



Fendrechtsstraat 10  
Rotterdam, NL  
+31 10 2067272  
v2@v2.nl

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## METADESIGN

Essay by Humberto Maturana for "TechnoMorphica," 1997.

Human beings versus machines?  
Or machines as instruments of human design?

The answers to these two questions would have been obvious years ago: human beings, of course. Machines are instruments of human design! But nowadays when we speak so much of progress, science and technology as if these were in themselves values to be venerated, there are many people who think that machines, as they become more and more complex and intelligent through human design, may in fact become alive so that they may supplant us as a natural outcome of that very venerated progress and expansion of intelligence. Also many people seem to think that evolution is changing its nature so that technology is becoming the guiding force in the flow of the cosmic change in relation to us. I do not hold this view. I do not look at progress, science or technology as if they were values in themselves, nor do I think that biological or cosmic evolution is changing. I think that the question that we human beings must face is that of what do we want to happen to us, not that of knowledge or progress. The question that we must face is not that of the relation of biology with technology, or that of the relation between art and technology, nor that of the relation between knowledge and reality, nor even whether or not metadesign shapes our brains. I think the question we must face at this moment in our history is that of our desires and whether or not we want to be responsible for our desires.

### LIVING SYSTEMS

Living systems are structurally determined systems, that is, they are systems wherein all that happens to them at any instant depends on their structure (which is how they are made at that instant). In structurally determined systems any agent impinging on them only triggers structural changes determined within them. The notion of structural determinism reflects the regularities and coherence of our living as we explain our living with the regularities and coherence of our living, and not with any transcendental aspect of an independent reality.

In a sense living systems are machines. Yet, they are a particular kind of machines: they are molecular machines that operate as closed networks of molecular productions in such a way that the molecules produced through their interactions produce the same molecular network that produced them, specifying at any instant its extension. In a previous publication with Francisco Varela I have called this kind of system autopoietic. Living systems are molecular autopoietic systems. As molecular systems, they are open to the flow of matter and energy. As autopoietic systems living systems are closed in their dynamics of states in the sense that they are alive only while all their structural changes conserve their autopoiesis. That is, a living system dies when its autopoiesis stops being conserved through its structural changes.

1. Humberto R. Maturana and Francisco J. Varela, "The Tree of Knowledge. The Biological Roots of Human Understanding," Shambhala, Boston & London, 1987.

The general condition for structurally determined systems is the conservation of the operational congruence between a particular determined system and the medium in which it exists in recursive interactions, as well as the conservation of the system's identity (its defining organization). These are both at the same time conditions for the spontaneous arising and spontaneous conservation of a structurally determined system, and the systematic result of its actual existing in recursive interactions in the medium while its defining organization is conserved.

The bodyhood, which is where the autopoiesis of the living system in fact occurs, is the condition of possibility of the living system, but the manner of its constitution and continuous realization is itself continuously modulated by the flow of the living of the living system in the domain in which it operates as a totality. It is, for example, in that operational domain where an elephant exists as an elephant, and it is in that operational domain where we human beings exist as human beings. Therefore, bodyhood and manner of operating as a totality are intrinsically dynamic, they interrelate, so that the one is not possible without the other, and both modulate each other in the flow of living. The body becomes, according to the manner in which the living system (organism) operates as a whole, and this in turn depends on the way the bodyhood operates.

As humanness began with conserving, generation after generation, living in language as the basic relational feature that defined the lineage, what indeed began was the transgenerational conservation of living in conversations. We human beings live in conversations, and all that we do as such we do in conversations as networks of consensual braiding of emotions and coordinations of consensual behavior. In these circumstances, a culture is a closed network of conversations which is learned as well as conserved by the children that live in it. The worlds that we live as human beings arise through our living in conversations. Whatever configuration of conversations that begins to be conserved in our living, becomes henceforth the world, or one of the worlds that we live in. This is what has happened and still happens in the course of our history. Moreover, we live in the conservation of each world that we live as if it were the very basis of our existence, and we do so in a dynamics of conservation that results in everything in us beginning to change around the conserved way of living that the conserved world entails.

Our culture constitutes the medium in which we are realized as human beings, and we become transformed in that bodyhood in the history of our culture according to the human identity that arises and is conserved in that culture. But, at the same time, as human beings that live in conversations we are reflective beings that can become aware of the way they live, and of the kind of human beings that they become. And as we become aware we may chose the course of our lives according to our aesthetic preferences, and live in one way or another according to the human identity we wish to conserve. So, our human identity is constituted as well as conserved in a systemic dynamics defined by the network of conversations of the culture that we live. That network is the interrelate of Homo Sapiens Sapiens, Homo Sapiens Amans, Homo Sapiens Aggressans or Homo Sapiens Arrogans, according to the culture that we live and conserve in our living, but at the same time we may stop being human beings of one kind or another as we change culture depending on the configuration of emotions that gives the culture that we live its particular character.

Emotions are kinds of relational behavior. As such our emotions continually guide our doings by specifying the relational domain in which we operate at any instant, and give to our actions their character as actions. It is the configuration of emotioning that we live as Homo Sapiens that specifies our human identity, not our rational behavior or our use of one kind of technology or another. Rational behavior began as a feature of the life of our ancestors with language in the use that they made of the abstractions of the coherence of their daily life as lingual beings. But then as well as now emotions specified the domain of rational behavior in which they operated. They were not aware of this interrelate, but now we know that every rational domain is founded on basic premises accepted a priori, that is, on emotional grounds, and that it is our emotions that determine the rational domain in which we operate as rational beings. Similarly, we use different technologies as different domains of operational coherence according to what we want to achieve according to our preferences or desires. Thus, it is our emotions that guide our technological living not technology itself, even though we speak as if technology did determine our actions regardless of our desires.

I maintain that we can see this in the technological history of our ancestors. Indeed, I claim we can see that different technological procedures were used by our ancestors for thousands of years, and that the technological changes that they made were related to changes in their desires, tastes, or aesthetic preferences, regardless of how their way of life changed afterwards.

### ORGANISMS AND ROBOTS

Both living systems (organisms) as natural entities and robots as a product of human design, are structurally determined systems in dynamic operational coherence with the structurally determined medium or circumstance in which they exist. The difference between them is in the way in which their respective operational coherence with their circumstance arose in their history of congruence with the medium. The robot arises through design. An artist or an engineer makes a design by disposing a set of elements and a configuration of relations between them in a way that constitutes a dynamic totality in dynamic congruence with a medium that has also been designed as such ad hoc. So, the robot, the medium or circumstances in which it operates, and the dynamic congruence between the two are the consequence of an intended design in what one might say is an ahistorical process. Robots, therefore, are ahistorical entities. Yet, since they are the product of an attempt to obtain some operational result in the future, they exist in a historical domain.

Living systems originated in a different manner. All living systems living now on Earth are the present manifestations of a still ongoing history of production of lineages of living systems through the reproductive conservation of living as well as of variations in the manner of realization of the living. This historical process is what is usually called biological or phylogenetic evolution. In this history the living systems and the circumstances in which they live change together congruently, so that they always find themselves spontaneously in dynamic congruence with the medium in the realization of their living. Living systems are historical systems. Yet, as they exist in the flow of their living in circumstances that change congruently with them, they exist in no-time in a continuously changing present.

Their historical character makes living systems different from robots, not their being molecular autopoietic systems. Robots are ahistorical in their origin; that makes them basically different from living systems, not just that they are not autopoietic systems. At the same time, because living systems are molecular systems they can be manipulated just like any other molecular system is, if the operational coherence of their constitution as they are respected.

### TECHNOLOGY AND REALITY

Technology is operation according to the structural coherence of the different domains of activity in which one may participate as a human being. As such technology can be lived as an instrument for effective intentional action, or as a value that justifies or gives orientation to a manner of living in which all is subordinated to the pleasure derived from doing it. When it is lived in this last manner, technology becomes an addiction whose presence those addicted wish to justify through rational arguments founded on the historical reality of its great expansion in modern times.

Lived as an instrument for effective action technology has led to the progressive expansion of our operational abilities in all the domains in which there is knowledge and understanding of their structural coherence. Biotechnology is a case in which such an expansion has had recursive consequences. Thus, the expansion of biotechnology has resulted in an expansion of the knowledge of living systems as structurally determined systems, and vice versa. However, it has not expanded our understanding of living systems as systems, nor has it expanded our understanding of our experience that which we console with the word "real" when we are not using it as an argument, that is, we live the "real" as the presence of our experience. I saw it ... I heard it ... I touched it ... Indeed, this is why I claim that it is a fundamental condition in our existence as structurally determined systems that we cannot distinguish in the experience itself between what we call our daily living perception and illusion. The distinction between perception and illusion is made afterwards by devaluating an experience in relation to another that is accepted as valid without knowing if it will or will not be devaluated later in relation to yet another one. In fact, this is why virtual realities are called realities. Yes, what we now call virtual realities have a special character because they are associated with modern technology, and are designed to involve many of our sensory dimensions, and ideally all possible ones. In these circumstances, what we call real (that with respect to which virtual realities are virtual), are those experiences that we use as the grounding reference for our explanation of those other experiences that we live equally as real in the flow of our living, but that we want to devaluate.

Our history as human beings that began when our ancestors began to live in conversations, has been one of recursive creations of new realities which are all virtual with respect to the basic one of our biological existence, but which become real (non-virtual) in the flow of our human living as through their operational binding with our basic biological living they become the basis for some new virtual reality. Therefore, what should concern us, is what we want from our human existence: what course do we want our humanness to follow.

Reality, when it is not just a manner of explaining our human experience, is that which we experience as the fundament of our living. Under these circumstances, reality is not energy, not information, however powerful these notions may appear to us in the explanation of our experiences. We explain our experiences with our experiences and with the coherence of our experiences. That is, we explain our living with our living, and in that sense we human beings are constitutively the fundament for all that exists, or may exist in our domains of cognition.

### EXPANSIONS OF BASIC REALITY

Changes in the dimensions of structural coupling occurring along the evolutionary history of the different kinds of living systems, have constituted evolutionary transformations of the domains of basic reality in which they exist. The same can occur through design, in the intentional use of prosthetic means that create new dimensions of interactions for an organism and thus become new sensory domains for it. Due to its operation as a closed network of changing relations of activities, the nervous system has no intrinsic limitation for dealing with the expansion of the basic reality of the organism that it integrates. Nor does the nervous system have any intrinsic limitation for dealing with novel sensory dimensions that may appear in the lives of organisms if their domains in interactions result expanded as a consequence of some independent structural changes of the medium.

If the manner of living that defines the class identity of a particular living system is conserved through the transformation of the basic biological reality in which it exists, the living system remains of the same kind, but its particular characteristics, and the relational space in which it lives, change. But if this manner of living is not conserved, the living system disappears as one of that class, and a new one appears in a new relational space.

### HUMAN BODYHOOD

Love, the spirit, our consciousness and self-consciousness, responsibility, autonomous thought, are central to our existence as human beings, but not only these, also our bodyhood. The present human bodyhood is the result of the history of transformation of the bodyhood of our human lineage as an outcome of living in conversations, so it is not just any bodyhood. If we modern humans were to make a robot that in its behavior is not different from us, showing spiritual concerns, self-consciousness, emotions and autonomous rational thought, it would still be a robot and not a human being due to the history of its bodyhood. In the history of the cosmos such a robot may replace us and we may disappear completely as many other animal species that have become extinct, and that will be our end and the end of humanness in the cosmos. Does it matter? For me, since I do not consider progress or technology as values in themselves, it matters and I do not want that to happen!

It is possible that we human beings will become adapted to the interference with the natural processes in our lives through the medical use of organ transplants, artificial organs, or artificial initiation of embryonic development. May be that we accept those practices because it seems to us that they will not change, nothing changes in fact because we go on living through it the same time it is becoming apparent that what threatens our humanness is in fact the commercial psychic space in which we now live, and in which we are ready to subordinate everything we do to commerce as if it does not matter what happens in the flow of human history. In a commercial psychic existence, the commercial value is the first and most fundamental concern.

But, is this relation to the bodyhood in humanness essential to humanness? I think it is because those features that make us the kind of beings that we are – namely, love, social responsibility, cosmic consciousness, spirituality, ethical behavior, and expanding reflexive thought – arise in us as dynamic features of our human bodyhood conserved and cultivated in a relational human living that conserves that bodyhood. Humanness is not an expression of some computer program that specifies certain ways of operation, it is a manner of relational living that entails its being grounded on a basic bodyhood. Yes, many of our organs can be replaced by artificial ones, but they will be replacements only if they replace the original organs in the realization of the human living. Yes, it is possible to eventually make robots that openly behave like us, but their history will be tied to their bodyhood, and as they will exist as composite entities in domains of components different from ours, the domains of basic realities that they will generate will be different from ours.

### REFLECTIONS

Technological transformations do not impress me, biological technology does not impress me, Internet does not impress me. I say this not out of arrogance. No doubt much of what we do will change if we adopt the different technological options at hand, but our actions will not change unless our emotioning changes. We live a culture centered in domination and submission, mistrust and control, dishonesty, commerce and greed, appropriation and mutual manipulation ... and unless our emotioning changes all that will change in our lives will be the way in which we continue in wars, greed, mistrust, dishonesty, and abuse of others and of nature. Indeed, we shall remain the same. Technology is not the solution for human problems because human problems belong to the emotional domain as they are conflicts in our relational living that arise when we have desires that lead to contradictory actions. It is the kind of human being, Homo Sapiens Amans, Homo Sapiens Aggressans, or Homo Sapiens Arrogans, at the moment in which we have access to a new technology, either as users or observers, that determines how we use it or what we do with it. We human beings can do whatever we imagine if we respect the structural coherence of the domain in which we operate. But we do not have to do all that we imagine. We can choose, and it is there where our behavior as socially conscious human beings matters.

Our brains are not being changed by technology, and what is in fact happening to us through technology, is that they are changing what we do while structuring the culture (the configuration of emotioning) to which we belong. Unless, of course, our emotioning changes as we reflect on what happens to us through the use or contemplation of technology and we undergo a cultural change. In fact our brains need not change for us human beings to be able to manage and understand whatever technological change the future may offer to us if we are willing to start from the beginning. What our brain does, is to abstract configurations of relations of activities in itself, which if coupled with our operation in language permit us to treat any situation that we live as a starting point for recursive relations in a process in fact open to any degree of complication. It is what happens in our emotions that determines the course of our living, and since emotions as kinds of relational behavior occur in the relational space, it is through the conservation of cultural changes (as changes in the configuration of emotioning that are conserved generation after generation in the learning of children) that the course of our biological history may result in changes in our brain.

Biotechnology is not a new practice, although what we can do now is very, very different from what we could do a hundred or 50 years ago. Internet with all its richness as a network is not basically different from other systems of interactions that facilitate the use of libraries and museums. No doubt the interconnectedness reached through Internet is much greater now than a hundred or fifty years ago with only telegraph, radio, or telephone. However, we still do with Internet no more nor less than what we desire in the domain of the options that it offers, and if our desires do not change, nothing changes in fact because we go on living through it the same configuration of actions (of emotioning) that we used to live. Certainly I know much of what is said and is happening in the domain of globalization of the flow of information, but it is not information that constitutes the reality that we live. This reality arises instant after instant through the configuration of emotions that we live, and which we conserve with our living instant after instant. But if we know this, if we know that the reality that we live arises through our emotioning, and we know that we know, we shall be able to act according to our awareness of our liking or not liking the reality that we are bringing forth with our living. That is, we shall become responsible for what we do.

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### PEOPLE AND ORGANIZATIONS

#### HUMBERTO MATURANA

Humberto Maturana (CL) is a neurobiologist and philosopher.

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