

nature of the “contextual conditions” is such that overall, the walking has a *nebulous* location, without any clear-cut boundaries. Moving outwards from the centre, the location includes more than just the bits of ground where I put my feet; it arguably includes the whole street, and, in a way, (but less definitely) the buildings and trees and parks that I pass by. Moving inwards from the cosmos as a whole, we can say that my walking is definitely happening on the planet Earth, rather than the solar system (because of the composition of the atmosphere); in France (because of the linguistic context), and in Paris (because of the weather, and the general atmosphere...). Thus, there is no clear-cut boundary between what is contextually relevant and what is not.

**6** But even if the location is “nebulous” in this way, and difficult to pin down, there is one thing that we *can* say for sure: the walking is not happening “in the legs.” I claim that exactly analogous considerations hold for the relationship between the brain and the mind. The brain is only involved in perceiving, thinking, imagining, feeling, being conscious and so on – what I have called “cognizing” for want of a better general term – *because* it is contextually situated in the body of a living organism, itself engaged in actions in an environment.

**7** Butz himself implicitly recognizes this to a very considerable extent, by the importance he (quite correctly) attaches to the “grounding” of cognizing in embodied sensory-motor dynamics. However, the “brain-centered” talk remains a niggling worry; and as I indicated at the start of this commentary, it has what I consider to be a particularly damaging consequence.

**8** “Perceived reality is a construct”; yes, we can all agree with that. But why should we assume that it is an “inner” construct? If the mind is not in the brain, as I have argued, the “perceived reality” is not “in” the head either. Since the brain is only involved in actual cognizing to the extent that it is situated *in a body that is interacting with its environment*, the reality that is “brought forth” (Maturana & Varela 1987) or “enacted” (Varela et al 1991) is *co-constructed* in the interaction between organism and environment. This co-construction is constrained (and made possible) by the particular features of *both* the organism and the environment. The position I am

arguing for is neither “internalist,” nor “externalist,” but rather seeks to go beyond the opposition between them; the construction happens in the interaction, and insofar as it is “located” anywhere, it has a “nebulous” location, rather like the walking in my simple example.

**9** Why does this matter for constructivists? Well, I think it is important because even at the best of times constructivism is already widely accused of idealism, solipsism and/or relativism, so the last thing we need is to give free ammunition to our opponents! We need to be able to say that if reality is indeed constructed, the construction in question is *constrained* by a “reality principle”; constrained, that is, not just by the particular features of the organism, but equally by the environment, and above all by the interactions that occur between the two.

## Anticipation and Self-consciousness Are these Functions of the Brain?

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**1** My reflections will be first, about how the brain operates in the generation of the adequate behavior of an organism in a changing medium, and second, about how self-consciousness appears in the course of the history of humanness.

**2** The first question arises from our daily experience of seeing an organism behaving in a way that seems to anticipate some desirable result, or from observing a developmental process as if it were guided by a drive to reach some particular form. These observations have given rise to the suggestion that the brain and the organism operate under the action of some *anticipatory drive*. The second question arises when we hold the view that language is an instrument that we human beings use to refer to entities that are external to us, and we find ourselves asking, *how do we distinguish ourselves* if we are not objects external to ourselves?

### My claims

**3** In these reflections I shall claim that the operation of the nervous system is not *anticipatory*, and that as a structure-determined system it cannot be anticipatory, even if for an observer it may seem to be so as he or she sees an organism behaving adequately in its changing niche. I shall also claim that self-consciousness is not the result of some particular neuronal process in the nervous system, but that it is a manner of living that has arisen in our human history as the consequence of our living as languaging beings in a flow of recursive coordinations of coordinations of consensual doings in which we are objects of our coordinations of doings.

**4** Indeed, I shall claim that there are no anticipatory processes in the cosmos and that the result of a process is not and cannot be part of its occurrence, and that self-consciousness is the particular inner feeling that we feel when we see that we are doing what we are doing.

### Structural coupling: My fundamentals for the answer to the first question

**5** We living systems are molecular systems. As molecular systems we are structure-determined systems, and as structure-determined systems we are systems such that nothing external to us can specify what happens in us. Something external to us impinging upon us can only trigger in us structural changes determined in our structural dynamics. Therefore, we human beings as molecular living systems are structure-determined systems, and all that applies to living systems as structure-determined systems applies to us. Structural determinism is not an assumption; it is our condition of existence.

**6** A living system arises in the operations of distinction of an observer as existing in three non-intersecting operational domains: the domain of the realization of its molecular autopoiesis, the domain in which it operates as a totality, that is, as an organism, and the domain in which it realizes its relational living in operational dynamic congruence with its niche as this arises continuously in the actual realization of its manner of living as an organism of a particular kind.

**7** When the observer distinguishes an organism, he or she brings forth in the same act the operational-relational environment in which he or she sees it, as well as the opera-

tional-relational medium in which he or she imagines it to exist, and in which the organism realizes an individual niche that the observer cannot see unless the organism itself shows it to him or her with its behavior.

**8** The observer calls “environment” all that he or she sees surrounding the observed organism, and calls “medium” all that he or she imagines as the great container in which an organism realizes its living. The niche arises as that part of the medium that the organism “touches, sees, hears ... or more generally encounters” in the many dimensions of the realization of its dynamic manner of living, and that the observer cannot see unless the organism reveals it through its living.

**9** An organism exists in a continuous process of structural changes as a result of its own internal structural dynamics modulated by the structural changes triggered in it by its interactions in its niche. The niche in which an organism realizes its living occurs in a continuous structural change arising in the interplay of the dynamics of the medium of which it is part, and the structural changes triggered in it by its encounters with the organism.

**10** The organism and its niche constitute an operational unity or totality in which both, the organism and its niche, change together congruently, in a process that follows a path that is continuously arising anew in the flow of their interactions. The path followed by the congruent changes of the organism and its niche arises in the encounter of otherwise independent processes, and an observer cannot predict its course even though he or she can expect one if the encounter occurs as part of a recurrent conservative dynamic that he or she has seen before as the environment of the organism, or has imagined as the medium in which it exists.

**11** What an observer distinguishes as the behavior of an organism is not something that the organism does by itself, but a changing relational dynamics that arises in the recursive encounter of the organism with its niche. As a changing relational dynamics, a behavior involves at the same time the organism in the realization of its autopoiesis, and the niche in the realization of its participation in the structural dynamics of the medium at that instant.

**12** In these circumstances, what an observer sees as the behavior of an organism is its tangent encounter with its niche in a structural

dynamics of coherent structural changes that is the result of the history of recursive interactions between the organism and its niche. I have called such dynamics of coherent structural changes in which the organism conserves its autopoiesis, *structural coupling*.

**13** When an observer sees an organism conserving its living (autopoiesis) in its domain of structural coupling in its niche, he or she sees it as an organism generating adequate behavior in its niche, whatever this may be. For the observer, the adequate behavior of the organism may appear as anticipatory, that is, as foreseeing what “the organism needed.” Yet the organism was only operating in the coherences of its structural coupling in its niche, in the present of a history of recurrent dynamic structural coherences that constituted a matrix of operational-relational coherences in which the organism can conserve its living precisely because the organism and its niche change together around the conservation of the manner of living of the organism.

**14** Systemic laws are abstractions of the spontaneous operational coherences of systems in any part of the cosmos that the observer brings about in its living. Three are the most fundamental ones, and I present them below.<sup>1</sup>

**15** *Systemic law of the observer and observing:* “Everything said is said by an observer (a human being making distinctions in languaging) to another observer that could be him or herself.”

**16** *Systemic law of conservation and change:* “Whenever in a collection of elements a configuration of relations begins to be conserved, a space is opened for everything else to change around the configuration of relations being conserved.”

**17** *Systemic law of the course of history:* “The course that follows the history of the structural change of organisms in general, and of human beings in particular, arises at every instant of the living of the organisms or of the human beings defined by the preferences and desires of the organism or the human being, and not by what an observer may think are opportunities or possibilities for the organisms or human beings involved. Something is an opportunity or a possibility only if it is desired.”

**18** *In synthesis:* What an observer sees as *adequate behavior* in an organism, is its operation in the present in dynamic structural coher-

ence with the medium in its niche that is the result of the conservation of the operational structural coherence of the organism and its niche in a history structural drift in which the organism and its niche have changed together congruently. Such a process occurs spontaneously without the participation of any guiding orientation towards an end as a result of the operation of the organism as a structure-determined system. Structural determinism is a constitutive basic feature of the cosmos that we human beings bring forth with our operation as molecular systems. Structural determinism does not imply predictability. Structural determinism is the basic condition that creates the possibility of understanding and explaining of all processes in the cosmos, even probabilistic ones.

**19** There is no possibility of the operation of any process that could be legitimately called *anticipatory* or that could be legitimately considered to occur under an anticipatory drive. If an observer sees an ordered process giving rise to some result that is surprising or admirable to him or her, and if he or she does not understand structural determinism, he or she will not understand the dynamic architecture that gave origin to that result, and will invent some semantic notion to connect the different instances of the process in a way that he or she can accept. The notion or idea of an *anticipatory drive* is such a semantic notion under the form of an *a priori* explanatory principle (cf. Ximena & Maturana 2008).

**20** Everything in the cosmos occurs as it occurs as a continuously changing present in which complexity arises in the encounter of processes that happen to be locally dynamically independent, even though they may be part of a larger systemic one. This is expressed in the following systemic law: “The result of a process does not and cannot operate in the process that gives origin to it” (Ximena & Maturana 2008).

#### **Languaging and objects: My fundamentals for the answer to the second question**

**21** If we attend to what we do in language, we will realize that language occurs as a flow of living together in coordinations of coordinations of consensual doings. That is, we will realize that language occurs as languaging, in the flow of our living together in recursive consensual coordinations of doings. Language has the concreteness of the doings in

the domain of doings in which we coordinate our doings.

**22** Objects, entities, notions, ideas, concepts etc., arise as coordinations of coordinations of doings, and do not exist otherwise. The meaning of the words, sentences, signs and symbols is not in the words, but in the flow of coordinations of doings that they coordinate. And a word can have as many different meanings as there are different flows of recursive coordinations of doings in which it participates.

**23** When a child learns to name an object he or she does not learn to name a preexisting entity, but learns a flow of recursive coordinations of doings with the languaging persons with which he or she may be living. So a baby that learns the ball, learns balling, and when he or she learns the doll, learns dolling. Thus, the baby learns in the same way, eyes, feet, mouse, lips, ... self, thinking ... as flows of recursive coordinations of consensual doings with other human beings, as manners of living together in consensual coordinations of doings ... and emotions as manners of relating in coordinations of consensual coordinations of relational doings.

**24** As an object arises as a flow of consensual coordinations of doings; the domain in which the arising object arises and has presence also appears as a domain of recursive consensual coordinations of doings in which the arising object participates in the recursive coordinations of consensual coordinations of doings that constitute its meaning. As the objects do not pre-exist the flow of consensual coordinations of doings that they are, the domains of recursive consensual coordinations of doing in which they exist as coordinations of doings arise anew with them, and new objects constitute new domains of existence as new domains of recursive consensual coordinations of doings.

**25** The *self* arises in the same way that any other object or entity arises, namely, in the recursive coordinations of consensual doings, first in the coordinations of doings in relation to doings with the body, and then, in the recursions of the coordinations of coordinations of doings with doings with the body in relation to other coordinations of doings. When we participate in this recursive dynamics of coordinations of doings, there arises in us the special configurations of inner feelings that we now distinguish in the flow of our languaging as *self* and as *our self*.

**26** The configuration of recursive coordinations of consensual doings that constitute an object in our coexistence with other human beings is what I call “operations of distinction”. So, when someone says that he or she is distinguishing an object or entity of any kind in his or her living as a languaging being, he or she is bringing forth a domain of consensual doings and recursive consensual doings in which that which has been distinguished has presence in a flow of recursive coordinations of consensual doings. And that flow of coordinations of recursive consensual doings constitutively implies an operational-relational matrix of coordinations of doings as a domain of human living in which the participating human beings distinguish entities that could be themselves.

**27** *In synthesis*: The *self* is not an entity; it is a particular feeling in a manner of operating in a flow of recursive coordinations of consensual coordinations of doings that involve the distinction of the doer of the doings as the observer of the doings being done. Furthermore, when in the recursions of the distinction of the observer, occur recursive coordinations of the observer doing its doing, the special feeling of *self-consciousness* arises as the feeling of feeling the coordinations of doing that the feeling of observing entails. In other words, self-consciousness occurs as an inner feeling felt by an observer that is seen by another observer (that could be him or herself) in the circumstances of distinguishing him or herself distinguishing him or herself.

**28** Whenever a recursion takes place an intrinsically new domain of doings arises, and at the same time a new domain of feelings is lived, which we may live as a completely new domain of meanings in our doings. For example, science, philosophy, theories ... technology have arisen like this. Once a new domain of recursive coordinations of doings, and hence, a new domain of reflections in doings, has arisen, our human living changes and we live the arising of new surprising happenings that we do not know immediately how to explain, and we feel that we are in front of a mystery. What we should never forget, however, is that structural determinism is the fundamental constitutive condition of our existence, and new operational domains arise in our living whenever our living becomes associated with recursive process in our doings, and ... our thinking and reflecting, and that

these are dimensions of our understanding that we cannot forsake if we want to understand our living as human beings.

#### Final remarks

**29** We all know that the result of a process does not participate in the process that produces it as a result. But as we live a culture in which we are accustomed to think in finalistic terms, that is, in a process designed with the purpose of obtaining the desired result, we frequently confuse our description of what we see in the appearance of what happens, with what may be happening that gives rise to such appearance. Thus we frequently treat a process in which we see a purpose as if there were a purpose in the operation of that process. This is what we do in biology when we use teleological considerations to understand the function of some unknown structure in an organism. That way of thinking may be useful for a while to find out how that structure operates in the relational space of the organism that has it, but does not tell us how that structure does what it does.

#### Note

1. The systemic laws here presented were taken from the essay on systemic and meta-systemic laws published in Ximena & Maturana (2008).

## Two Basic Agreements and Two Doubts

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**1** Martin Butz’s target article draws a picture of how anticipation has shaped the mind, from simple forms of sensorimotor engagement to higher level cognitive abilities and consciousness. We agree with the author that the “cognitive mind” is the product of a construction of an “inner reality”: an internal, endogenous representation of the word that is autonomous from sensory input and the external word. We are also very sympathetic to the author’s effort to spell out this con-