerful evidence has been presented that there is no linearization in I-language -- as we would expect from the fact that it plays no role in core semantics and is required only for reasons having to do with the interface with the SM systems, which have nothing to do with language (and for sign languages is only partial given properties of visual space). Richie's response to this evidence is to beg the question.

The essence of the matter is this: If linearity is part of I-language, then in a wide array of cases there will be both a linear-based algorithm L and a structure-based algorithm S to deal with them. E.g., in the case of [1]

[1](i) pictures of the man copula on the table
   (i) a picture of the men copula on the table

there is a trivial linear algorithm L and a complex algorithm S to determine agreement of the copula. For L is adjacency. For S is: determine the structure and locate its head. From infancy, we reject L and select S. Why? The strong conceptually based reason is that linearity is not part of I-language, which keeps to the simplest computational operation as expected by natural law,

---

so that we disregard 100% of what we hear -- linear order -- and attend only to what the mind constructs and we never hear -- structures. The question then is this: if linearity is available, why do we select S and ignore L?

Richie's response (which is conventional) is that L is ruled out because it is inconsistent with S, thus begging the question, which was: Why do we pick S rather than L? By the same logic one could say that S is ruled out because it is inconsistent with L (far simpler, and keeping to 100% of experience). The same holds for all the fascinating examples Richie presented in his lecture. Furthermore, this is true for all constructions in all languages.

Therefore, his argument for privileging and widely expanding the more complex operation Pair-Merge doesn't get off the ground.

Further problems.
There are further problems. Take Japanese. Richie argues that the underlying order is VO, suggesting that the language faculty incorporated temporality. But temporality is irrelevant to underlying order.

There are other problems, e.g., Richie's proliferation of raising rules that have no motive other than to preserve the thesis of uniform underlying order. The positive part is that as always, he presents a lot of fascinating material, worth careful attention. But I don't see how the basic picture can be maintained.

Suppose ordering is available in I-language. Question: why isn't a simple ordering algorithm A used, say in "carefully....", rather than the abstract structural principle P about how the sentence was generated?

[2]i The man who repaired the car carefully packed his tools.
   ii Carefully the man who repaired the car packed his tools.

In [2]i we have an ambiguity: "carefully" may refer to the way he repaired the car or to the way he packed his tools. No such ambiguity in [2]ii: "carefully" now unambiguously refers to tool packing. The alleged simple ordering algorithm A cannot explain this. We need an abstract structural principle P.

Repeat: Question: why isn't a simple ordering algorithm A used, say in "carefully....", rather than the abstract structural principle P about how the sentence was generated? Response: it would violate P. But this begs the question, which was: why is A dismissed in favor of P instead of P being dismissed in favor of A?

Well, this brings us back to Moro et al. on real versus impossible languages {Moro, 2008 #4417}. It is P, not A, that is biologically rooted.

The labeling algorithm (LA).
The creation of anti-symmetric structures and linearization are required for the interface with SM. But there is also an issue at the interface with CI: labeling. All elements must be suitably labeled when they reach CI. Points of symmetry are a problem for LA. They cannot be labeled. Therefore, as Moro has amply detailed in his work, the symmetric (Musso, Moro et al. 2003) must

be turned into an anti-symmetric structure, for instance by raising XP, or by raising YP (the raising of predicates) (Moro 1997). Raising and labeling are part of Narrow Syntax (NS), which seems to agree with Kayne's hypothesis that NS has at least partial, though not total, ordering. He says: "Antisymmetric linear order is part of core syntax". Not just an issue at the SM interface.

Chomsky on knowledge.
Let's start with Aristotle's distinction between possession of knowledge and use of knowledge. Thus, we all possess knowledge of arithmetic, and we all use it in calculation. Use of knowledge is an action, so lots of other things enter. That's why my calculations sometimes don't correspond to my knowledge -- what's called an error.

The three of us (Chomsky, Bever and me) have knowledge of languages, for all of us a mess. Abstracting in the normal manner of science, we construct ideal pure cases, I-languages, like frictionless planes. The ideal speaker-hearer possesses knowledge of an I-language, and uses this knowledge in perception and production (actually, almost all use is internal, but put that aside). Since philosophers insist on misinterpreting the way the term "knowledge" is used, I tried to avoid pointless controversy by making up technical terms: competence is Aristotle's possession of knowledge, performance is his use of knowledge.

As in the case of arithmetic, many factors are involved in performance, e.g., memory, or Bever's perceptual strategies. Sometimes performance doesn't match competence. I just received a letter from a highly respected linguist sent to a list, telling someone "I and everyone is very pleased with....." That's a mismatch, what we call an "error". Judgments are, one can say, performance. Technically, the judgments elicited in informant work are acceptability judgments. That's also true of introspective judgments with oneself as the informant.

Grammaticality is a theoretical notion, part of the theory of the ideal speaker-hearer, a notion that scandalizes linguists but is no more scandalous than frictionless planes or in fact anything in the sciences. In Aspects (Chomsky 1965) I wrote that the object of investigation is an ideal speaker-hearer, abstracting from irrelevancies (itself of course a theory-laden notion). I assumed that this was utter triviality, as the counterpart is in all rational inquiry, all science in particular. It aroused a storm of protest. It remains a triviality.

As for E-language, I defined it negatively: any concept other than I-language. I added that I doubt that there is any coherent concept in that domain. Others use the term and seem to have something in mind, but I frankly don't know what.

An interview with Chomsky
In 2022, Andrea has published, in Italian and in English, a long, all-encompassing interview with Chomsky. "The Secrets of Words" (Chomsky and Moro 2022). In that little great book we read: 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— and this is something of a theme in their conversation. Another theme is that not everything can be known; there may be permanent mysteries, about language and other matters. Not all words will give up their secrets.

Little epilogue

I owe a lot to Andrea, personally, scientifically and more broadly. In many occasions I benefited from his personal explanations of complex linguistic issues. His encouragement towards and critical evaluation of several of my writings has been of great help. Dear Andrea, onwards! To the speed of 70!

Massimo Piattelli-Palmarini
(December 2022)

BIBLIO

Chomsky, N. (1965). Aspects of the theory of syntax. Cambridge, MA, The MIT Press.

Chomsky, N. and A. Moro (2022). The Secrets of Words, The MIT Press.

Kayne, R. S. (2022). "Antisymmetry and externalization." Studies in Chinese Linguistics **43**(1): 1-20.

MORGAN, G., et al. (2002). "Language against the odds: the learning of British Sign Language by a polyglot savant." Journal of Linguistics **38**(1 25 April): 1-41.

Moro, A. (1997). The raising of predicates, Cambridge university Press.

Moro, A. (2010). Breve storia del verbo essere: Viaggio al centro della frase, Adelphi.

Moro, A. (2010). A Brief History of the verb TO BE. Cambridge MA, The Mit Press.

Moro, A. (2013). The Equilibrium of Human Syntax: Symmetries in the Brain. Abingdon UK and New York NY, Routledge / Taylor and Francis.

Musso, M., et al. (2003). "Broca's area and the language instinct." Nature Neuroscience **6**(7): 774-781.

Smith, N. V. and I.-M. Tsimpli (1995). The Mind of a Savant. New York and Oxford, UK, Blackwell.

Smith, N. V., et al. (1993). "Learning the impossible: The acquisition of possible and impossible languages by a poliglot savant." Lingua **91**: 279-347.

Smith, N. V., et al. (1993). "Learning the impossible: The acquisition of possible and impossible languages by a polyglot savant." Lingua **91**(4): 279-347.