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BIOSEMIOTIK

– praktische Anwendung und Konsequenzen
für die Einzelwissenschaften –

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About lines, pictures, things, animals and man

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Prologue

Disciplines in general can be seen as schools where knowledge is organized for the purposes of teaching. Scientific societies cohere by sharing beliefs and maintaining so called standard theories. The communicational basis for all scientists before, during and after their work is everyday language. Individual knowledge can, often will - and indeed always must - extend across disciplinary borders. The more practical the questions scientists ask the more disciplines are called into question. To peel an apple is a simple task.

To describe in detail what one does may involve:

- physics—to know the materials involved and how to deal with them mechanically,
- biology—how the apple came into being,
- economics and trade—to know where it came from, and how
- anatomy (“cutting apart”)—for knowing the structure of apples and peeling hands,
- anthropology and evolutionary biology—how humans came into being,
- ethology—to know the overt behaviour of handling an instrument,
- cultural theory—to know the instrument’s form, the idea and the style of peeling,
- medicine—to know how to deal with undesired side-effects,
- (dynamic) systems theory and cybernetics—to help describing the situation,
- linguistics and semiotics—for the texts involved and their messages,
- the neurosciences—for the inner causes of the behaviour involved in peeling, writing and reading,
- psychology, sociology and philosophy—to provide the broader situational context, depending of course on the school of thought again, see “disciplines” above ...

As long as no theory (or project or institution) can bind together the disciplines involved to know what humans do in everyday (or laboratory) tasks, transdisciplinary efforts like Semiotics will not be taken serious in science.

As a physician I belong to a group of people with historically acknowledged competence in semiotic activities. Here is a very short description of what one does in "western" medical work.

After making an interpretation of complaints and symptoms and arriving at a diagnosis therapeutic actions can follow either on the “materialistic” level (invasive procedures, administering substances) or by other means e.g. verbal interactions (psychotherapy).

If there is no personal interaction not even a nonverbal one creating an “aura curae” (a situation of mutual goodwill) there is no therapeutic effect. This is shown by the breakdown of the placebo-effect under double-blind-conditions (v. Lucadou, 2001).

Semiotics, biosemiotics, neurosemiotics?

One can interpret the findings above as an indication that chemicals, say the molecules of a substance alone, outside a therapeutic context are not carriers of sign activity beyond their natural effectiveness.

Let me put accordingly the so called semiotic threshold, the origin of an entity that can interpret signs, in a first approximation between the extremes of Ch. Peirce's pan-semiotic approach and U. Eco's restriction to the linguistic/cultural level.

For T. Sebeok the semiotic universe begins with the origin of life and for C. Emmeche (2000) "The hidden prototype of a basic biosemiotic system is the simple prokaryotic cell".

I also put the semiotic threshold far back on the evolutionary time scale, back to the origin of distinctive abilities. For believers in evolution animals were the first organisms with a value ("meaning") system enabling them to make choices and leading a complicated life, often complex beyond description.

Finally, acknowledging Sebeok that the domain of semiotics is in fact essentially continuous in gist and problematic with that what is today practised under the label of cognitive science, I take the nervous system (NS) as the interpretant (the organ of interpretation) in animals and man.

For the sake of a straight argumentation only vertebrates are considered here, their evolution has started roughly with paleozoic fish and proceeded to our own species so far.

A neuroscientific approach to semiotics is not yet worked out, worse, there is still no global theory of the brain—in fact I shall try to show in the following that we can not explain a single brain.

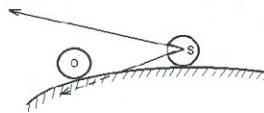
Let me start by analysing a situation philosophers use to show our epistemic faculties: Sitting and watching an object like a glass of water or a table in front of him or her.

World, body, mind

Here is a sketch showing a three-body-situation, two things on the surface of the earth:



We make one of the two things an observer subject (S) so that we can see how he/she (henceforth: he) can see something, an object (O) in his visual field:



As the subject (S) looks through one of his eyes he sees the horizon of the earth in the background and in the foreground the object (O) like a ball:



“Outside”, better “around” the view of the observer is (S), now referring to his body. Vision is framed, the body is always surrounding the view like a hole or a tube. An observing subject looks out, he is endo-positioned - and so are we if we succeed in taking his viewpoint.

For a better illustration here is the “view of the left eye” first shown by E. Mach (1922): You can see the situation of a person looking at himself stretched out on a long chair inside a room:



Such a view if perceived as a whole is a (re)construction of many “partial representations per glimpse”, assembled by saccadic eye movements. The depicted observer and you as a reader do it in a similar way.

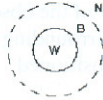
The truly subjective left-eyed-view (close your right eye!) is framed on the right side by the nose of the person and upwards by the eyebrow. It is not so clearly framed to the left and downwards - and also not to the right side from the nose “outwards” — unless the right eye would assist in extending the view.

Nothing is visible outside the vision field, but in everyday situations we don't care because we know what's around — at least we think we know.

This knowledge or conviction of “continuity around us” serves as a (mental) extension of the visible world proper, the mental domain extends (outwards of) the actual moment's view. The further situation is accessible “on demand”, by turning the eye, the head or the body.

Contrary to our belief and everyday experience our actual vision field is bounded, the body forms a window-like frame around it. Imagine that in forward locomotion the frame is carried along and the time axis will make it a tube or a channel. Behavioural experience (here: vision during locomotion) is a “body-channeled” process.

The subjective view turns the relation of the body and it's visual world inside out. The visual world appears in the centre of attention of the subject, then comes the framing body and encompassing both is the working space of the NS, the mental domain.

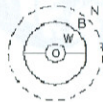


The body (B) separates and connects (W), the visible world and (N), the mental extension of the visible world. The idea of being endo-positioned was introduced by O. Roessler (1992).

The world/body contrast line (which distinguishes the observer and the observed) is only in parts visible as a contour line, and it is blurred. (In Mach's picture it is drawn sharply). You won't find a border between your body and mind, there is no line of distinction.

Because vision clearly makes sense of the environment, less of the body and none of the mind, the focus of interest and attention will be in the centre area/layer of our world (view). We shall expect some thing or an object there. When an object is attended to, the subjective situation, that is the (view from the) endo-neuro-stance is completed.

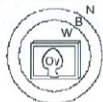
Object, world, body and mind neatly align and the 4 domains of experience (reality?) can be shown in their relation to each other:



The situation becomes a bit (many bits) more complicated if the subjective view of a TV-watcher/PC-user is sketched.

The surface of the object will appear differentiated, like painted, another object, say a person may show up, with a background of it's own, and only people used to it know that both are only dis-played, virtual.

Monitor design, a software aptly called after a window and (picture) framing in general play on the endo-body and/or endo-neuro view:



Finally, as a reader now looking at the picture above you have still another, an overall, real layer of experience, your actual reading situation: Close your right eye (to find your nose as a framing element) and look at the book or reprint which is your object.

Now we try to “zoom” through the four situations wrapping each other like a Russian doll, yet they are transparently framed for our visual experience.

The first is the last mentioned: the book/paper as the object and as background the actual situation around you.

The second is difficult because the sketch as a whole is the object and the more or less empty paper area around it is the background.

The third is diagrammatical, schematic only: You must “enter” the sketch and identify with the observer (B) to look out through his eye(s) into (W) as background where the drawn monitor is object Nr. 3.

The last is easier to see because we are quite used to it: (Ov) is an actor, object Nr. 4, with an empty situation as background, both on the screen.

For those (semioticians?) who are willing to see the chain of arguments above, what follows is a short “line phenomenology”.

On the origins of lines

As we shall discuss later, matter appears in chunks which are separated by “non-chunky” distance. We call chunks of matter things (or bodies or objects or individuals) and we can call the distance-space a “natural medium” if it is air or water.

Things etc. have a certain inner space and appear covered by a surface. (A surface in our biosphere is always an “interface” because natural media fill in the outer space/distance and can thus also be regarded as “bodies”). As a matter of fact (!) a surface or interface is no thing in itself, it is a place where two things touch or border on each other.

When we say that an interface appears between two things or spaces, we can say that a line appears where three things or spaces meet (Fuerlinger 1984):

- The contour or outline does not really exist, it is a product of the view of an observer (1) distinguishing any thing (2) from a transparent medium (3). The medium also serves as (a transmitter of other things in the) background.
- The edge is similar to the contour line but it is a real structure, it has a fixed place on the surface of an object and it is perceptible for touch.
- The borderline separates two adjacent areas of colour or luminosity (shadow) on a surface.
- The drawn line is a minimal body (ink on/in paper, chalk on a blackboard, the shadow produced by a scratch). The line’s body is so extremely long, narrow and flat that it can only exist on/in a carrier surface.

The semiotic power of the drawn line lies in it’s two parallel contours which are simply called a line. It is the most important and widespread sign carrier, only produced by humans and for the purposes of communication.

Other “deep” questions may arise in the contexts of typology and “origins”, and we shall dwell on another one eventually yielding a surprise.

How do we classify things or objects? What sort of categorization mechanism do we use, in everyday life, in science, in general?

Natural kinds: the “other” theory

What sorts of things/objects do we know? We shall now do a quick listing of everything and after that we try to look for the origin of “thingness”.

There is only one way to do the latter, namely to go all the way back to the first things/objects, to get hold of these basic, natural categories. But we start with the listing—and of course with ourselves.

Because behaviour of single individuals with single objects is the domain of interest here, the first question must be: What are the objects you are in contact with?

Being far from you I can tell you (with decreasing certainty): Your clothing, a watch, a book/paper, maybe glasses, a desk, a pencil or a cigarette, a chair (a bed, a tram or bus, ?), your wife, (child, dog, colleague?) etc.

Now looking for origins, we can first ask “ontogenetically”: What was the first object for your self or what was the most important one? It’s easy to answer these two questions because the answer is normally the same, Mama.

If we now try to look back into our documented history and then into the early history of humankind, we may imagine our ancestors in prehistoric times. What objects did they encounter or watch at least?

First we enter the era of hunter-gatherers. Evolutionary psychologists say that most of our brain functions were shaped there (Barkow et al., 1992), but hunting, competing and other tasks for survival must have developed much earlier. So we cross the border between humans and animals backwards - and we meet ordinary primates.

Monkeys and apes seldom use instruments in natural environments but we speculate that they perceived fruit, water, plants and other animals as the most relevant parts of their environment.

In a next big step believers in evolution must accept shrew-sized insectivores as a transient life form of our lineage. Taking their worldview would show that no artefacts exist and that the visual world has not got much colour and depth.

Talking about early mammals we know that they were predators and busy with hunting but we must also assume that during these times predator avoidance gained absolute priority (dinosaurs ruled, and their stepping legs alone were a threat).

The things they were in contact with, to sum up, were either like themselves, or other animals as prey, still other animals as predators, there was water, obstacles, plants. Insectivores pay no attention to immobile things as we do which means that the only important objects for them were (and still are) animated, others.

The last time jump, right into paleozoic waters: no child rearing behaviour, no drinking and for pelagic fish no sheltering. Every thing that is left is “others”, living, moving, behaving ... in short:

The first object in evolution was an other (individual).

If accepted and applied to sciences dealing with “thingness” or subjects and objects in general, the “other” theory can—and eventually will—change some long established standard theories.

The reasoning behind the other theory is rather uncontroversial but also unusual for people living largely in an environment of artefacts. Even many believers in evolution may stick to their favourite object or animal group (see prologue) and ignore the history of their (organ of) concept formation.

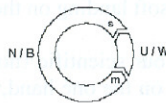
Only some consequences can speculatively be hinted upon. A general implication in bold terms first.

If hunting and being hunted, competition and mating were, and still are, the basic tasks for nervous systems, nothing in the findings of psychology, of the cognitive—, behavioural—and neurosciences will make sense except in the light of interactive behaviour.

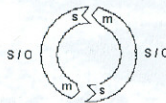
The social sciences can get an unexpected “deep” and dynamic basis. The top position of sociology amongst the other sciences, the definition of the individual and the restriction of “sociality” to a single species need reconsideration if neuro-physiology really originated as “socio-physiology”.

In (Bio) Semiotics no standard theory is threatened. Let us choose J.v. Uexkuell’s functional circle as a non-interactive, “single-individual” model for dealing with the world and speculate how an interactional extension would change it.

In the original model (below), the sensor (s) and motor parts (m) of a nervous system (N) or body (B) “grab” a part of the Umwelt (U):



Uexkuell has only one of his functional circles dealing with the inanimate environment, namely locomotion with obstacles etc., so I propose to represent the three other functions which are enemies, hunting and sexuality, in a more symmetrical way:



The resulting circuit can serve as a general model for so called dynamic systems exemplified in parasitism, hunt, fight, courtship, dance and direct communication. Co-evolution between species most often resulted in mutually adapted, in fact balanced, interactions.

During an interaction (at least) two individuals are sender and receiver at the same time, their sensorimotor systems are (cross-)coupled online. Motion detection leads to a (re-)action which is detected by the other and leads to a re-re-action etc.

Motion triggers motion. To a large extent this is done in a reflex-like manner by the so called mirror neurons (Rizzolatti 2000). The evolutionary origin of these inner sensorimotor shortcuts is unknown but hunting is a likely candidate because following each other is essentially “mimetic” behaviour (Fuerlinger 1997).

The behavioural-, cognitive- and neurosciences will have to get socialised, in a double sense. First, they will have to realize that

the top centre of attention and guidance of behaviour, the so called “homunculus of cognition”, is the (behaviour of the) other.

Second, they will have to cooperate, to merge their efforts to reach the long desired common goal, a global brain theory. Two questions address this issue:

Why is our interest and attention so often focused on a single object of desire (or avoidance)? It is the outcome of attention processes which during the long run of evolution in innumerable encounters most often (and ultimately always) had to deal with single exemplars/individuals only: a predator, a partner, a prey animal or a competing other.

Consequently, K. Popper facing a glass of water takes part in a typical realistic, but not a proto-typical epistemic situation. A single brain or intelligence works somehow idle without an adequate counterpart.

If an ordinary room with only furniture in it is already a big challenge for an artificial intelligence (“situated cognition”, Clancey 1997), natural intelligence has solved from it’s very beginning a lot of “three bodies in interaction”-problems, namely two mobile bodies chasing each other on top of a third.

In sheer “computing” power we can compare the catching of a fleeing prey animal or a successful mating event to the soft landing on the moon’s surface, our species’ collective peak experience.

And why is our everyday and our scientific (notion of an) object “de-animated”, without agency or reactivity? It is, on the one hand, the vanishing of the two main incentives to move (prey and predators), on the other hand the human urge to describe and thus conserve and immobilise (the remainder of) his main life events.

Drawings and pictures emerged that latter way. They are daily and valuable semiotic tools, but they are a poor class of stimuli for a battle-tested nervous system. To be sure, a paper dog can not represent a real dog.



The Dalmatian above commonly used in psychology textbooks would immediately “pop out” if he moved only a millimetre. A moving individual needs no pre-cueing, it is object and event together (see epilogue).

Figure-ground, part-whole, Gestalt and “binding” are problems of method, results of testing procedures using written text or pictures. Biological motion is holistic, it is the salient (latin: jumping) feature for attention and, together with (indices for) matter, volume and weight, a “master-feature” of reality.

Finally some remarks about our animal heritage, in (neuro-)biological contexts. What were the selective pressures that augmented most the cognitive and behavioural complexity of our vertebrate line, our encephalisation, our intelligence?

The most challenging (not necessarily the most time demanding) tasks must have had the biggest impact. Three tasks (behavioural domains, modules) meet the requirements of

- regular occurrence (at least once in a lifetime),
 - high complexity (minimum: a dyadic interaction) and
 - maximum survival value,
- but only one is recognised since Darwin's time, namely sexuality.

The other two functions, hunting and being hunted, are swept under the carpet of environmental interactions called natural selection. Predators and prey figure as parts of a species' niche only but both demand, as everybody can imagine,

- 100 % activation and acceleration of the whole body in minimum amount of time.
- Categorisation and decision processes must accordingly work with maximum precision and robustness, yet
- they must work with instant flexibility for strategy changes induced by the other, so we might conclude that

Early sensorimotor processing in both hunting contexts must be a central mechanism of natural selection.

In addition, we can be sure that vertebrates have excelled in both roles for long spans of time during evolution. This means the recent vertebrates are the product of neural arm's races going on in both directions for half a billion of years.

We humans still command such a "hybrid" prey- and hunter body. It is run by nervous structures with a general intelligence for seamlessly solving all problems of successive or parallel interaction.

Most of the time we are pursuing goals, but always we are trying to avoid the threats of others. We are still "wild at heart", but because we were so often on the menu we are not so perfect hunters and killers.

Epilogue: About movement

Konrad Lorenz, ethologist, once said: "There is no intuition ('Anschauung') of space and no intuition of time but there is only one intuition, of movement in space and time" (Altenberg seminaire, 13.3.1980)

What movement really is we experience "a priori" in mothers womb from conception on and after birth every time our whole body is moved actively or passively.

Only humans try to decompose the unique quality or "primacy" of movement (M. Sheets-Johnstone, 1999) into dimensions, usually four, three for space and one for time.

In this way of reduction descriptions became possible, but physics, ethology, psychology or the neurosciences can never replace or model "movement as such".

Animals may live (in or through) a sensorimotor continuum, a permanent "flow" experience, they may not need (a conceptualisation of) space and time.

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