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HOLISTIC CYBERNETICS – CONCEIVED AS THE RESULT  
OF A GRADUALLY LESSENERED ‘DETACHMENT OF THE OBSERVER’

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# Holistic Cybernetics - conceived as the result of a gradually lessened ‘detachment of the observer’

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## Abstract

For help in explaining our theoretical understanding of nature, Pauli once suggested to Bohr a gradual lessening of the ‘detachment of the observer’, a notion of Bohr based on his concept of complementarity. Pauli expected further steps in this direction.

We suggest further such steps - in line with an epistemological development towards revelation of presuppositions rather than asking for fundamental truths. When taken to the basic presuppositions for communication, we reach language in its holistic conception and cybernetic realization, namely *holistic cybernetics*. That is a system of two holistic languages, one communication language and one genetic language. An essential presupposition is that the communication language is *shared* among a population of communicating individuals. The genetic language is responsible for this, and provides (via evolutionary adaptation) linguistic capacities that are shared (beyond complete description) among the communicating individuals. This explains induction as beyond deduction in the communication language. We compare holistic cybernetics with well known self-referential cybernetics (‘cybernetics of cybernetics’ and second-order cybernetics).

## 1 Introduction

Recall for a moment the early stages of cybernetic thinkings, when Mead suggested to look at *cybernetics as a language*, allowing fruitful interdisciplinary talk. And, furthermore, proposed to apply cybernetic principles to the organization of cybernetical activities - suggesting with von Foerster the expression ‘cybernetics of cybernetics’. How von Foerster furthered such self-referential aspects into an ordering of cybernetics with *first-order cybernetics* as *the cybernetics of observed systems*, and *second-order cybernetics* as *the cybernetics of observing systems*. See [Pias C, 2004].

In the expansions to follow, with second-order cybernetics at center, various conceptions of ‘the

observer’ have occurred. Some, appealing to physical-like measuring instruments or automata, some to living organisms, some allowing ‘the observer’ to be a full-fledged human observer, and this even with a stretching of observation all the way to communicable thinking. Compare a proposal of Maturana, in a panel discussion in 1990 on old and new cybernetics (quoted from [Heylighen et al eds, 1990]).

A PROPOSAL OF MATURANA [Heylighen et al eds, 1990, page 42] “What if we were saying that the new cybernetics is not the cybernetics of control, or the control of the controller, but the cybernetics of understanding”.

In the Second Heinz von Foerster Congress, 2005, we proposed to look at cybernetics more in terms of a holistic understanding than in a self-referential one (with its noticeable problems of explaining self-reference in terms of unfolding orders, and of how to understand ‘the observer’). With reference to the holistic conception of language [Löfgren L, 2004], we there suggested ‘holistic cybernetics’ as follows.

**Holistic Cybernetics** [Löfgren L, 2005]. “Holistic cybernetics is a system of (at least) two holistic languages, one communication language, *shared* (in a nontrivial way) among a population of communicating individuals, and one genetic language accomplishing the sharing presupposition. The genetic language provides (via evolutionary adaptation) linguistic capacities that are shared, beyond complete description in the communication language, among the communicating individuals (explaining for example induction as beyond deduction in the communication language.”

Another way of understanding the involved holism would be to start out from Pauli’s view of gradually lessening the ‘detachability of the observer’ (suggested in a letter to Bohr in 1955). And, from there on, *to extend* the understandings of the ‘gradual lessening of the detachability of the observer’ to a communicable limit, in line with a foundational program *aiming at revelation of presuppositions* rather than searching for absolute truths (cf [Löfgren L, 2004]), thereby revealing a full holistic concept. That is, not of some generalized quantum system, but rather of some completion of first-second-order approaches to cybernetics. Namely to a *complementaristic conception* of cy-

bernetics, on a par with the above explicit view of holistic cybernetics as a system of two languages. A conception, that is, with deep appeal to our natural sharing of holistic language. Simply notice the way we naturally 'read' a sentence - *always* in terms of the meaning (compositional interpretation) it produces in our conscious mind (with linguistic capacities shared with other minds) entangled with the, often subconscious, reading of its syntactical structure.

Notice that such an epistemological extension of understanding a 'gradual lessening of the detachability of the 'observer' will also involve a transition from Bohr complementarity to the phenomenon of language. That is to *linguistic complementarity*. This transition step may be more a matter of revealing deeper presuppositions, even compared with those involved in Bohr's introducing his concept of complementarity; cf [Primas H, 1983]:

[Primas H, 1983, page 349] "A new style in science began with quantum mechanics when Niels Bohr initiated a spiritual renewal by introducing his concept of complementarity. It turned out that complementarity is far more important than quantum mechanics, it has led to development of science that encourages a holistic vision."

"Bohr made it very clear that the notion of complementarity is not restricted to quantum physics. He stressed that the idea of complementarity is related 'to the general difficulty in the formation of human ideas, inherent in the distinction between subject and object' (Bohr 1928)"

It is in such a direction of understanding 'the formation of human ideas' that we have to look deep into the presuppositional foundations for language as a phenomenon where thoughts are born and communicated. This is where we meet linguistic complementarity, where it is the weighing possibilities in its tension aspect that are behind subject-object distinctions as appearing in predicative conceptualizability.

## 2 Excerpts from Holistic Language

The following excerpts from our holistic understanding of the phenomenon of language [Löfgren L, 2004] may be helpful for reading the paper.

**Language** is, in its general holistic conception, a *whole* of complementary description-interpretation processes. The meaning of "complementary" is that of *linguistic complementarity* given below.

In particular Carnap's semiotic fragmentation thesis, stipulating individually understandable syntax, semantics, pragmatics parts (cf [Carnap R, 1968]), does not hold for the phenomenon of language in its general holistic comprehension.

**Linguistic Complementarity.** In its *holistic conception*, language is a whole of description-interpretation processes, a whole which does not allow part-constructions like pure descriptions or pure interpretations within the language. Instead, within the language, there is a tension between describability and interpretability. For example, it may be possible to describe more and more

of the interpretations in the language, due to its reflexive powers. But there will always remain a non-vanishing undescribable interpretation-residue. We then say that we *weigh* the tension toward the describability-side, and refer to the description-construct as *description-like*. In weighing the tension toward the other side, the interpretation-side, with a small but nonvanishing noninterpretable description-residue, we refer to the interpretation-construct as *interpretation-like*.

There are various related ways of viewing linguistic complementarity:

- (i) as descriptiveness incompleteness: in no language can its interpretation process be completely described in the language itself;
- (ii) as a tension between describability and interpretability within a language: weighing towards increased describability implies decreased interpretability, and conversely;
- (iii) as degrees of partiality of self-description (introspection) within a language: complete self-description within a language is impossible;
- (iv) as a principle of "nondetachability of language".

For illustrations of *weighings* as in view (ii), see for example [Löfgren L, 1998].

Languages may change and evolve, and with them their capacities for describing and interpreting. Yet, at each time that we want to communicate our actual knowledge, even on the evolution of language, we are in a *linguistic predicament*, namely to be confined to a language with its inescapable complementarity.

**Linguistic Closure.** Our thinking abilities are usually looked upon as free and unbounded. But when it comes to *communicable thought*, we are confined to some shared communication language. The systemic wholeness, or the complementaristic nature, of this language implies a closure, or circumscription, of our linguistic abilities – be they creation of "pure thoughts" communicable in a formal mathematical language, or constructive directions for an experimental interpretation-domain of a physics language. The nature of this closure is not that of a classical boundary of a capacity, like describability, or interpretability. It is a *tensioned and hereditary* condition on the systemic capacity of *describability-and-interpretability* admitting *potentialities* in two directions:

(a) The closure is **TENSIONED**. Within the language there is a tension between describability and interpretability (view (ii) of the linguistic complementarity), whereby it may be possible to increase the describability at the cost of a lowered interpretability, and conversely. In other words, what the closure bounds off is neither describability, nor interpretability, but their interactive whole as a linguistic unit of *describability-and-interpretability*.

(b) The closure is **HEREDITARY**. Languages may evolve, and at a later time we can have access to another shared communication language of greater capacity for communication. However, we are then back to the *linguistic predicament*: at each time that we try to communicate thoughts – even introspective thoughts about language and its evolution – we are confined to a shared language, however evolved, and the linguistic complementarity

of that language restricts our communicability in the tensioned way according to (a).

### 3 Pauli's view of a gradually lessened 'detachment of the observer'.

In a general perspective, the topic of the 'detachability of the observer' is related with ideas of making conceptual "cuts", like in separating mind and matter, observer and the observed, measuring apparatus and system measured upon, inside and outside, etc. By way of well known examples, the *Cartesian cut* separates the whole reality into mind and body. The *Heisenberg cut*, see [Primas H, 1994], which presupposes the Cartesian cut, divides in addition the purely material universe of discourse into a material object and material observing tools (with interactions, but no Einstein-Podolsky-Rosen correlations, between the observed object and the observing tools).

The Bohr-Pauli exchange of ideas on the detachability of the observer ought to be sufficiently well understood by the following quotations from a letter that Pauli wrote to Bohr in 1955.

#### Pauli's letter to Bohr

The following quotes from Pauli's letter to Bohr in 1953 are taken from the printed version of it occurring in Laurikainen's book [Laurikainen K, 1988].

"To a certain extent I am therefore glad, that eventually I found something [indicating disagreement]: the definition and the use of the expression 'detached observer', which appears on page 10 above of your lecture and which reappears on page 13 in connection with biology. According to my own point of view the degree of this 'detachment' is gradually lessened in our theoretical explanation of nature and I am expecting further steps in this direction. ... it seems to me quite appropriate to call the conceptual description of nature in classical physics, which Einstein so emphatically wishes to retain, 'the ideal of the detached observer'. To put it drastically the observer has according to this ideal to disappear entirely in a discrete manner as hidden spectator, never as actor, nature being left alone in a predetermined course of events, independent of the way in which the phenomena are observed. 'Like the moon has a definite position' Einstein said to me last winter, 'whether or not we look at the moon, the same must also hold for the atomic objects, as there is no sharp distinction possible between these and macroscopic objects. Observation cannot *create* an element of reality like a position, there must be something contained in the complete description of physical reality which corresponds to the *possibility* of observing a position, already before the observation has been actually made.' I hope that I quoted Einstein correctly; it is always difficult to quote somebody out of memory with whom one does not agree. It is precisely this kind of postulate which I call the ideal of the detached observer. In quantum mechanics, on the contrary, an observation *hic et nunc* changes in general the 'state' of the observed system in a way not contained in the mathematically formulated *laws*, which only apply to the automatical time dependence of the state of a *closed* system. I think here on the passage to a new phenomenon by observation which is technically taken into account by the so-called 'reduction of the wave packets'. As it is

allowed to consider the instruments of observation as a kind of prolongation of the sense organs of the observer, I consider the unpredictable change of the state by a single observation — in spite of the objective character of the result of every observation and notwithstanding the statistical laws for the frequencies of repeated observation under equal conditions — to be *an abandonment of the idea of the isolation (detachment) of the observer from the course of physical events outside himself*.

...  
Probably you mean by 'our position as detached observers' something entirely different than I do, as for me this new relation of the observer to the course of physical events is entirely *identical* with the fact, that our situation as regards objective description in 'this field of experience' gave rise to the demand of a renewed revision of the foundations for 'the unambiguous use of our elementary concepts', logically expressed by the notion of complementarity."

#### On Pauli's goal behind lessening the detachment

Notice that Pauli here expects 'further steps' towards lessening the detachment of the observer - but does not ask for a *null-detachment* or *complete inclusion*. This is understandable in the light of his quantum theoretical insights. Compare as well more recent positions in *quantum theory of observation as measurement*.

NULL-DETACHMENT DIFFICULTIES [Busch, Lahti and Mittelstaedt, 1996, page 131]. "The quantum theory of measurement is motivated by the idea of the universal validity of quantum mechanics, according to which this theory should be applicable, in particular, to the measurement process. Hence one would expect, and most researchers in the foundations of quantum mechanics have done so, that the problem of measurement should be solvable *within* quantum mechanics. The long history of this problem shows that, in spite of many important partial results, there seems to be no satisfactory route towards its solution. This general impression is confirmed in the present work by means of no-go-theorems."

Furthermore, in the wider epistemological context we intend for this paper (for the foundational deepening of Pauli's lessening of the detachment), a null-detachment of the observer would imply complete self-description - which would contradict view (iii) of linguistic complementarity. Complete self-description within a language is impossible - whereas degrees of self-description may well be developed. Compare also views (i) and (iv) of linguistic complementarity.

### 4 Holistic advancements of Pauli's view

In advancing Pauli's further steps towards revelation of basic presuppositions for observation and communication, we understand linguistic complementarity as an epistemological extension of Bohr's complementarity concept (in revealing more fundamental presuppositions). At the same time we extend 'the observer' (an expression which all too easily connotes embod-

iment and classical detachability) into ‘holistic language’, namely the language the observers share in making observations which are intersubjectively acceptable.

### From Bohr Complementarity to Linguistic Complementarity.

When Bohr first introduced the concept of complementarity in quantum physics, in his Como paper [Bohr N, 1928], he did so in a way which is perhaps more general than what the subsequent discussions of it seem to reflect. Compare his view of a possible “complementarity theory”:

BOHR’S PRIMARY VIEW OF COMPLEMENTARITY [Bohr N, 1928, page 580] “Indeed, in the description of atomic phenomena, the quantum postulate presents us with the task of developing a ‘complementarity’ theory the consistency of which can be judged only by weighing the possibilities of definition and observation.”

In [Löfgren L, 1994, pages 159-60] we compare Bohr complementarity with linguistic complementarity. With definability a special case of describability, and with observability a case of interpretability (see [Margenau H, 1966]), we regard linguistic complementarity (tension between describability and interpretability within a language) an extension of Bohr’s primary view of complementarity (tension between definability and observability).

Notice the different natures of the underlying presuppositions. For linguistic complementarity we have two presuppositions P I and P II (see [Löfgren L, 2004, pages 146-7]).

P I states the general opposition between descriptions and interpretations in a language:

descriptions (sentences, theories) are always finite (finitely representable) and locally independent of time; for interpretations (meanings, models) no such restrictions are presupposed.

P II concerns the necessity for communicating individuals to *share* a communication language. The sharing condition, reflecting the adaptation of the language to its niche, is in general beyond full description in the communication language.

P I and P II obviously also apply to Bohr’s reasoning behind complementarity, but are not there revealed. Rather, they are detached - indicating limitations for Pauli’s lessening of the detachment. Nevertheless Bohr frequently returns to the importance of using natural language (rather than a not fully interpretable quantum “language”) to communicate unambiguously experimental conditions for quantum measurements. But such beliefs (ideal, or detached in the present context) rather seem to indicate that Bohr is not fully aware of a linguistic complementarity.

### From observers to their shared language.

The step from “observer” to the “language shared between the observers” becomes necessary for the ‘lessening of the detachment’ problem as soon as we start to understand view iv of linguistic complementarity. That is, that the principle of nondetachability of lan-

guage also applies to the language in which observers observe, experiment, think, communicate, make intersubjective conclusions with other observers, etc. In particular so, notwithstanding Bohr’s appeal to natural language for reaching experimental objectivity. In [Löfgren L, 1994] we argue this point in some detail.

The sharing presupposition P II is in [Löfgren L, 2004] stated as follows:

PRESUPPOSITION II. Communication presupposes that a language be *shared* among participants of the communication. This means that they all have *inherited* (genetically; i.e., a phenomenon in genetic language) some basic description-interpretation processes of the language, and may have *acquired* (by learning the language in its acquisition phase) certain other commonly held properties, permitting them to further explore, by the description-interpretation processes constituting the language, a linguistic domain of common interest (which may contain conceptions of the language itself).

## 5 Holistic cybernetics as closure of the advancements of Pauli’s view

The wide aim of Pauli’s epistemological goal for a lessened ‘detachment of the observer’, and that of our further extensions of this observer perspective, reveals that we are not aiming at some quantum theory but rather at an understanding of the phenomenon of language. That is, an understanding respecting the basically revealed presuppositions for communication which allows us complementaristic conceivability of language in language. That is, without detaching ourselves from the language - which is the usual situation when we try to formulate scientific results in theories in “formal languages” which are but detached fragments of holistic language.

Thus, with holistic language as of a different category than that of theory (and that of “formal language”), and with the possibility here to understand language in language, we rather associate with cybernetics, for which “self-referential” characterizations are well known. Cf cybernetics of cybernetics, as well as formulations of cybernetics using “the observer” concepts - not to speak of the characterization of holistic cybernetics given above in the introduction of this paper.

Our extensions of Pauli’s view have ended in language, holistic communication language, as category for what in Pauli’s view is ‘the observer’. Also with wide understandings of observers, such as stretching observing all the way to communicable thinking, our extension comes to a natural stop here. Compare:

[Dummett M, 1991, page 166] “Language, it is natural to say, has two principal functions: that of an instrument of communication, and that of a vehicle of thought. We are therefore impelled to ask which of the two is primary. Is it because language is an instrument of communication that it can also serve as a vehicle of thought? Or, is it conversely, because it is a vehicle of thought, and can therefore express thoughts, that it can be used by one person to communicate his thoughts to others?”

With this view of the function of language, we seem

to be at the right fundamental concept. That is, in holistic communication language - where also the two functions seem entangled and perceivable as weighings (perspectives) in the language. Whereby our “theories” become understandable as description-like weighings with nonvanishing but small interpretation-residues.

## 6 Holistic cybernetics compared with self-referential cybernetics

With “self-referential cybernetics” we refer here to the early stages of cybernetic development, mentioned in the introduction. Namely to *cybernetics of cybernetics*, of Mead considered a language allowing self-applicability (for example possibilities of application of cybernetic principles to cybernetic production of principles), and to von Foerster’s furtherings into *first-order cybernetics* as the cybernetics of observed systems, and *second-order cybernetics* as the cybernetics of observing systems.

In these views there seems to be a tacit fragmentability assumption in that we can in some principal way distinguish between language and its meaning, between a sentence and its meaning, between theory and model, between description and interpretation, etc. By this we do not want to suggest that there are no interactions between fragmented parts. On the contrary. What we mean is that such tacit fragmentability assumptions may show up as illusions, or as being distortive if taken seriously - in the sense that they appear as fictions if our natural holistic communication language is not detached.

By contrast, in our holistic perspective we do not fragment our natural communication language into “language and its meaning” (which we do in for example logics where “language” refers to a “formal language” of sentences and their syntax, and meaning to semantics). Instead we conceive holistic language as a genuine whole of description-interpretation processes. Attempts to make such linguistic processes produce pure descriptions, or pure interpretations, are impossible in the language. But there is a linguistic complementarity, allowing weighings towards a description-like side and an interpretation-like according to section 2.

In our holistic perspective, with language a vehicle of thought and an instrument of communication, we naturally view cybernetics more in terms of holistic cybernetics than in terms of self-referential.

### Holistic versus second-order cybernetics

. In holistic cybernetics, *self-reference is always partial* - cf view (iii) of linguistic complementarity as well as [Löfgren L, 1990]. Is there some similar understanding in *self-referential cybernetics*?

Not, as far as we have seen, as documented in some similar terminology (like *partial* self-reference, or *degrees* of self-reference). But, perhaps it is von Foerster’s classification into first- and second- etc orders

of cybernetics that intends to support degrees of self-reference.

An ordering of cybernetics, that is, which may have been inspired by a *predicative* view of cybernetics. Conceiving “observing observing” as a second-level predicate. That is, with a predicate/object switch as in: Observing(as predicate) applicable to Observing(as object). Realizable by levelling the predicates as in *second-order predicate calculus* where first-order predicates are quantified over objects, and second-order predicates are quantified over first-order predicates.

But as long as self-referential cybernetics is conceived as a theory or science, the predicate-levelling must go on - unless the self-reference is accepted as partial. If not, but with second-order cybernetics considered a complete self-referential cybernetics - *the null-detachment problem* arises. Cf at this point the following observation of Glanville.

[Glanville R, 2004, page 1384] “What happens in second-order cybernetics? The distinction between first- and second-order cybernetics depends, as has already been developed, on a change in attitude to the observer who, in second-order cybernetics, is understood to be both within the system being described and affected by it.”

This position, and functioning, of the observer is precisely that which defines null-detachment - an impossible goal of complete self-description; see both view (iii) of linguistic complementarity and [Löfgren L, 1990].

**Conclusion.** Second-order cybernetics, as deductive theory or science, is bound to be incomplete with respect to describability of control and communication. The influence of our nondetachable natural communication language is not taken into account.

Holistic cybernetics, as holistic language, is a closure of lessened detachments of “the observer” (of the language shared by observers). Conceivability is here holistic and not assumed fragmentable as in idealistic searches for pure theories or for pure models (as in non-holistic understandings of for example “formal languages”). Characteristically we have a linguistic complementarity which can be viewed as a tension between describability and interpretability within the language. It can be weighed towards a description-like side as well as towards an interpretation-like side.

Holistic cybernetics allows weighings towards description-like accounts of holistic cybernetics, as well as of cybernetics of second-order (and of higher predicative orders), and also of “cybernetics of cybernetics” (whether interpreted non-holistically or holistically).

### Are cybernetics of cybernetics and second-order cybernetics synonymous?

Very often, cybernetics of cybernetics and second-order cybernetics are considered synonymous. Cf, Glanville’s briefing of this conference session: “I have, at the last two conferences, chaired the session on Cy-



bernetics of Cybernetics etc - also known as Second Order Cybernetics.”

However, in [Glanville R, 2004, page 1380] Glanville takes on a more critical attitude, and attempts an argument for a possible synonymy. It ends: “Thus, the Cybernetics of Cybernetics is Cybernetics when the observer’s presence is admitted rather than disguised - or even completely denied.”

We agree with “Cybernetics of Cybernetics” as a very general kind of formulation which can be interpreted in many ways. Also so, with Mead’s characterization of it as a language (cf Section 1).

In a non-holistic perspective of Cybernetics of Cybernetics, it surely is possible to interpret it as a second-order cybernetics - of the character of theory, because also language will then be so fragmented.

In a holistic perspective of Cybernetics of Cybernetics, it is also possible to interpret it as Holistic Cybernetics - thus not as theory but as holistic language. For example in understanding “cybernetics of cybernetics” as “applying cybernetic principles to the cybernetic production of principles”. Cf from [Löfgren L, 2004] how we explain the phenomenon of *induction* as occurring in holistic language (although partly hidden from complete description in the language). With causes in the adaptation of the language (its constituting individual linguistic agents) to niches where it fits. Resulting in genetically propagated linguistic capacities - nonconscious capacities to behave inductively (to the surprise of non-holistic deductivists). Notice the role here of the genetic language in Holistic Cybernetics.

By way of conclusion we see the wide applicability of Cybernetics of Cybernetics, in contrast to the more specific form of second-order cybernetics, as reason for not considering them synonymous.

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