Maturana Across the Disciplines

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> Context • Humberto Maturana has generated a coherent and extensive explicatory matrix that encompasses his research in neurophysiology, cognition, language, emotion, and love. **> Purpose** • Can we formulate a map of Maturana's work in a manner that is consistent with the systemic matrix it represents and that serves as an aid for understanding Maturana's philosophy without reifying its representation? **> Method** • Our arguments are based on experience gained from teaching and presentations. **> Results** • We present a map that that represents Maturana's main contributions as clusters of notions clustered according to how we see them to be related to each other as a projection of a matrix of ideas onto a two-dimensional space. We claim that there are many paths through these clusters of ideas. Though ideas relevant to individuals are obtained from various partial perspectives, a deep understanding of any element is dependent on an understanding of the whole matrix. Furthermore, we summarize the contributions to this special issue on Maturana. **> Key words** • Generative process, matrix of concepts, systemic, conceptual map, pedagogy.

Introduction

For more than 40 years the work and ideas of Humberto Maturana has permeated the academic world and applied disciplines. What began as an answer to the question "What is life?" has become an encompassing explanatory network that includes living, cognition, languaging, and emotioning. In October 2010 we decided to collect contributions to find indications of the fruitfulness of Maturana's work across disciplines. In our call for papers, we were looking for articles dealing with these questions:

1 | What are the applications of Maturana's work in various domains of inquiry and action, including both the humanities and the natural sciences?

2 | What are the potential extensions and expansions of the notions and concepts implicit in Maturana's work?

3 | What can be said about Maturana's work in historical and cultural perspectives, i.e., how does his epistemology fit into a historic view, or fit with current cultural and ethical views?

4 | The result of our endeavor is a collection of papers that confirms our expectations. Many scholars have been and still are influenced by and concerned with Maturana's insights. However, before we present a summary of these contributions, we would like to attend to the question of why Maturana's insights are difficult to understand.

Understanding Maturana's extensive body of work

Maturana is one of the few contemporaries who has generated a "wide, complete, explicatory system" (Glasersfeld 1991). Given that indeed his work is extensive, as is evidenced by the currently most complete bibliography of his works (Whitaker, this volume), it is no easy task to provide an overview of his whole body of work. On the one hand, an adequate overview would far exceed the scope of this editorial introduction. On the other hand, an attempt to summarize key points risks not only superficiality, but also invites an inappropriate foreclosure of comprehending the integrated nature of the matrix. Because Maturana's body of work is so extensive, it enables multiple perspectives based on subsets of that work, each of which has enabled valued insights for people in different fields and with different interests. However, what is obscured in any particular perspective, or even in a group of several perspectives, is the systemic, integrated coherence of this work. In this introduction we would like to address, reflect on, and illustrate Maturana's "whole, wide, complete, explicatory system" as a *matrix* of concepts.

According to our experience, one cannot wholly apprehend any such matrix instantaneously at first glance. One must traverse a path or progression through its constituent elements before the whole can be grasped. This is particularly relevant in the case of Maturana's work. Not only is his work extensive, the concepts and insights are not mutually independent. For example, one cannot grasp the notion of an autopoietic entity maintaining its organization homeostatically unless one understands Maturana's specific usage of the term "organization." Furthermore, these concepts were conceived, presented, and/or extended at different times. As a result, one may distinguish "periods" in Maturana's work based on the movement of his focus from neurophysiology, to living systems, to cognition, to language, to evolution, to emotions, and most recently to concerns of human living. The insights newly arising in each period are valid in and of themselves but also inevitably deepen the understanding and implications of earlier ones.

Maturana's contributions are, in our view, individually valuable and unique due to his gift of stepping outside the limitations that are implicit in the usual way of formulating any given question. However, their power is amplified as their interrelationships and interdependencies are recognized and absorbed. As a result, we see the set of Maturana's contributions as not just a matrix but as a *systemic matrix* – i.e., not just an assembled collection of static elements but an integrated network with dynamic and synergistic attributes. During the decades of Maturana's original contributions, it took years for this systemic character to become apparent and increasingly clear.
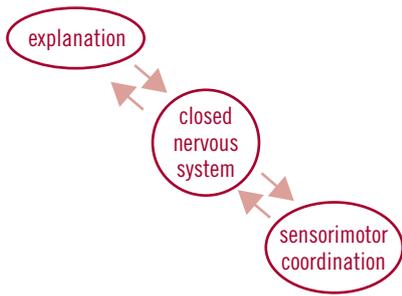
Figure 1: An example of the reciprocal dependency that pertains to the full understanding of a set of three notions from Maturana's matrix of ideas. In this example, it helps to know what the anatomy of an explanation is as one listens to the explanation of a closed nervous system. Similarly, one understands an explanation in terms of the sensory motor coordination that a living system, including a languaging human being, must have lived, and lived without direct access to the world (closed nervous system), in order to deepen one's understanding of an explanation..
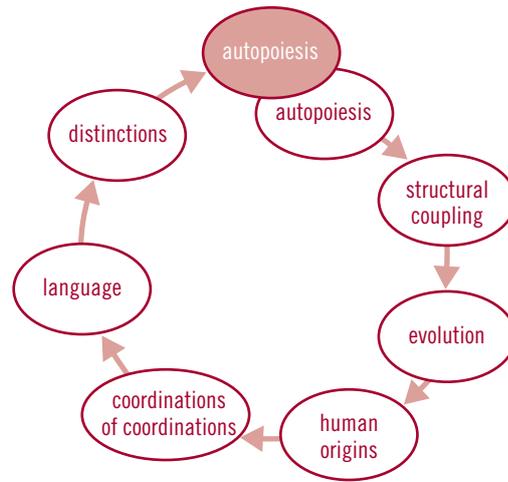
Figure 2: An example of the circular development of understanding of a notion such as autopoiesis. The initial understanding is deepened in each step in this process, until by the time one has completed the path, the understanding of autopoiesis has taken on a new character. A silmilar circular development pertains to other notions.

We will now illustrate what we connote by the term "systemic" via three examples.

First, a systemic matrix, whether of molecules or ideas, grows in a generative manner where the identities of the constitutive components that comprise the eventual matrix have remained conserved as their relations are in turn established and conserved. Thus the earlier basic notions of Maturana's work are conserved within the whole, even where he has, over the decades, extended or refined how he explicates them.[1]

The second example arises from our pedagogical experience. Ideas that are dynamic in nature, that is, that consist of the dynamic relation among several elements, can only be understood through operating the dynamics. This is, of course, well known in the physical domain, and both experiential and case-study based teaching are based on this understanding. What is not as obvious is that many concepts also require a mental operation as a process in order for the understanding to arise Con-

sider, for example, Maturana's "consensual coordination of consensual coordinations." This phrase does not make sense until one mentally operates the specified dynamics, so that one first comprehends consensual coordination as a process, and then operates that process recursively on itself. This is a task of the imagination that is not easy when first encountered. It represents an instance of result and process taking place in different domains. It is also one of the processes that underlie Maturana's statement that "the student learns the teacher;" namely the student learns the manner of thinking that generates the relevant concepts.

Our third example also comes from our pedagogical experience. The understanding of any part of a systemic matrix is systemic; namely a full understanding of any one part is dependent on an understanding of other parts. Thus the odd situation arises that in order to understand B, one needs to have understood A, but A in turn is not fully understandable until one has understood B; similarly B and C may have a reciprocal relation of illuminating each other. Fortunately, either A or B can be presented in such a way that it offers meaning on its own, thus providing a starting point from which a deeper

understanding can arise through a circular process. One example of such a relation is shown in Figure 1.

Perhaps a better way to express this is that a partial, though useful, understanding of any given element expands and evolves as understanding of other elements develops. For example, autopoiesis is usually first regarded as a definition of life (in spite of Maturana's explicit claims that it is not a definition[2]), and as other parts of the matrix are incorporated into one's thinking, autopoiesis becomes an abstraction that refers to that dynamic that we distinguish uniquely in a system such that we can say it is living (Figure 2).

1 | However, it is not our intention to provide a documented historical development of Maturana's work here; these comments are intended only as a general impression.

2 | Maturana uses the term "abstraction" to specify what an observer does in distinguishing a consistent set of regularities, and the term "definition" as an agreed starting point with a priori premises that are often obscured. Hence he states "My assertion that living systems are molecular autopoietic systems is neither a definition nor an explanatory proposition, it is an abstraction of the operational coherences apparent in the actual living of living systems as molecular systems. Therefore, my assertion is that living systems are molecular autopoietic systems" (Maturana 2002: 11).

Figure 3: A two-dimensional representation of a multidimensional matrix of some of Maturana's contributions and related concepts. If the matrix were to be viewed from a different perspective, the apparent clustering would appear different. Terms in large font are labels for each cluster.

The notion of autopoiesis is a specific case of the general question of "what is it that we do as we operate as observers?;" namely autopoiesis is not a thing-in-itself that exists independent of us, although we, for the convenience of having a "shortcut" that relieves us of cognitive burdens (Riegler 2001) and for the satisfaction or pleasure in generating and engaging with the richness of conceptual world, treat it as if it were so.

Having thus introduced and described how we see Maturana's work as a systemic matrix, we would now like to proceed to illustrate it. We shall do so in the form of a diagrammatic representation that we shall call a "map," i.e., a flat representation of a multidimensional matrix. Our map of notions relevant to Maturana's body of work (Figure 3) is not exhaustive, and a few of the notions included (such as "epigenesis") are not Maturana's unique contributions. This

map is organized according to how we see clusters of ideas to be adjacent or related to each other as seen as a projection onto a two dimensional space. Hence this particular adjacency representation is only one of many possible ones.[3]

For any particular workshop or course, or for progress in self-directed studies, one has to begin somewhere on the map, and then expand the territory. Some routes are easier to follow than others, but an appropriate starting point can be offered if one knows the concerns, background, and implicit premises these entail, as well as the attitudes and emotions of the participants.

3| If we had the capacity to draw in three or more dimensions, the clusters and the topics within the clusters would appear to align differently according to the viewer's perspective.

In our pedagogy we have explored many different routes through Maturana's ideas. Some routes we have found easier to comprehend than others, and in part this is determined by the background of the learners. For example, in teaching people with a background in environmental management we have found it effective to begin with what is familiar for them, namely "systems" – they have after all been studying ecosystems and how we manage them. After a brief consideration of what an explanation entails, we turn to living systems, evolution, perception and cognition… all along the way evoking a new way of looking at these familiar things. Only quite late in this program are we able to effectively discuss epistemology, reality, and specific terms such as "objectivity in parentheses"… but having done so, the learners review all that preceded from a new perspective and see how this

is relevant to their concerns in their respective experiential world (Figure 4 left).

Alternatively, in teaching people who have been elementary schoolteachers and are concerned with pedagogy, we find it easier to begin with emotions and emotioning; what Maturana has to say about love immediately resonates with them (Figure 4 right). Clearly, there are many different paths through this map, but based on our experience, some paths are easier than others. This is due to an underlying "dependency structure" in which ideas depend, at least in part, on a comprehension of other ideas. As shown in Figure 1, this is a *reciprocal* dependency, with the implication that one needs to take care as to which aspects of an idea one tries to explain at any moment, and not insist on a full understanding until other ideas have been internalized. We would also like to point out that no book, paper, seminar or course can adequately transfer full understanding.[4] Value for one's living, both professional and personal, can of course be gained from one such source. This is clearly the case with Maturana's work, since the "complete explicatory system" is extensive, the ideas are mutually modulating, and thus it is not just a system to be studied as such. Rather, it is a systemic network that is understood in a systemic rationality. This should not come as a surprise as our cognition is itself also a systemic generative process. We are using a systemic process to understand a systemic phenomenon that in itself includes the systemic nature of our own process. This is of course a radically recursive perspective. Based on our experience it usually takes years of living with and reflecting recursively throughout the entire matrix in order to incorporate this dynamic fully in one's own thinking.[5]

As with many extensive theories, people and groups of people in different fields claim Maturana as the basis for their work, but their concepts of what this work entails or means differ from each other. We encountered this phenomenon when col-

lecting the contributions and peer reviews for this issue. This may be because subsets of the ideas are in themselves valuable to many people; and as they have followed the lineage of implications of some subset of the matrix, further ideas from the matrix may or may not resonate with what they have created based on their particular perspective. Furthermore, people with similar views begin to converse with others, and the result is lineages of understanding and even lineages of academic pursuit and writing that claim Maturana as their basis, even though they differ from each other.

In Figure 5 we try to illustrate the notion of interconnectedness in a three dimensional matrix. The connecting lines are not arbitrary; each refers to a mutual modulation between two notions, either between the clusters as a whole, or between some of the sub-ideas in each cluster. Not all the relevant connections are drawn here as we can attest that an expansion of this figure into a more complex dependency diagram looks even more like a tangled web than Figure 5. The most relevant aspect, in this context, of Figure 5 is that there are different perspectives that have resulted in groups of people who focus on different aspects of the matrix. In some cases these looks are an emphasis within the whole; in other cases they entail a blindness to other parts of the matrix. Three such perspectives are presented: the "theory of autopoiesis," the "biology of cognition," and the "biology of love." A fourth perspective is that claimed by Maturana and his colleague Dávila in the Escuela Matríztica de Santiago, namely the "biological and cultural matrix of human existence" – an operational understanding that is inclusive of the entire matrix that is based in Maturana's life work.

Contributions to this issue

Given the breadth of Maturana's work it is not surprising to find that his ideas are applied in a great number of disciplines, ranging from his original field of biology to dynamical systems theory, linguistics, immunology, ethics, and psychotherapy. In what follows we provide a preview of the contributions to this special issue, ranging from the natural sciences to the humanities.

The collection starts with a text from Maturana himself. Some time ago, **Alberto Paucar-Caceres** and **Roger Harnden** approached us with their translation of **Humberto Maturana**'s Preface to the Second Edition of *De Máquinas y Seres Vivos Autopoiesis: La organización de lo vivo*. Although the Spanish version had already been published in 1994, it had not been published in English.

In his three-part paper, **Hugo Urrestarazu** clarifies and amplifies the key characteristics of "autopoiesis" and aims at transferring its theoretical features to a more general phenomenological domain, thereby creating the opportunity for applications of autopoiesis in areas other than biology. In the first part, published in this issue, the author focuses on the terminology, presents a basic definition, and introduces conceptual tools relevant to systems of which autopoietic systems are a subset. In particular, he reviews the six validation criteria for identifying a system as autopoietic, as originally developed by Varela, Maturana and Uribe. Urrestarazu claims that these "VM&U Rules" are applicable to both biological and non-biological systems. Parts 2 and 3 of his paper will be published in future issues of *Constructivist Foundations*.

Seiichi Imoto's objective is to revisit Maturana's writings in an attempt to distill and clarify his unique and original contribution to a biologically inspired philosophical world view. Imoto sets out to identify the logic of Maturana's biology, which he claims is grounded in the notion of a structure determined system as an entity existing and operating in two non-intersecting phenomenal domains. Focusing on these fundaments, the paper stresses the novel understanding of systems proposed by Maturana and postulates the origins of his approach.

The goal of **Nelson Vaz**'s paper is to apply Maturana's epistemology to the field of immunology. The paper is critical of "classical immunology," which focuses on the production of "antibodies" that protect the organism from attack by micro-organisms. Vaz first contrasts this with the work of Varela, Coutinho and Stewart, who conceived the immune system as a *cognitive* system. He then goes further and demands a wider view of the organism as a biological system and of the constitutive role of human observers in

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4| Cf. the constructivist tenet that such media cannot transfer understanding to a passiv recipient (Glasersfeld 1995).

5| This is something we may call "slow thinking along the path of living."
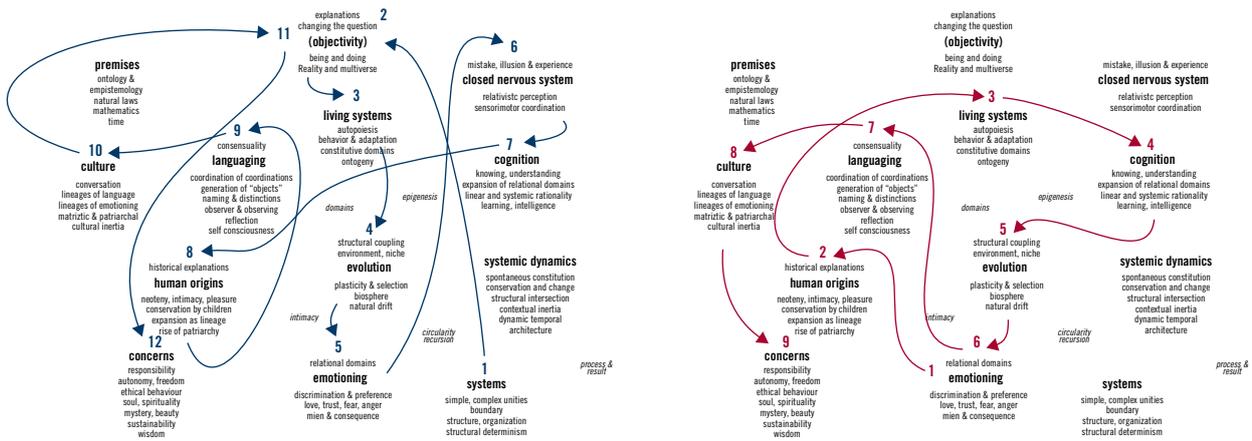
Figure 4: Two different paths through some parts of the matrix presented in Figure 3. The one on the left has been found appropriate for environmental managers and the one on the right for elementary school educators. Although the arrows indicate an apparently linear progression, in practice some notions in each cluster are not fully developed until another cluster has been introduced, and there is a lot of cross referencing as one progresses such that the interconnected nature of this matrix emerges. Thus the map is only useful as an outline if the matrix as a whole is already well understood.
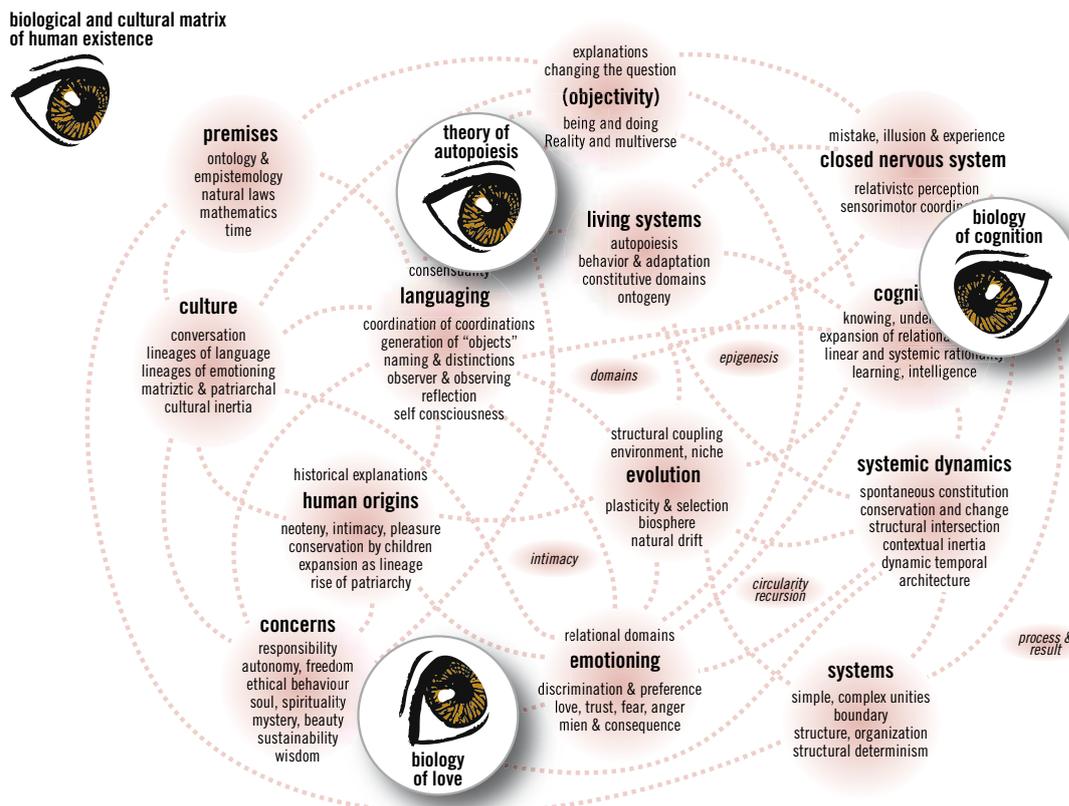
Figure 5: Examples of some different partial perspectives taken in regarding Maturana's systemic matrix of ideas. The connecting lines are neither random nor complete; each indicates a relevant connection between at least some of the ideas in a cluster. Although some aspects of the matrix are more apparent and treated as more relevant in each perspective, this does not imply that other clusters are necessarily invisible. The perspective of the biological and cultural matrix does not imply an external view; rather it indicates a comprehensive perspective. The notion of the "observer's eye" is borrowed from Maturana.

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delineating experimental realities. For Vaz, Maturana's biology of cognition provides this broader perspective. Given the controversy between these paradigms we asked one of the peer-reviewers, **Alfred Tauber**, to write an open commentary from the "classical" perspective. The commentary is published here, together with Vaz et al.'s response, in which they also try to posit the question of whether the Varela et al. paradigm has made any recent progress.

In his contribution, **Alexander Kravchenko** aims at resolving a number of conceptual tangles between the modern orthodox views of cognition, language, and linguistics through an understanding of Maturana's biology of cognition and language. The latter is conceived as the basis for a paradigm shift in the language sciences. The author relates the critique of orthodox linguistics offered by Roy Harris to a constructivist view of knowing, languaging, and meaning-making to provide an effective methodological tool in the study of language.

Hugh Gash links Maturana's two ideas on how we explain reality, namely objectivity in parentheses, and objectivity without parentheses to issues of personal, interpersonal, and societal ethics. He makes a connection between the emotion of love and our choice of how we explain reality, as reality in parenthesis requires cooperation and respect, which take place in love. Thus emotions and the manner of explaining are connected in a manner that determines the ethical implications of the accepted epistemology.

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Rossella Mascolo shows how Maturana's epistemology dissolves the dichotomy between science and ethics that characterizes bioethics as it is traditionally understood. She does this by positing that the biological basis of human beings as a languaging species has embodied in it the biology of love, which is characterized by care for the other, which, in Maturana's terms is the basis of ethics. She points out that the "naturalistic fallacy," which she considers a problem for Cartesian ethics, is not an issue in Maturana's work because as a self-declared biologist Maturana does not shun situating ethics as integral to human embodied existence, lived in languaging.

Together with Humberto Maturana, **Ximena Dávila** founded the Matríztica School

and has been a close collaborator with him ever since. In her paper she puts forth the suggestion that the cultures we live often lead us to generate worlds in which we are self-depreciating. In this stance we find ourselves undeserving of love because we are incapable of satisfying the expectations of others about how we should be. Her remedy for this condition is reflexive "liberating conversations" in which the individual finds herself understanding that she is a loving, biological, cultural being.

In his personal essay, serving as a concluding afterword, **Fernando González** reflects on the significance of Maturana's work in his own life and in general. He argues that one can live without the need to base anything on a reality independent of oneself and calls such a way of living "parenthesism," alluding to Maturana's "objectivity in parentheses." Gonzales also touches upon the question of how science teaching commonly inculcates a perspective inimical to personal responsibility for one's world, and he concludes by offering a list of important abstractions from Maturana's body of work.

Conclusion

Since the field of Maturana's work is rich, enchanting, and sufficiently different from what most people begin with, anyone who seriously engages with it ends up with what we want to call an "intensely personal relation" with those ideas they have found to be relevant to their life or work. In some cases that personal view becomes a passion that directs what people do or alters how they do it. Also in the papers comprising this issue of *Constructivist Foundations*, we find different perspectives and different orientations. Even where people do not choose to pursue Maturana's work explicitly after a thoughtful encounter with it, it often deepens the way they continue to pursue the work they were doing, or inspires them to look into the deeper implications of what they understand. Yet, what is constant is that each person sees Maturana's body of work from a perspective that is fundamentally personal – their own view, their world, constituted in a manner that has been shifted or altered by what they have learned from him.

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