

- cognition. Reidel, Dordrecht: 1–58. Originally published in 1970. ► <https://cepa.info/535>
- Maturana H. R. (1988)** Ontology of observing: The biological foundations of self-consciousness and the physical domain of existence. In: Donaldson R. E. (ed.) Texts in cybernetic theory: An in-depth exploration of the thought of Humberto Maturana, William T. Powers, and Ernst von Glasersfeld. American Society for Cybernetics (ASC). ► <https://cepa.info/597>
- Maturana H. R. (1997)** Metadesign: Human beings versus machines, or machines as instruments of human designs? Instituto de Terapia Cognitiva, Santiago. ► <https://cepa.info/652>
- Morin E. (1992)** From the concept of system to the paradigm of complexity. *Journal of Social and Evolutionary Systems* 15(4): 371–385.
- Wilden A. (1984)** System and Structure: Essays in communication and exchange. Second edition. Tavistock Publications, London. Originally published in 1972.
- Wittgenstein L. (1968)** Philosophical Investigations. Translated by G. E. M. Anscombe. Basil Blackwell, Oxford. Originally published in 1958.
- Wittgenstein L. (1972)** The blue and brown books. Basil Blackwell, Oxford. Originally published in 1958.
- Wittgenstein L. (1975)** Philosophical remarks. Translated by Raymond Hargreaves and Roger White. Basil Blackwell, Oxford. German original published in 1964.
- Wittgenstein L. (1998)** Remarks on the philosophy of psychology. Volume II. Basil Blackwell, Oxford. Originally published in 1980.

**Vincent Kenny** lives in Rome applying systemic constructivism (i) in psychotherapy (ii) in consulting to organizations, and (iii) in sports psychology, particularly with professional tennis players.

**Funding:** No external funding was received while writing this manuscript.

**Competing interests:** The author declares that he has no competing interests.

RECEIVED: 18 OCTOBER 2022

REVISED: 9 NOVEMBER 2022

REVISED: 16 NOVEMBER 2022

ACCEPTED: 18 NOVEMBER 2022

## Turning Language-Science Prospects into Science

Ekaterina Sangati  
Okinawa Institute of Science  
and Technology, Japan  
kat.sangati/at/gmail.com


**> Abstract** • I argue that in order to move from mere prospects for a Maturanian language science to a mature language science, we need to specify a scientific methodology, operationalize our concepts and posit falsifiable predictions. This need is articulated using Maturana's views on scientific method and illustrated with respect to two linguistic notions: ambiguity and mutual orientation.

« 1 » In his target article, Alexander Kravchenko defends the claim that the Maturanian view on language is a better foundation for linguistics as a science than previously or currently dominant approaches and, as such, can provide better explanations of various linguistic phenomena. As a cognitive scientist heavily inspired by Humberto Maturana's work, I wholeheartedly agree. However, in what appears to be a sweeping rejection of investigated phenomena, research methods and empirical results produced by non-Maturanian linguistics over the past several decades, Kravchenko, in addition to rejecting its foundations, risks throwing the baby out with the bathwater and his view perhaps even runs counter to Maturana's own view on science. In this commentary, I point to two key questions that need to be addressed before Maturanian linguistics can become a mature language science.

### Scientific methodology

« 2 » At the conclusion of the article (§53), Kravchenko proposes that a new agenda for the language sciences needs to be defined, which will include answering the methodological questions of *what* linguistics as a science should study and *why*. However, another question seems to be conspicuously missing from this agenda, namely that of *how* Maturanian language science should proceed. This is especially important if the answer to the *what*-question is “language as the human praxis of living” (§52) or “a trans-

disciplinary study of the human being and the phenomenon of humanness” (§34, emphasis removed), both embodying a decidedly and explicitly holistic view. Without any guide on where to start and how to approach such an ambitious explanatory goal, it is difficult to imagine any progress, let alone hope to replace the dominant views.

« 3 » The *how*-question is a question about what should be considered a scientific methodology that could deliver scientific explanations rather than mere descriptions. In more concrete terms: What is the proposed scientific methodology of Maturanian language science that is coherent with constructivist epistemology but also able to deliver scientific results and explanations? 

« 4 » Can we look to Maturana himself for any hint on how to answer this question? Indeed, Maturana (1991) distinguished between philosophical and scientific explanations, where the latter is meant to be an explanation generated in accordance with scientific method. Based on Maturana's original four-step account (Maturana 1978, 1988a, 1988b) I propose a slightly enlarged picture:

- 1 | *Choose an explanatory target* by specifying a phenomenon that could be observed by performing some set of operations in a praxis of living (e.g., pointing at something with an index finger while exclaiming “Look!” Typically, this will result in one's interlocutor turning in the direction of pointing);
- 2 | *Generate a hypothesis* by proposing “a generative mechanism, which when allowed to operate gives rise as a consequence of its operation to the phenomenon to be explained” (Maturana 1988b: 7);
- 3 | *Formulate a prediction* based on the proposed hypothesis, i.e., posit what other phenomena should be observed if the mechanism posited in Step 2 could be plausibly surmised to generate the phenomenon specified in Step 1;
- 4 | *Make an observation* according to a specified methodology (I added this step to emphasize that science is a procedure that conserves observing); and
- 5 | *Assess the observations* (i.e., falsification/confirmation of the hypothesis based on commonly agreed statistical considerations).

Steps 4 and 5 are based on practices in a community of observers and are only valid relative to such a community and therefore do not deliver “absolute and true” knowledge.

« 5 » As can be intuited from these steps, Maturana’s method is basically a standard hypothesis-deduction scientific approach (Hepburn & Andersen 2021) with a constructivist emphasis on the role of the observer in scientific practice and, possibly, an autopoietic theory background of what types of systems are amenable to scientific study (at least based on Maturana’s earlier works on the nature of life and cognition). Specifically, a generative mechanism mentioned in Step 2 can only be a dynamic, structure-determined system:

“[A] scientific explanation necessarily consists in the proposition of a model (explanatory hypothesis) that in its operation as a structure-specified (mechanistic) system generates, through the realization of the properties of its components in their neighbourhood relations, the phenomenon to be explained.” (Maturana & Guilloff 1980: 137)

« 6 » This approach to scientific explanation and the explication of a “generative mechanism” (Step 2 above) bears a striking resemblance to contemporary views on explanations widely adopted in cognitive (neuro-)science and biology known as the New Mechanism framework. Here, as well, the scientific investigation starts from the identification of a phenomenon to be explained and proceeds by proposing a mechanism: “a structure performing a function in virtue of its component parts, component operations, and their organization” whose “orchestrated functioning” is responsible for the phenomenon in question (Bechtel & Abrahamsen 2005: 423).

« 7 » Much has been said recently about compatibility between the mechanistic approach to explanation and non-cognitivist frameworks (Bechtel & Abrahamsen 2010; Abramova & Slors 2019; Bich & Bechtel 2021; Wilson 2022). Many mechanistic explanations in cognitive science remain committed to representational and computational foundations, where either the phenomenon is defined in terms of semantic properties being processed or the mecha-

nism is broken down into semantically laden components and operations. How such explanations could be replaced with a more Maturanian “structure-determined system” that has no semantic parts, without dissolving into non-mechanistic explanations (e.g., dynamical explanations, Zednik 2011; see also Glennan & Illari 2017 for a review of mechanistic explanations across time and disciplines) and whether one can have genuinely dynamic, self-organized, non-reductionist mechanisms that also acknowledge the role of the observer (Lyre 2018; Meyer 2022) remains a target of future study. Nevertheless, a mechanistic framework as such seems compatible with a Maturanian language science and could offer valuable directions for getting a grip on its methodology and the elucidation of its key theoretical concepts. For example, it could highlight the current gaps in a new agenda for Maturana-informed language sciences (Maturanian language science, for short).

### Linguistic phenomena and operational definitions

« 8 » Kravchenko introduces a number of key concepts in Maturanian language science, such as languaging (§15), consensual domain (§19), mutual orientation (§27), context-dependence. However, taking the mechanistic scaffold outlined above, it is unclear at present whether these concepts are meant as phenomena to be explained or as explanatory constructs that could be turned into proposed mechanisms and tested empirically. Thus, a more general question arises: How are the key concepts of Maturanian language science operationalized such that they can lead to a formulation of a generative mechanism and empirical predictions, as well as compared to existing theories and results? <sup>12</sup>

« 9 » It appears that from the list of concepts in the previous paragraph (languaging, consensual domain, mutual orientation, context-dependence), some could be classified as explananda (phenomena to be explained) and some as putative explanations – at least as they are introduced in the target article, since the same phenomenon could serve as either depending on the observer’s perspective and explanatory interest. Lack of clarity on this point is problematic in itself, as it makes both theoretical refinement

and empirical testing difficult. Moreover, even if we can guess which concept is meant as a target phenomenon and which as an explanation, there are additional pressing issues that need to be addressed. Let us illustrate this by taking two of the terms as examples: context-dependence and mutual orientation.

« 10 » First, Kravchenko states that “every linguistic interaction is necessarily context-dependent and unambiguous for the interlocutors” (§29) and only ambiguous to the observer who lacks proper background because she was not part of the conversation or is faced only with written text (§30). This statement sounds like a case of an identified phenomenon to be explained, i.e., ambiguity in languaging or rather its essential context-dependence. It is also, however, a very strong claim that throws away decades of research in linguistics and psycholinguistics as investigating an artificial problem posited to be a consequence of misleading epistemological assumptions. That is, the phenomenon of linguistic ambiguity has been investigated extensively by “orthodox linguistics,” a variety of empirical results have been obtained in both behavioral and neuroscientific domains and a range of mechanisms have been postulated for how humans resolve ambiguities on multiple levels of language and reach mutual understanding (see, e.g., Spevack et al. 2018 for a review from an interactive perspective on language). A Maturanian language scientist might want to reject the mechanisms as relying on bad assumptions, but are we also supposed to reject all the empirical regularities that have been observed? If these regularities are mere artifacts of experimental paradigms, should they be rejected as not part of the phenomenon of language? Or can Maturanian language science provide alternative explanations for when and why they occur, i.e., how ambiguity *can* arise when proper context is lacking?

« 11 » Furthermore, in an ecologically valid context of two interlocutors engaged in live conversation, would Maturanian linguistics be in the business of trying to explain how every sound, word or sentence is *immediately* understood, given such a proper context? Is the empirical claim here that in this case there is no ambiguity whatsoever? Or is it that there is no ambiguity on a personal, experiential level, but there might be

ambiguity resolution happening on a sub-personal level, at millisecond scales, using various contextual sources (cf. a similar debate about theory of mind, Spaulding 2010)? How can this be disambiguated empirically, or, in other words, how can context-based understanding be operationalized and studied?

« 12 » Another key concept raised in the target article is mutual orientation, a process of mutual reduction of uncertainty within the interactants' cognitive domains (§27). It seems to be proposed as an explanation for communicative understanding and behavioral congruence, as opposed to an orthodox mechanism of "information transmission." If it is indeed an explanation and not an explanandum, could we posit a more explicit generative mechanism of mutual orientation and generate additional empirical predictions, such that it could be compared to existing proposals?

« 13 » Consider, for instance, the conceptual-alignment mechanism proposed by Arjen Stolk, Lennart Verhagen and Ivan Toni (2016), who similarly start from the observation that viewing communication as a signal encoding–decoding process is theoretically inadequate and unfeasible in practice (e.g., when building artificial agents). They then suggest that communication is a process of coordination in a shared conceptual space, in which interlocutors continuously generate possible-world interpretations of what is being said, probe them with exchanged signals and try to align their conceptual structures by inference to the best explanation. The authors then show how the account leads to several empirical hypotheses, for instance, that the timing of shared neural activity will lead to a communicative signal rather than follow it, a hypothesis that was confirmed in an MEG study (Stolk et al. 2013). They additionally propose a neuronal mechanism of "upregulated broadband neural activity" (Stolk, Verhagen & Toni 2016: 188) that could implement the shared conceptual space. A Maturanian language scientist might disapprove of notions such as possible-world hypotheses or inferences of shared meaning as tied to an information-processing perspective (but perhaps a reformulation of these notions could be developed). However, this is the type of depth and precision that is required to produce a

genuine alternative to orthodox science of language.

« 14 » In summary, the prospects for a Maturana-inspired scientific investigation of mind and language are indeed exciting, but they require a lot more work to turn them into a viable alternative to the established paradigm.

## References

- Abramova E. & Slors M. (2019) Mechanistic explanation for enactive sociality. *Phenomenology and the Cognitive Sciences* 18(2): 401–424. ► <https://cepa.info/5837>
- Bechtel W. & Abrahamsen A. (2010) Dynamic mechanistic explanation: Computational modeling of circadian rhythms as an exemplar for cognitive science. *Studies in History and Philosophy of Science* 41(3): 321–333.
- Bich L. & Bechtel W. (2021) Mechanism, autonomy and biological explanation. *Biology & Philosophy* 36(6): 53. ► <https://cepa.info/8106>
- Glennan S. & Illari P. M. (2017) *The Routledge handbook of mechanisms and mechanical philosophy*. Taylor & Francis, London.
- Hepburn B. & Andersen H. (2021) Scientific method. In: Zalta E. N. (ed.) *The Stanford encyclopedia of philosophy*. <https://plato.stanford.edu/entries/scientific-method>
- Lyre H. (2018) Structures, dynamics and mechanisms in neuroscience: An integrative account. *Synthese* 195(12): 5141–5158.
- Maturana H. R. (1978) Biology of language: The epistemology of reality. In: Miller G. A. & Lenneberg E. (eds.) *Psychology and biology of language and thought*. Academic Press, New York: 27–63. ► <https://cepa.info/549>
- Maturana H. R. (1988a) Reality: The search for objectivity or the quest for a compelling argument. *Irish Journal of Psychology* 9(1): 25–82. ► <https://cepa.info/598>
- Maturana H. R. (1988b) Ontology of observing: The biological foundations of self-consciousness and the physical domain of existence. In: Donaldson R. E. (ed.) *Texts in cybernetic theory: An in-depth exploration of the thought of Humberto Maturana, William T. Powers, and Ernst von Glasersfeld*. American Society for Cybernetics (ASC). ► <https://cepa.info/597>
- Maturana H. R. (1991) Scientific and philosophical theories. In: Leser N., Serfert J. & Pletzner K. (eds.) *Die Gedankenwelt Sir*

Karl Poppers: Kritischer Rationalismus im Dialog. Carl Winter Universitätsverlag, Heidelberg: 282–374.

- Maturana H. R. & Guilloff G. (1980) The quest for the intelligence of intelligence. *Journal of Social and Biological Structures* 3: 135–148. ► <https://cepa.info/555>
- Meyer R. (2022). An explanatory taste for mechanisms. *Phenomenology and the Cognitive Sciences*. <https://doi.org/10.1007/s11097-022-09802-0>
- Spaulding S. (2010) Embodied cognition and mindreading. *Mind & Language* 25(1): 119–140.
- Spevack S. C., Falandays J. B., Batzloff B. & Spivey M. J. (2018) Interactivity of language. *Language and Linguistics Compass* 12(7): e12282.
- Stolk A., Verhagen L., Schoffelen J. M., Oostenveld R., Blokpoel M., Hagoort P., van Rooij I. & Toni I. (2013) Neural mechanisms of communicative innovation. *Proceedings of the National Academy of Sciences* 110(36): 14574–14579.
- Stolk A., Verhagen L. & Toni I. (2016) Conceptual alignment: How brains achieve mutual understanding. *Trends in Cognitive Sciences* 20(3): 180–191.
- Wilson A. D. (2022) Ecological mechanistic research and modelling. *Ecological Psychology* 34(1–2): 48–70. <https://doi.org/10.1080/10407413.2022.2050912>
- Zednik C. (2011) The nature of dynamical explanation. *Philosophy of Science* 78(2): 238–263.

Ekaterina (Katja) Sangati is a postdoctoral scholar in the Embodied Cognitive Science Unit at Okinawa Institute of Science and Technology. Her research goal is to develop an enactive yet mechanistic and formalizable approach to language and social interaction.

**Funding:** No external funding was received while writing this manuscript.

**Competing interests:** The author declares that they have no competing interests.

RECEIVED: 6 OCTOBER 2022

REVISED: 11 OCTOBER 2022

REVISED: 17 OCTOBER 2022