14 Ontology of Learning and Semiotics

Abstract

The chapter considers the ontological background for action theoretical semiotics. The concepts of subject, action, competence etc. are explained in relation to more fundamental concepts of substance, property, event, disposition etc. The circular model of action is concretised further with the help of perceptual control theory (PCT). PCT explains how a human or any living being acts purposefully by perceiving its environment, comparing the perception to an internal reference and trying to move or keep the perception in the reference by affecting the environment. Learning is concretised as reorganisation of the subject's control system and partially as memorising.

Ontology, dispositions and the possibility of pansemiotics

In this chapter, I will try to map the ontological sphere of reality as a foundation for such semiotic phenomena as meaning, action and learning. In addition to the ontological survey of the basic building bricks of our reality, I will consider the mechanisms behind these phenomena. Ontological analysis cannot be a straightforward description of reality (see Heil 2003). The constructivist epistemology begun by Kant makes it dubious or even unbelievable that reality would really be as we perceive and cognize it (Kant 1982/(1787)). Following his critique of traditional metaphysics, Kant developed the transcendental method of philosophical anthropology. This method means, or at least contains, an inquiry into the possibility conditions of the subject under research. For us this means that we shall ask under what ontological and physical conditions those semiotic phenomena discussed in previous chapter can exist⁴.

Of course, there are also other constraints for ontology than the requirement that it should clarify how semiosis is possible. In addition, ontology must be coherent with all we know, especially with science, and lend clarity to everything. Then it must itself be a good scientific, or rather, philosophical theory by being understandable, explicit, coherent, comprehensive, economically concise and elegant. A special criterion usually connected to ontology is what is termed ontological parsimony, or Occam's razor, which states that one must not deploy any more categories than is necessary for any explanation. The more parsimonious theory is considered the better one of the two theories, which are otherwise equally compelling. (Martin and Heil 1999.)

⁴ It was typical to Greimas to avoid ontological analysis because of his striving to semiotics as an empirical science. He stated the we need three levels on analysis in semiotic research: The first and lowest is the level of description where the studied discourse is described, the second is methodological level which determines the descriptive language and the third and highest level is epistemological where the methodological principles are founded (Greimas 1976). That last level can easily be interpreted as a descriptive ontology or analysis of the necessary ontological commitments of the research.

One of the most promising ontological theories or approaches is the one developed originally by late C B Martin (e.g. Martin 1980; Martin 2008) – which, naturally, leans on older classical roots. The younger colleague of Martin, John Heil (e.g. Heil 2012; Heil 2013), has developed the theory further and made it more famous. I will here apply what I have called a simplified Martin-Heil ontology (see Pikkarainen 2013), which I will briefly describe. Martin-Heil's ontology can be classified as a nominalist substance-property ontology. This means – in this case – that the most basic category or being is a substance or substances with properties. And the nominalism here means that the properties do not have any existence of their own – they are not universals. They are real – unlike radical nominalists claim – but they are dependent on the substances. In fact, they are the ways of being, or the ways of existence, technically *modes* of a substance or substances. Thus, this view can also be called a mode theory. For example, let us think about two balls. They both have a similar or “same” property of sphericalness. However, there does not exist any universal or general property of sphericalness, but those balls have both their own sphericalness. Sphericalness is a mode, or a way of being, of any ball or any spherical substances. (Martin 1997)

The second important idea in (a simplified) Martin-Heil ontology is the principle which may be called compositionality or structuralism. It means that the substances, which I will call objects from now on, can contain other objects, i.e. they can be constructed from other, smaller objects. Every object, respectively, can be a part of another, bigger object. This means that objects do not have any absolute, independent and eternal identity, because any object can be divided into many smaller objects or blended with some others into a bigger one. However, this is only part of that principle. More importantly, objects are not only collections of other objects, but they have a special structure as a part of their way of being. A simple example is an object X which consists of three other objects A, B and C. Here X is an ordered tripartite object so that {ABC} would be different from {ACB} because of the different relations between the parts. Also {ABC} is different from {A B C}. In addition to this one-dimensional example, normal objects should be thought of in terms of four dimensions, which will therefore include time. That's why {ABC}₁ can be different from {ABC}₂ if in the previous all the parts are blended at the same time and in the latter someone is added later than others. (e.g. Heil 2012, 168)

The properties of an object are sides or aspects of its way of being, of how it exists. The way of being of an entity is of course a single whole, the whole way how that entity is at the moment. But we talk about many properties of an object, because our senses and other possibilities of experience slice and categorize different sides and parts separately, away from the whole. The relationships of an object to other objects are also part of its way of being. The properties of an object will partially change when it becomes a part of a bigger object. Let us think about an object which has a structure, which consists of smaller objects with their particular relations with each other. The properties of this bigger object are a certain kind of function of both the properties of the smaller objects and the relations between the smaller objects. As the saying goes, the whole is more than the sum of its parts. There are at least two

⁵ The epistemological principle of Greimas, which he calls phenomenological, that the properties define the object is quite near to mode view, even though it reminds also trope theory (Greimas 1976; c.f. Bacon 2008)

truths behind this saying. First, the way of being of the parts may change when they come together and secondly their combined way of being depends on their internequine relations.

The third, and perhaps the most original, view in this ontological theory concerns the nature of the properties and the question of the relationship between the concepts of disposition and quality (Martin 2002; Heil 2005). A common view is that properties can be divided into two exclusive classes: qualities or normal occurrent properties like colour, shape, size etc. and dispositions which are strange counterfactual properties like fragility. Some scholars think that one or another of these classes is empty. Instead here we think that these two concepts are not at all classes of properties but rather they are sides of properties. Like a coin or a sheet of paper the way of being of an object has these two sides: the occurring or manifesting feature or quality on the one hand and the dispositional, not manifesting side on the other hand. For example, a colour like redness is the manifesting side of the disposition, i.e. a readiness, to reflect, transmit or radiate light with red wave length.

There seems to be a certain kind of asymmetry between those two sides of properties, so that the manifesting side is dependent on the dispositional side. That is why it is not correct to assume that the properties of an object would be determined fully by its position in the network of relations to other objects (c.f. Latour 2005). Instead every existing object has its own way of being which it brings to all new relationships. Of course, the way of being of an object changes when its relations to other objects change, when it becomes a part of some network; but primarily this change is about the way its dispositions will manifest themselves in a new environment. Because the external relationships of an object are part of its way of being and also manifest themselves, we can think that also they require respective dispositions. It is possible for an object to settle itself only into such relationships and networks for which it has dispositions.

It is of course possible to think that the way of being of an object would change so profoundly that also its dispositions would alter. For a hypothetical, extremely small and simple object this could be fatal and mean that it would transform into an entirely different object. At least for a hypothetical observer, it would appear that one object vanishes and another emerges. But for typical complex objects, things are not so dramatic: we can imagine that its compound way of being, including its dispositions, will change when its internal structure changes – even though the dispositions of the participant objects would remain intact. It seems probable, in any case, that if the dispositions change it is because of the changes of the occurrent qualities. The already existing dispositions manifest themselves in a new way in a new situation and this can cause changes in the dispositions. Think of a matchstick which has a disposition to catch fire when scratched on the side of matchbox. As soon as this disposition is manifested it becomes lost. (?)

Finally, we get from dispositions and qualities to the quite revolutionary corollary for the philosophy of science, namely a dissident view of causality and causation. While the current, received view of

causality assumes that causal relations take place between events and are mediated by the laws of nature (Schaffer 2016), we should now question the ontological position of both events and laws. An event is a derivative entity; a change of a property of an object and thus causal relations are basically between objects – and their ways of being. The laws which rule these events are then based on the dispositions of the objects. Briefly, a causal event is an encounter of objects so that their properties reciprocally cause them to manifest some qualities (and, as a consequence, possibly some dispositions change also). What will be manifested in any situation depends on the dispositions of these objects themselves. For example, a dry grain of salt has a disposition of solubility to water and a drop of water has a disposition to dissolve salt. When they encounter the solvability of the water causes the solubility of the salt manifest dissolution and the solubility of the salt causes the water to manifest saltiness. (Martin and Heil 1998)

The ontological view which is shortly and superficially described above offers some very significant vistas for semiotics and education. Perhaps the most important general idea is that the theory is coherent and explicit starting point instead of the ad hoc implicit assumptions which we so typically make in theorizing. Firstly, as a nominalist starting point it frees us once and for all from the haunting problem of dualism; for materialism, idealism and dualism are possible only if we first accept the existence of universal properties. In addition, the same nominalism makes it more difficult to classify things – and (especially) students, which is one of the worst deadly sins of educators. Secondly it can help the paralyzing puzzlement we feel when thinking about the relationship between the freedom of action and the determinism of modern scientific world view. In a similar vein, it helps us understand learning as a thorough reorganization of the structure of the learner and not just as a deposition of knowledge. Thirdly, and most importantly, this ontology justifies a certain kind of pansemiotics.

Famously, Peirce did consider and defend a pan-semiotic view in his view that that there may occur a triadic process – semiosis – in the inanimate sphere of reality⁶. Most authorities today think that biosemiotics is the broadest area of semiotics, that proper semiotic phenomena can, and do, exist only in living nature. In fact, it is often thought semiosis alone defines life (Especially Sebeok, cited in Kull, Emmeche and Hoffmeyer 2011). There is one remarkable exception, namely Deely (2001) who has developed the original Peircean idea about the semiotic sphere outside living nature, namely physiosemiotics. I will not delve into the interesting application by Deely of the triadic semiosis to the development of the physical reality (see Pikkariainen 2016). Instead, I use as starting metaphor a more everyday idea about communication or negotiation between two communicators, which is undeniably a semiotic phenomenon. If we consider the idea of a causal relationship between two objects, as described above, we can see a striking similarity to the process of communication and negotiation.

⁶ For example, the famous: "...all this universe is perfused with signs, if it is not composed exclusively of signs (Peirce 1974, 302)."

When one object (causally) affects another one it causes some disposition to manifest itself somehow as some occurrent quality in the latter. What the latter manifests, does not depend only on the properties of the first object (e.g. its mass and hardness) and on the nature of the encounter (e.g. its approaching velocity and angle) but also always on the very dispositions of the latter object itself. We can say that the latter object reacts or responds to the first one in its own way, as if it would “interpret” the effect from its own “horizon”. We can also think that the latter object experiences the encounter in its own way and by its manifesting new properties creates a representation of the encounter⁷. For example, a stone happens to hit a metal sheet. Among many perceivable and unperceivable changes, the stone may manifest its fragility by a new rupture in its surface and the metal sheet may manifest its malleability by a new dent. They both attain a memory of this encounter. They both had a readiness to react in this way. In addition to these almost panpsychic inferences, it must be stressed that this encounter is a piece of reciprocal and simultaneous interaction – an idea which appeared already in Newton’s law of force and counter force.

Life as perception control

As we saw, the inanimate reality displays evident marks of semioticity when seen from a slightly different angle. This new angle should not be confused with prescientific animism – however attractive that may seem. Instead, the view is most compatible with modern science. However, it should be clear that the status of physiosemiotics is different from that of biosemiotics (and zoo-, anthropo-, socio-, edu- etc. semiotics). We cannot find proper meanings (as defined in the previous chapter) inside that sphere. Meaning is the way in which some object or its properties, or events as changes, affect and relate to the action of the subject. We cannot find subjects of action in inanimate reality because action is bound to, if not even synonymous with, life. Nevertheless, we should now be more confident of the idea that meaning, action and life are at least possible in this reality studied by science, because it is perhaps, after all, not so different from our familiar semiotic environment. There are good and suitable building blocks available for life, action and meanings.

For life, we need a living object, an organism, which is, even at its simplest is an astonishingly complex compound of small inanimate objects. An organism has a complex and extremely improbable structure. If its parts were thrown together that throwing should be repeated and almost indescribable number of times to get just that structure. More importantly yet, if that structure finally happened to be the result, it would immediately be destroyed because of the causal effects of all the other objects. The essential prerequisite of a living organism is that its creation and maintenance requires energy – action which is just what life is. Here I am not saying that some blow of *élan vital* or external god is needed for this – no, rather the organisms themselves are responsible for this action⁸. As we know, the creation and maintenance of more and more complex and improbable organisms requires firstly self-preservation

⁷ C.f. (Strawson 1997) for a strict panpsychist conclusion.

⁸ In (1995) Powers drafts a theory how the basic form of life, i.e. purposeful action, can develop in chemical compounds.

and, secondly, procreation. This process of increasing complexity of organisms from generation to generation is called evolution and in a way, it is the most basic form of learning (see. Olteanu in this volume).

I will now concentrate on the self-preservation of an organism as a general model of action. What the self-preservation preserves is the structure of the organism itself; here, however, is the critical difference from the inanimate sphere. A complex inanimate object maintains its structure by passively receiving the effects of the other objects in its environment, either rigidly, flexibly or by breaking apart and using in these processes only that energy which happens to be initially conserved in its internal relations. Instead, a living organism takes energy from its environment and with this energy initiates changes in its own structure in order to prevent those effects of other objects which could threaten the continuity of its existence. And here we are faced with an apparent paradox: to maintain its structure the organism must change its structure. The solution to this paradox is that only part of its structure, or rather part of its properties, is essential, such that the change in properties would threaten its existence. These essential properties can be called *homeostatic*. For example, the glucose and oxygen levels of blood and body temperature are such homeostatic properties in mammals. Preservation of the narrow dynamic equilibrium of these properties (i.e. homeostasis) is necessary for the continuation of its life. (Encycl. Britannica 2015.)

To protect its essential properties from changing too much, the organism must affect and regulate its relations to its environment. It should avoid encounters with some objects and achieve encounters with some other objects. For this it can cause and use changes in its own non-essential properties like position, situation, length of muscles and angles of joints. The successful regulation of the relationship between the organism and its environment requires some kind of sensing organ, a kind of a window onto the environment. Through this window the organism can perceive positive and negative meanings, positive in the sense of something which can help it preserve its homeostasis and negative in the sense of something that hampers it⁹. When the organism perceives something negative, it starts to cause changes in its structure to prevent that – to make that negative perception vanish.

An organism thus seems a lot like, for example, a thermostat. There are remarkable structural similarities but also very critical differences. When we consider a thermostat as a part of a heating system we can see that it is preserving a “homeostasis” i.e. a comfort room temperature. It is sensing the temperature (as input), and if it perceives a negative “meaning” of cooling below the pre-set temperature it causes a change in the other part of the system, namely it starts the heating (as output), which will prevent the cooling. This preventive “action” will continue until the perception of coolness has vanished. All this is nearly exactly like the action of the organism. This kind of model is called a negative feedback loop, which means firstly that the causal relations act in a circular motion from input to output and from output to input. Secondly, the term negative is used in the mathematical sense so

9

Note that also Greimas (1976) stated that perception is the place where meaning is born.

that the feedback tries to reduce the initial source of the process. Negative feedback systems tend to stabilize to some state of equilibrium, contrary to a positive feedback system, which tends to accelerate its action in principle limitlessly (Powers 2005 / 1973, 45).

Our modern technological world is perfused with human made, mainly negative, feedback systems, usually called by engineers “control systems”. Their mathematically somewhat advanced but principally very simple theory was invented in as late as the 1930s. Astonishingly, this theory has only minimally affected our understanding of living organisms and human action despite the clear structural similarities. Even the cybernetic movement (see Wiener 1961) understood those theoretical principles somewhat wrongly. The only and very remarkable exception is Powers (2005 / 1973; 1998; 2008) and his disciples¹⁰, who have shown that we really can understand, and even make experimental research with exceptional accuracy about, human action when utilizing these principles. In psychology and closely-related sciences this approach would finally release us from the Cartesian and behaviouristic baggage which still rules from humanistic psychology to cognitive sciences (Yin 2013).

What, then, are the above-mentioned critical differences between engineered control systems and living organisms? The thermostat is created by an external agent, who has determined its input (thermometer) and output (heater) functions and, especially, she or some other user will set the limits for the goal temperature. The thermostat does not have any internal homeostasis which it has to protect. Instead, for a living organism, its own vulnerable homeostasis sets its ultimate goals, the reference values for its perceptions. It perceives in its environment what it has learned to perceive from evolution and from experience. Similarly, it outputs what it has learned to produce efforts which will diminish just that kind of negative perceptions and achieve those kinds of positive perceptions.

The type of control in living organisms is particularly the control of perception input. Most engineered systems are built to produce something specific, and for them it is important to directly and strictly control the quality of the output. This model confuses our ideas of human action in a major way: we think that we plan our doings, that we observe our behaviour and get feedback via perception about the going of our doings. But that is just not how living organisms act (Powers 2008, 145-150; Vancouver and Scherbaum 2008). We primarily observe our environment or, strictly speaking, our relationship with our environment, and only secondarily and superficially our own doing. We have multiple more organs for sensing our environment than organs to affect it. There is not much to perceive in our doings – in relation to the consequences of these doings in the environment.

The action (i.e. life of a living organism) consists firstly of internal processes which maintain and reproduce its essential and homeostatic structure. Secondly, for this, it has to keep its relations with its

¹⁰ A group of researchers around the globe are working on the Perceptual Control Theory (PCT) and interacting via CSGnet mail list. More information e.g. in: <http://www.pctweb.org/>

environment within such limits that on the one hand it can get the new energy it needs for its internal processes and on the other it can avoid and defend such environmental effects which would damage or destroy the continuation of its internal structures and processes. Thirdly, it has then to perceive what is happening in its environment and evaluate these perceptions in relation to the above-mentioned goals. Fourthly and finally, if it perceives something that it does not want to perceive (i.e. something harmful, either an appearance of a danger or a disappearance or lack of something useful), it immediately starts to modify its relationship with its environment by causing within the environment those effects which should be conducive in that kind of situation. This last part is the negative feedback effect, which will continue until the unwanted perception is removed.

Semiotically, this view of action and life as control of perceptions is very fruitful and natural. Famously, the most remarkable forerunner of biosemiotics, J von Uexküll, had a very similar and familiar circular model of action and meaning (von Uexküll 1982). Also, Dewey had very similar ideas, especially when criticizing the conception of a reflex arc (Dewey 1896). What is different and new in the theoretical developments brought about by Powers¹¹ is firstly the insight that the engineering theory of negative feedback control with all its mathematical sophistication can be applied to an understanding of living and even human beings. A central part of this insight is the concept of internal purposes in these control systems as the reference values for the perceptions. For technical systems, the user or operator sets those reference values, but living systems generate them by themselves. The second peculiarity is the emphasis on the idea that what is controlled is perceptions, not the output or the environment. Third, and most interesting, is the idea that the organism, and especially the human being, is not only one big control system but rather a complex and evolving hierarchical structure of small control systems, where the higher systems set reference values to the lower ones.

Before continuing to the basic forms of learning in living organisms, it is perhaps necessary to briefly describe the conception of the hierarchical structure of the control systems. I will discuss control units as the simplest and smallest control systems. A hypothetical and oversimplified basic level control unit in an organism consists of three parts (see Powers 2005 / 1973, 61):. The first is a perceptual input function, which consists of at least one or more sense receptors. This function converts a certain kind of environmental effect, a stimulus, to a neural current with a certain strength. The neural current goes to the third part of the control unit, which has a comparator function and compares the strength value of the perceptual signal to the reference values. If there is a difference – perception has an unwanted value – the comparator produces a respectively strong current called an error signal and sends it to the third and last part of the unit namely output function. the output function, which consists typically of one or more motor neurons connected to a muscle. The muscle then in the last resort causes a causal chain in the environment which closes the feedback loop.

Almost any organism, and especially a human being, has a great amount of these kind of units. The problem that emerges from this can be expressed thus: how is it possible that the whole organism can act as one agent so that the outputs of the units do not scatter or contradict each other? Their outputs depend on their references, so how are their references streamlined and harmonized so that their outputs can form a coherent cooperation? The answer is in the above-mentioned hierarchical structure of many more, in principle similar, control units which forms one kind of a bureaucratic organization. There is the performance stage with receptors and muscles, but above that an unlimited number of management layers. At every level the higher units set the goals for their subordinates by sending their own output as reference signals to the comparators of the lower units. The lower units, correspondingly, send their perceptions to the higher ones and so the management echelon can know what is going on and what kind of “orders” are needed. (Powers 2005 / 1973, 70 forward)

Epistemologically – and semiotically – the hierarchy of control units is central. Every single control unit can perceive only one tiny slice of the environment. In the receptors and the input function of a basic level unit a certain environmental effect -- a light beam, pressure, sound wave, or other simple stimulus – is measured or converted to a simple numerical value which corresponds to only the experienced strength of the effect. It is only at the next level of hierarchy that some higher unit collects from its subordinate perceptions a proper quality sensation like colour, temperature, weight etc. At higher levels the perceptions of objects, movements, events and sequences are constructed. The developed animals have still higher level-like programs, which are sequences with alternative branching points. And human beings in particular have such complex and high level perceptions like principles (honesty, honour, maximization of profit etc.) and system concepts (democracy, nationality, religion etc.). The higher-level perceptions are always some kind of structured collections of the lower ones.

Forms of learning

Like meaning, learning too could be understood broadly and loosely as phenomena ranging to the physiosemiotic sphere. Then we could probably quite reasonably say that changes in the dispositions of the objects is learning. Despite the structural similarities, I will, however, state that the changes in dispositions of complex objects is a prerequisite of learning, but not yet proper learning. Only living organisms can learn, and it seems that the ability to learn is one central criterion of a living being. As we defined earlier, learning is a change of a competence of a subject of action. And a competence can be thought of as a complex special case of dispositions; and though not empirically perceivable itself, it makes it possible for the subject to manifest a certain kind of action. As we assumed above, those dispositions can change or new dispositions may be created when existing dispositions manifest themselves in new ways. Similarly, competences change and grow when the subject acts with its existing competences.

Now we have seen that action is control of perceptions. Competences can be situated in all the main parts of the control loop. They make it possible to perceive certain effects and aspects of the environment or rather the relationship between the subject and the environment. They make it possible to create new complex perceptions from the simple ones. They make it possible to control these perceptions by setting reference values for them. And finally, they make it possible to affect the environment and the relationship with it by the organism's output. But how do these competences change as organism keep control? In the perceptual control theory conceived by Powers (2005 / 1973, 179) , three main forms of learning – or actually one fundamental form and two with a minor role – are analysed. The most important form is called *reorganization* and the others are *memory* and *problem solving*.

Problem-solving, with all the hype surrounding it, would not be interpreted as a proper form of learning in terms of a creation of new competences but rather just using the already acquired competences in a new way. Problem-solving, which is usually meant by this hyphenated term, takes place in the perception-level of programs, and actually Powers (ibid.) refers to it as *problem-solving programs*. A program is like a sequence of events, except it has one or more branching points and consequently more than one end point. After a branching point two or more alternative sub-programs usually open up, which may then branch themselves and so on. A program is like a labyrinth where you must get in from some point, find one alternative way through it and finally get out at some point. It is important to remember here that a program is also a perception and as such a construction representing something in our environment and a different kind of solution through a program connecting to a different performance. Our success in our external action depends on how we run the program. The program was, however, always already there; and if we want to say that we have learned in the problem-solving process, then we must also remember how we did it.

And now we get to memory. Memory is presupposed to happen at all levels of control, and probably in all neural activity (Powers 2005 / 1973, 207). It can be compared to the qualities manifesting themselves in the encounter of physical objects: If a striking hammer causes a dent in the metal, then this dent could be called the memory of that striking. But again, this is not memory as learning as if it wouldn't affect the dispositions of the metal as well. And clearly this can happen too, if for example the metal will manifest itself differently when the next hammer-strike occurs, because of the trace of the previous hit. For perception control theory memory means that, in principle, to every control unit there remains a trace of every perception. It may be that most of these traces are wiped away by new traces, but many of them will remain. The most significant and, of course, most repetitive memories will remain most probably because they are most important for the well-being and continuation of the organism. The phenomenon of classical conditioning could be regarded as an example of memory-learning. In it some non-significant stimulus (i.e. environmental effect, like irrelevant sound), is caused a short time before a significant effect – for example, when food is served to a subject. A hungry subject soon learns to connect the first stimulus as a sign to the latter stimulus and it starts to prepare to eat when the first one comes (Yin 2013).

But how are memories used by the organism? Powers (Powers 2005 / 1973, 221-228) drafts a model to illustrate how a control unit in a hierarchical control system can be in different “modes”. Normally, it is in a control mode, such as the one described above. Alternatively, it can change into an observation mode. In this mode, it stops controlling and only echoes its perceptions to the units above, but now the memories of them are also created. (Powers refers to this mode as a mode of school students.) The third mode is the automatic mode, which is probably the most common mode, at least in all lower level units. In all routine types of activity especially, like walking or sitting, many low-level units just control their perceptions according to the references from above; but they neither send their perceptions to the above units, nor save them to the memory. The fourth and last mode is most important for the use of memory and is called the imagination mode. In this mode, the lower unit does not send perceptions to the one above, but instead sends its memories. Despite its clear fruitfulness, the model is a little problematic because in real life these modes cannot be so separate. Especially the memories may be often, or even usually, mixed to perceptions in all controlling¹².

Memory determines mainly the semiotic competence of the subject. It is required for recognition of signs as signs and for the creation of new signs. But the proper meaning of the signs is bound to the whole action loop and the doings or output which the perception causes if it is different from the reference. Meaning can also remain internal in the way that certain perceptions will wake certain memories if the observation mode is mixed with the imagination mode. According to the theory, the organism or its subsystem in principle never plans its output. It happens automatically depending only on the difference between perception and reference. So how does the learning (or, creation of new competence for external doings) which we usually regard as most important occur? This form of learning is called *reorganization*.

In reorganization, the internal and external connections of control units – or, rather, some or part of them – change, thus transforming the internal structure of the whole system. In these processes any of the functions – input, comparator and output – may cause smaller or greater alterations to the activity of individual control units and, in the last resort, alterations to interaction between senses and muscles. But still more importantly the relations between units can change. These latter transformations are seen to account for the development of the conceptual layers of the hierarchical control system structure mentioned above from qualities via objects, movements, events etc. to the principles and system concepts, which are especially human features. Kant’s epistemology assumed that these categories form an innate and a priori structure of the human mind. Later, this assumption of innateness has become under suspicion and Powers offered a quite explicit theory how its development happens at an early age in a human being and how it can change even at a later age (Rijt and Plooi 2015).

The hypothetical model of reorganization presupposes that it is caused, especially and initially, by the problems in the fundamental control of the homeostatic properties. If a homeostatic dis-equilibrium

¹²

Martin Taylor, personal correspondence.

continues longer than just for a moment, it starts to pressure for reorganization. Reorganization means that in the control units, which are in use but are not able to correct the problem, changes which are not predetermined will start to take place and will continue until the initial problem eases off. Thus, it is a special case of trial and error learning (Powers 2008, 107-112). In addition to this basic mechanism there seem to be two additional ones. Also, a remarkable and continuing failure of any control of perception may cause reorganization. For example, if you want to perceive a dart flying to the bull's-eye, always with the chance that it flies off-target, that will cause reorganization in the hierarchical control system consisting of your sight and your hand movements – or a decision to change the hobby.

However, it is difficult to understand how the reorganization can know where the changes are needed, because the active hierarchical system of control units can be, and often is, very large. Here it seems that a certain phenomenon which we often regard as human specialty has a leading role. That phenomenon is *consciousness*. It is generally thought that consciousness is connected the tasks with demanding information management and which require learning (see Baars 1988). In perceptual control theory, most of our action (i.e. control) succeeds unconsciously, and thus consciousness is not needed normally for almost anything. But its special task is supposed to be that it directs the reorganization: by directing your consciousness to some problematic part of your action you also direct the reorganization there. Thus, by consciousness we do not manage information but our learning. This principle is also used successfully in psychotherapy (Powers 2009).

References

- Baars, B. J. (1988) *A cognitive theory of consciousness*. (Cambridge, Cambridge U.P)
- Bacon, J. (2008) Tropes. In E. N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy*. (Available at: <http://plato.stanford.edu/archives/spr2008/entries/tropes/>)
- Deely, J. (2001) Physioemiosis in the semiotic spiral: A play of musement 1, *Sign Systems Studies*, 29, pp. 27.
- Dewey, J. (1896) The Reflex Arc Concept in Psychology, *Psychological Review*, 3, pp. 357-370.
- Encycl. Britannica. (2015) Homeostasis. In The Editors of Encyclopædia Britannica (ed.), *Encyclopædia Britannica*. (Available at: <https://global.britannica.com/science/homeostasis>)
- Greimas, A. J. (1976) *Sémantique structurale: recherche de méthode*. (Paris, Larousse)
- Heil, J. (2003) *From an ontological point of view*. (Oxford, Clarendon Press)
- Heil, J. (2005) Dispositions, *Synthese*, 144, pp. 343-356.
- Heil, J. (2012) *The universe as we find it*. (Oxford, Oxford University Press)
- Heil, J. (2013) *Philosophy of mind: a contemporary introduction*. (New York, Routledge)
- Kant, I. (1982/(1787)) *Immanuel Kant's Critique of Pure Reason*. (London, Macmillan)
- Kull, K., Emmeche, C. & Hoffmeyer, J. (2011) Why Biosemiotics? An Introduction to Our View on the Biology of Life Itself. In C. Emmeche & K. Kull (eds.), *Towards a semiotic biology: life is the action of signs*. London: Imperial College Press, 1-21-(Available at: <https://oula.linneanet.fi/vwebv/holdingsInfo?bibId=1348697;>)
- Latour, B. (2005) *Reassembling the Social: An Introduction to Actor-Network-Theory*. (Oxford, GBR, Oxford University Press, UK)
- Martin, C. B. (1980) Substance Substantiated, *Australasian Journal of Philosophy*, 58, pp. 3-10.
- Martin, C. B. (1997) On The Need for Properties: the Road to Pythagoreanism and Back, *Synthese*, 112, pp. 193-231.

- Martin, C. B. (2002) Properties and Dispositions. In D. M. Armstrong, C. B. Martin, U. T. Place & T. Crane (eds.), *Dispositions: a debate*. London: Routledge, 71-87-
- Martin, C. B. (2008) *The Mind in Nature*. (Oxford, Clarendon Press)
- Martin, C. B. & Heil, J. (1998) Rules and Powers, *Noûs*, 32, pp. 283-312.
- Martin, C. B. & Heil, J. (1999) The Ontological Turn, *Midwest Studies In Philosophy*, 23, pp. 34.
- Peirce, C. S. (1974) *Collected Papers of Charles Sanders Peirce*. (Cambridge, Massachusetts, Harvard University Press)
- Pikkarainen, E. (2013) From the Ontology of Interaction to the Semiotics of Education. In K. Tirri & E. Kuusisto (eds.), *Interaction in Educational Domains*. Rotterdam: Sense, 51-62-
- Pikkarainen, E. (2016) Signs as functions: Edusemiotical and ontological foundations for a semiotic concept of a sign, *Semiotica*, 2016, pp. 27-44.
- Powers, W. T. (1995) The origins of purpose: The first metasystem transitions, *World Futures*, 45, pp. 125-137.
- Powers, W. T. (1998) *Making sense of behavior: The meaning of control*. (Montclair, NJ, Benchmark Publications)
- Powers, W. T. (2005 / 1973) *Behavior: The control of perception*. (New Canaan, Benchmark Publications)
- Powers, W. T. (2008) *Living control systems III: The fact of control*. (Bloomfield, NJ, Benchmark Publications)
- Powers, W. T. (2009) PCT and MOL: a brief history of Perceptual Control Theory and the Method of Levels, *The Cognitive Behaviour Therapist*, 2, pp. 118-122.
- Rijt, H. v. d. & Plooi, F. (2015) *Ihmeelliset viikot [Wonder weeks]*. (Denmark, Human Publishing)
- Schaffer, J. (2016) The Metaphysics of Causation. In E. N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy*. Metaphysics Research Lab, Stanford University, (Available at: <https://plato.stanford.edu/archives/fall2016/entries/causation-metaphysics/>)
- Strawson, G. (1997) The self, *Journal of Consciousness Studies*, 4, pp. 405-428.
- Vancouver, J. B. & Scherbaum, C. A. (2008) Do We Self-Regulate Actions or Perceptions? A Test of Two Computational Models. *Computational and Mathematical Organizational Theory*, 14, pp. 1-22.
- von Uexküll, J. (1982) The Theory of Meaning, *Semiotica*, 42, pp. 25-82.
- Wiener, N. (1961) *Cybernetics or control and communication in the animal and the machine*. (New York, M.I.T. Press)
- Yin, H. H. (2013) Restoring Purpose in Behavior. In G. Baldassarre & M. Mirolli (eds.), *Computational and Robotic Models of the Hierarchical Organization of Behavior*. Berlin, Heidelberg: Springer, 319-347-(Available at: http://dx.doi.org/10.1007/978-3-642-39875-9_14)