

Humberto Maturana

Interviewed by Adam Lucas

ECONOMISTS, businessmen, and politicians are fond of saying that competition is necessary for economic growth and human well-being. Using Darwinian evolutionary theory as a justification for this assertion, they claim that humans are 'naturally' competitive. "It's the law of the jungle out there", they seem to say, "that's why we need the capitalist competition of the marketplace. The 'survival of the fittest' is a perfect description of how the market should operate." But if humans really are biologically competitive, doesn't that legitimate the exploitation of the 'weaker' by the 'stronger', the 'unfit' by the 'fittest'? Where might moral considerations and ethical responsibility fit into such a picture? And why is it so seldom that we ever hear any other case put to us?

Generally speaking, the choice we are given seems rather bleak. Either we accept the 'scientific' view that humans live in a cruel and indifferent cosmos, and therefore, that we must ourselves be cruel and indifferent in order to survive, or else we can retreat to an uncritical religious faith and some form of creationism. Such a simple view of the meaning and implications of evolutionary theory need not be accepted. The Chilean neurobiologist, Humberto Maturana, is one of many scientists who dissent from this narrow orthodoxy.

Maturana shifts the terrain of the debate on human nature and evolution by proposing that cooperation and love are not simply forms of social behaviour, but the biological preconditions for human evolution. According to Maturana, humans are therefore not just naturally sociable and cooperative, but naturally loving and compassionate beings. After all, he argues, how could language and culture have arisen if humans had always lived in competition and strife, in what Thomas Hobbes called 'a war of all against all', with each person pursuing his or her own self-interest? Maturana says that if we pause to reflect on this issue, we find that it is trust, acceptance and the pursuit of intimacy and a shared existence that provide the basis for social cohesion, language and culture; not competition, and not self-interest, although there can be no doubt that these latter characteristics have been instrumental in the formation of hierarchical, male-dominated societies over the past several thousand years.

Maturana's radical views on the origins of language, self-consciousness and culture can be traced back to the beginning of his career in the early

1960s, when he first began to depart from biological orthodoxy by trying to conceive of living systems in terms of the processes that constitute them, rather than in terms of the organism's relationship to the environment. In some ways, Maturana's work can be seen as an elaboration into the biological and social domains of Ilya Prigogine's theory of dissipative structures, in the sense that Maturana shares Prigogine's concern with the dynamics of evolution and self-organisation. Indeed, Maturana's concept of *autopoiesis* is often discussed in connection with Prigogine's work. At the same time, Maturana has identified qualitative distinctions between different forms of biological and social behaviour which Prigogine can only allude to at the physical level. But while Prigogine places an emphasis on the essential openness of living systems, because of his focus on thermodynamics and therefore, matter and energy flow, Maturana's focus upon perception and language places an emphasis on the essential closure of the nervous system in terms of its dynamics, and how this operational closure constrains the structural changes that go on within organisms and species over time, including those changes related to perception and cognition.

Maturana is perhaps best-known for having coined the term *autopoiesis*, and for his related theories in developmental biology, which modify some of classical Darwinism's basic assumptions about evolutionary change. Autopoiesis refers to the self-production of living organisms that are structurally coupled to one another and the medium or environment within which they live. But the structural, evolutionary changes which they undergo over time are not actually 'chosen' or 'selected' by their environment, as vulgar Darwinism would have it. Maturana argues that, on the contrary, any structural changes that go on within an organism or species cannot be specified by the environment, because any changes occurring within the organism are specified by the previous state of that organism, and not by the structure of the disturbing agent. Maturana calls this the *structural determinism* of biological entities. Thus, the environment is merely the source of external perturbations, and can *trigger* structural changes in the organism, but it is misleading and wrong to say that the environment 'chooses' or 'selects' those changes. It is only the scientific observer, who has some knowledge of the possible changes that the organism could undergo in different environmental conditions, who is able to see that only one possibility is actualised.

But this is simply one aspect of Maturana's fascinating contribution to modern evolutionary theory. These ideas were first elaborated in *Autopoiesis: The Organisation of the Living* (1973), and subsequently refined in his more recent book with Francisco Varela, *The Tree of Knowledge* (1987), and numerous academic papers. Maturana recently retired as a Professor in the Faculty of Science at the University of Chile in Santiago, having returned to his homeland in 1980 after seven years in exile. Like many other Chilean academics

and intellectuals, Maturana left the country following the overthrow in 1973 of the democratically elected socialist President Salvador Allendé by the American-backed fascist General Augusto Pinochet. Nevertheless, Maturana's years of exile seem to have contributed to a growing international audience for his work, in fields as diverse as biology, ecology, psychology, social theory, philosophy, medicine, education, and the arts.

I first encountered Maturana's challenging ideas over ten years ago through numerous references to his work in Erich Jantsch's classic book, *The Self-Organizing Universe* (1980). Shortly afterwards, I began reading Maturana's own work, and was pleased and surprised at the clarity of his expression and the refreshing and often philosophical insights which he brought to biology. When I discovered that Maturana was a regular visitor to Australia, I contacted the Melbourne coordinator of his biannual weekend seminar programme and organised to interview Maturana by telephone. The following is a transcript of that interview.

Could you begin, Professor Maturana, by explaining the meaning of the term *autopoiesis*, and the context within which you initially applied the term?

Certainly. The word has two Greek roots: *Autos*, which means 'self', and *poien*, which means 'to produce'. So it indicates self-production. I thought that I had coined the term, but it seems Aristotle used this word once or twice...

Do you know the name of the text?

No, I don't. In fact, I didn't know that this word had been used before. I invented it in order to refer to the organisation of living systems; systems that produce themselves through their own constitution as molecular systems.

Obviously, *autopoiesis* is closely bound up with the general dynamics of self-organisation in the universe. Unlike Prigogine's concept of dissipative structures, however, your own work applies specifically to living systems with cellular structures. It seems to me that what is novel about your interpretation of biological evolution is the emphasis you place on the nervous system, which you claim operates as a closed system in its dynamics, and that it is this operational closure of the nervous system which should be treated as fundamental to our understanding of how perception and cognition work. But what's your evidence for this?

Well, the evidence could be anatomical, for example. If you look at the nervous system in its make-up, in terms of nerve cells connecting with each other, you see that it forms a network of elements that are completely interconnected with one another. At the same time, it is not something that one

can show, but something that one has to abstract and conceive from its operation.

You see, in any system with which you interact, you can always consider the surface of interaction as an opening. But this obscures what is happening within the system. In the case of the nervous system, I claim that if one looks at the nervous system as open, in terms of the interactions of the organism with the medium, then you do not see how the nervous system operates; that it actually operates as a closed network of changing relations of activity.

For example, if you consider the energetic dimensions involved in seeing: photo-receptors can respond to a single photon. Now, how does one know that they can respond to a single photon? Because you can create an experimental situation in which a person claims to be able to see when a single photon of some sort is fired through their field of vision. But the whole activity required for seeing, in terms of the experience of seeing, involves the activity of hundreds of millions of cells. So the energetic activity of the brain that is required to respond to that single photon is much, much larger than the energy of that single photon. Secondly, the experience of seeing depends on the connectivity of the network. So the photon only triggers something that is realised within the nervous system. Now if one does not recognise this, one will speak about the photon 'carrying information'. But when you try to work out just what 'to carry information' means, you discover it means nothing.

One of the examples that you often use to illustrate this point relates to whether there is a direct correlation between the spectrum of light that comes through the eye, or the wavelength of light, and the colour that's actually named or perceived. Could you briefly explain the research that you conducted in this area, and your research findings?

Well, the research was precisely in terms of trying to make a correlation between the spectral composition of the light to which the eye is responding, and the activity of the ganglial cells in the retina. What you find is that under many different conditions, which entail many different spectral compositions from the object observed, you get the same activity in the nerve cells. For example, the perception of the colour green can be triggered by a number of different light perturbations.

If this is so, and experiment shows that it is, whatever is happening in the ganglial cells in the retina is independent of the spectral composition coming from the object. Therefore, it has to do with something else. And what that turns out to be relates to the connectivity of the retina, the characteristics of the cells of the retina, and not with the characteristic of the light to which the eye is responding.



How then does this affect our traditional views of perception and representation?

Firstly, it shows us that the colour of the objects we see is not determined by the features of the light which we receive from the objects. When you see something, the act of seeing is in fact an act or a process that entails an experience determined in the structure of the observer. So the whole question of cognition changes. It cannot be triggered any more as a manner of knowing or pointing or distinguishing or perceiving an independent reality, but as a manner of operating in coherence with the circumstances of living. The question is therefore of a different kind.

What then is the relationship between the external world and our perception of it?

The external world is an explanatory construct for our experiences. If you want to explain how we are able to display coherent behaviour, then you have to resort to the structural dynamics of the organism. You have to see and show that the structure of the organism is a particular structure that arises in interaction with a medium, which you must eventually describe with reference to the organism.

A good analogy can be found in pharmacology. During the period in which chemistry was less capable of making full descriptions of different molecules, scientists who wanted to speak about the properties of different substances used what are called bio-assays. You injected a substance into an animal or added it to a plant, and used the animal or plant as an indicator of the presence of the substance. For example, the changes in the ovaries of a female rabbit indicate the presence of a hormone, oestrogen. So these substances were described in terms of the changes the organism underwent with regard to them. The analogy is that this is how the outer world is described, through our changes. So we do not see an outside world, but rather, we generate an outside world through our changes.

This last point leads us on to one of your more controversial claims, which in some ways can be seen as a response to Kant. You claim that as biological beings with an operationally closed nervous system, we humans can't make any statement about a reality that exists independently of our doing or our actions. But what exactly do you mean by this?

The question of whether it is possible to speak about an independent reality is not new, of course. In fact, it is very old. Kant himself developed this criticism about the idea that one can't claim to speak about the thing-in-itself, and yet he retained the notion of the thing-in-itself.

Now what I am saying is, if we consider our biology, and the way that we operate as living systems, one realises that, when we are actually experienc-



ing something, we cannot distinguish perception from illusion. When we commit a mistake, we do not know that we are committing a mistake. The mistake is acknowledged as something that is inadequate only after we have done it. While we were doing it, we did it as though it were valid.

Through these reflections and arguments, and by looking at how we operate, it turns out that we can say nothing about an independent reality. We explain our experience with our experience. You see, even science does not depend on the supposition that we are speaking about an independent reality. The philosopher of science, Karl Popper, himself realises this, but he conserves the notion of an independent reality as a sort of controller of the validity of what he is saying. Now what I am saying is that even this notion of reality as a controller cannot be sustained, because it pertains to our operation as beings that can say nothing about anything independent from our selves. Now this doesn't create a powerful problem, because we have been living like this anyway for a long, long time, but it at least opens for us the possibility of being aware that we shall live the world that we bring forth. That the world in which we live does not depend on something external to us, it depends on us as living systems doing whatever it is we do in language.

Kant was particularly concerned with this problem, just as I am. But finally, he could not accept that one could indeed say nothing about an independent reality, and so he kept this notion. It requires, perhaps, a certain daring to accept that you don't need this notion of an independent reality. Modern physics, particularly quantum physics, is in a situation in which it is becoming apparent that this supposed reality is continuously changing. One of the great problems in contemporary physics is the role of the observer, and whether it is possible to include the observer as part of the physical system, because the observer is not a physical being, but a biological being. So this question has somehow been present in many ways, but as far as I know, nobody else has been willing to take the full step of acknowledging that we can say nothing about this so-called independent reality. I believe that the very notion of an independent reality is meaningless.

Would it be fair to say, then, that you are not denying that there is a world that exists independently of us? But is it simply a matter of fact that the way we are structured doesn't enable us to speak about it?

Well, it's a little bit more than that, because the very notion that there is an outside reality belongs to our way of being. You may remember that when physicists first began to discuss the possibility of the existence of black holes, they claimed that the laws of physics end where the black hole begins. What they meant by this is that a black hole is a mass of matter that absorbs other matter; everything goes inside, but nothing goes outside. The physicist can



therefore say nothing about what happens inside the black hole. Physics simply ends there, because it can say nothing about that particular state of affairs. In order to say something about it, you must operate in interactions. Therefore, anything you could say about it would not apply. So it is a matter of that kind. Whatever we say about an independent reality does not apply. We may argue that we need this notion for epistemological reasons, but whenever we want to say something about it, it doesn't apply. So the very notion of an independent reality is intrinsically misleading, because it leads us to believe that reality would apply to notions such as 'thingness'. But it doesn't apply, because the notion of 'things' applies to what we do.

Your comments remind me of the different assumptions about the nature of reality which underlie different languages. For example, in Hopi Indian, and some Aboriginal languages, there is no notion of subject and object. Like the late physicist David Bohm's concept of the holomovement, these languages assume that there is an unbroken unity of being within which different subjects exist as relatively autonomous. Here, reality is the wholeness within which we move and draw attention to particular qualities. It is the act of bringing those qualities into attention and isolating them from the whole through language which gives them their appearance of 'thingness'. In your own terms, such languages could be seen as recursively drawing attention to their own construction. Are such issues related to what you are talking about?

Yes, but at the same time, these languages are still just languages. They are domains of operation in coordinations of coordinations of behaviour. Entities do arise in terms of whatever it is we can distinguish; which could be relations, totalities, differences. But in different cultures, with their different languages and different manners of living together, the kinds of distinctions made in each language are also different.

For example, Chinese thinking is very systemic, while European thinking is very linear. Westerners deal with everything as though it had to do with linear argumentation. Although I don't know what is happening now with this tremendous occidentalisation of China, I do know that in traditional China, there was systemic thinking. The whole notion of yin/yang, for example, has to do with a systemic view, not oppositions in our terms, but systemic coherences. This entails different manners of living, and yet language still has to do with coordinations of coordinations of behaviour.

How does your own theory of language differ from traditional views?

There are several traditional views on language. Chomsky, for example, insists on the generative character of grammar, and the distinction between superficial and deep structures. Essentially, this has to do with the coherences



of the generation of speech. But Chomsky doesn't deal with meaning; it is simply left out. It is another problem. The school of Jacobson does something different. It is not concerned so much with grammar, but with meaning. Jacobson thinks that every element in language has meaning.

Now, the notion of communication, symbolisation and symbols enters very much into the usual description of language. What I'm saying is something different in the sense that I think that any reflection about language has to go together with the understanding of meaning, and that grammar is secondary to meaning. Secondly, I am saying that communication and symbolisation are secondary to language, and that language consists in an operation of coordinations of behaviour, and in fact not just in coordinations of behaviour, but in coordinations of coordinations of behaviour. Therefore, meaning arises immediately in the process of coordinations of coordinations of behaviour which in turn constitute language. Grammar has evolved to deal with the regularities of those coordinations of behaviour.

So language is primarily related to doing, to behaviour and activity, not symbols, and not communication, because symbols and communication are secondary. The primary thing in language, according to what I say, is the process of coordinations of coordinations of behaviour.

The example that you sometimes use to explain your conception of language as coordinating coordinations of behaviour relates to the act of pointing. If someone points at something for somebody else, they can perceive that there is a relationship between the pointing finger and the object that is being pointed at, whereas a dog or a cat will simply look at the pointing finger.

That is basically correct, but it's not exactly that they will perceive that there is a relation. If I point, I am doing two things. On the one hand, I am coordinating my relation with the person for whom I am doing the pointing, and on the other hand, I am coordinating this coordination by orienting the attention of this person in one direction. So what you have there is a coordination of a coordination of behaviour.

You would have a better example when you call a taxi. You make a gesture, and you connect with the taxi driver. What you see is that the person looks at you, and then you make another gesture, indicating where you would like this person to stop. With the second gesture, you coordinate your previous coordination. Now the result is a coordination of behaviour which can be commented upon as if it had been an agreement for taking a taxi.

Another controversial claim which you make is that language originated at some time in the very distant past. Could you explain how long ago you think language first arose, and why you have come to this conclusion?

I believe language may have begun as early as three million years ago, because of the great many changes in the structure of the nervous system, the face, and the respiratory dynamics. All of these changes are associated with our being languaging beings that use sound production in language.

Are you referring to physiological changes that have been found in the fossil record of early hominoids and hominids?

Physiological changes, anatomical changes, and behavioural changes. These are very great coherent changes, so they are not something that could arise through a single mutation. It's a whole series of coherent changes that must have taken place continuously for many generations.

But what's the source for your conclusions? What other research has been done in this area in order for you to draw such conclusions?

My propositions about language have to do with my own more or less formal research in relation to daily life and what we do with language. Now with respect to the origins of language, I make this assessment because if you listen to many of the people who are dealing with this question, they will say that language began fifty thousand or one hundred thousand or two hundred thousand years ago; some time much nearer to the present. They are also thinking in terms of genetic changes. Now the reason why I think differently is because the characteristics of a species are not primarily determined through their genetic constitution, but rather by a manner of living that is concerned with systemic actualisation, in which living system and medium change together. This requires different dynamics, and this is why I don't think that two hundred thousand years is enough.

It's been known for some time now that humans share a fossil ancestor with the chimpanzees, and that our early hominid ancestors began to evolve along a different evolutionary path about five to six million years ago. My own criticism of the genetic basis for language partially relates to the fact that human beings share more than 99% of their DNA with chimps, and yet our physiology and behaviour is very different. I believe that the tremendous expansion of intelligence, apparent throughout human history, is the result of our hominoid and hominid ancestors being biologically different from the chimpanzees; the outcome has been an enormous increase in the size of the human brain.

If you compare the size of the brain of human beings to the size of brains of chimpanzees for example, the human brain is three times bigger. It's not only bigger, there are of course many other differences in terms of the connectivity.



In the book you co-wrote with Francisco Varela, *The Tree of Knowledge* (1987), you argue that, although chimpanzees are ‘linguaging’ beings, and can even be taught to use sign language, as evidenced by the work of R.A. and B.T. Gardner and others, they do not live in language. Unlike any other creatures on earth, human beings live within the constructions enabled by language or symbolic communication. Furthermore, you assert that chimpanzees demonstrate a greater propensity for competition and struggles for power than did our hominid ancestors, who lived in cooperation, love and shared intimacy. You also claim that if they had not possessed these characteristics, we would have remained simian, like the chimpanzee. In other words, it was these characteristics that allowed our hominid ancestors to develop language and evolve in a totally different direction to our now distant cousins.

Because you place love at the centre of human relationships and language, and claim that humans are biologically loving beings, could you talk about the role of trust in human relationships generally?

Trust is a fundamental element in social life, but it is love that constitutes social coexistence, just as it is the emotion that constitutes trust. Love is the domain of those behaviours through which the Other rises in a legitimate and allied coexistence with you. This constitutes trust; to trust the Other to the extent that he or she does not have to justify himself or herself in relation to you. So trust is secondary to, or goes together with, love. What I claim in relation to love and language is not that love is central for language, but that love has been central for the origin of language. Now that we are in language, we can also use language to hate one another.

But love was the precondition ...

Love was the precondition. It was the condition which allowed humans to live together in sufficient nearness and recursive intimacy to subsequently permit the growth, development and conservation of living in coordinations of coordinations of behaviour.

However, it should be acknowledged that there has been a shift in human development since Neolithic times. I think that human history is a history of cooperation, in the sense that it is centred on love. But in the last fifteen thousand years, cultures have arisen which have emphasised struggle, competition, and relations of domination.

I take it that you are here referring to the emergence of patriarchy, and the work of some anthropologists and archaeologists who argue that the earliest human societies were basically egalitarian, and that elements of this egalitarian culture survived in various forms over a wide geographic area until the late Middle Ages?



Yes. I believe that such ways of life arose from herding practices amongst pastoral tribes. These tribes, who worked and lived with herd animals, developed techniques for killing off other animals which preyed on the herds. At some time in the distant past, these techniques related to the appropriation of food sources and the development of weapons and killing began to be conserved as a manner of living. Appropriation in the broader sense of taking land, animals and people by force soon followed. In this patriarchal manner of living, procreation and reproduction, rather than a focus on the systemic coherences of life, became more important.

I believe that if you look at history, you will soon realise several things. One is that conflicts are never resolved through war. War may change the domain of the conflict, but conflicts are always resolved through agreement, through collaboration. Competition has never led to what one would call the creation of general and basic better conditions for life. It may have led to a more deep, effective handling of things here and there, and through this perhaps to things that may sound very novel, but it's always very narrow.

If we look at what happens to us in daily life, first of all, we see that when people are deprived of love at whatever age, they become ill. Competition generates all kinds of stressful situations; physiological distortions and things of this sort. Now if you attend a little to daily life, you will soon realise that domains of competition reduce intelligence, and they reduce the ability to see, because they force you to focus in a particular direction, while the relational situation of mutual respect and acceptance, that means love, opens this space of view, expanding intelligence. If you are a teacher and you observe your students, you will observe that whenever they are accepted, and treated in a respectful manner, and loved, they become more intelligent.

Does what you are saying have any implications for education?

The main implication for education is a change of emphasis from competition to collaboration, as a condition which fosters self-respect in young people. To collaborate, you have to respect yourself. If you do not respect yourself, you cannot collaborate, because you feel that you risk your own disappearance in your relations with the Other. So you have to foster self-respect, and self-acceptance. Through that respect for the Other, acceptance of the Other, comes the possibility of generating things together in the pleasure and desire of doing them together.

Now if you compare this with what happens in most schools, where there is an emphasis on competition, you soon realise that schools should on the contrary be generating situations in which children can cooperate and grow. I do not know what it is like in Australia, but in Chile there is an expression, 'They are not even there'. As a consequence of this kind of attitude amongst adults, children become disconnected. They are being brought up in such a way that they have no connection with the community to which they belong.

They live a life which is essentially empty. I believe that one has to shift the orientation of education to creating the conditions of the development in children of self-respect, rather than fostering the idea of competition. This would open respect for collaboration, and if there is collaboration, there is the possibility of doing things together for the well-being of everyone, rather than simply for oneself or a small group of people with similar interests.

What about science and ethics?

Well, for ethics I think that this is very important. Unlike Kant, I think that ethical concern has no rational foundations. Therefore, human rights have no rational foundations. Human rights are rather an expression of a desire to live in a certain, particular way. So ethics has to do with love; the concern for the Other has to do with love. This entails a change in understanding of the matter of ethics. With science in general, I think that this may lead to a recovery of systemic thinking—which is of course happening already—to a deeper understanding of systems in general. A more adequate interplay of linear thinking and systemic thinking allows for a more complete understanding of ecological and biological phenomena.

In some of your more recent work you have claimed that there is a potentially infinite number of forms of reason or rationality. You support this claim by pointing out, quite rightly I think, that any rational system is always founded on premises that are accepted through non-rational preferences. Although this may initially seem like a very radical view, and certainly one that will not endear you to positivists and realists, it dovetails with some ideas in post-structuralism, about there being many forms of reason, rather than a singular rationality, which has been the classical idea.

The very many forms of reason have to do with the very many domains in which we live. So each domain of coherences of life is also a domain of rationality, in the sense of coherences of the argumentation possible in that domain. Therefore, whether an individual is in one domain or another is simply a matter of preference. If one is aware of one's emotions and hence one's preferences, one can be responsible for the rational arguments that one develops, which is usually not the case.

You see, one needs to make a distinction between having reasons for doing something, and having motives for doing something. When one asks for reasons, one asks in terms of rational argumentation to justify something. When you ask for motives, you ask for the involvement of another person, and hence the opening of responsibility for his or her participation in doing something. Thus, the distinction between reasons and motives opens the possibility of being aware of one's responsibility for what one does. Although this is not necessarily a new idea, it does make the relationship between reason and ethical responsibility more obvious. And I think this is very important for science and ethics, indeed, for social life in general.

