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Firstness

As seen from the perspective of Complexity Research

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Abstract

This paper presents a sort of phenomenology of complexity-theoretic reasons for rethinking the philosophical understanding of "firstness". Many of these reasons are well known in systems theory, mathematics, physics and other natural sciences but are - to my knowledge - not yet widely considered in the discipline where the quest for "the first" origins - in philosophy. The paper thus is meant as an invitation to philosophers to consider "firstness" from the perspective of complexity research.

Philosophizing about "firstness" runs up on a fundamental difficulty. Whatever can be said about it can only be said *circularly*.[1] This implies that we should not start from "the first", that is, from the beginning and develop from there what we want to say step by step, going from "first" to "second" to "third" and so on until we reach a comprehensive explanation.[2] What we will do instead, is to start *somewhere* hoping that this "somewhere" manages to temporarily carry our reasoning in a way that provides time to adjust it and therewith to rearrange it into a new "somewhere" which in the next time-step again provides an albeit just tiny time gain for a further adjustment of an again only provisional "somewhere". This chain of "somewheres" eventually might lead back to where we started, thus revealing a circle, or more to the point, a *network of references.* And we can hope that the nodes of this network will mutually stabilize each other. At close look however, the network might appear to be grounded in *nothing but itself*. Expressed a bit floppy in terms of one of today's common pastimes: philosophizing about "firstness" - and this means philosophizing in general - might turn out to have the character of solving SUDOKUs. Or in more scientific terms, philosophizing might emerge as a recursive operation with no need for any "first".

Somewhere *n* = Somewhere *n* - 7 - *Recursions*

Let's have a look at recursions "at first". We define the recursive operation *op* as

$op(x)$ = divide x by 2 and add 1

If we start this operation at $x = 4$ and then repeatedly apply it to its own results we get the following sequence:

$op(4) = 2 + 1 = 3$
$op(3) = 1.5 + 1 = 2.5$
$op(2.5) = 1.25 + 1 = 2.25$
$op(2.25) = 1.125 + 1 = 2.125$
$op(2.125) = 1.063 + 1 = 2.063$

As should be easy to see, the more often we repeat this operation the closer its results approach 2. The decisive aspect here is that the operation does the same if we

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[1] For an opening, remember Paul de Man's (1979) reference to "the first" being not conceivable as such without "a second". Rather than "the first", "the second" therefore should be considered the actual first - if it wouldn't face the same problem.

[2] And no, I will also not start by discussing any historical conceptions on how "firstness" has been seen by the "classics". Without doubt such recapitulations have value and can help to orientate thinking. But they also generate "path dependencies" and thus tend to direct thinking into worn-out regions. In my opinion, philosophy is not well advised if it restricts itself to historiography!

start it with, say, x = 1. When repeating *op* recursively, that is, when iterating from *op*(1), the results again approach 2. And the same is true, if we start it with x = 15 or x = -3 or whatever other number we choose.

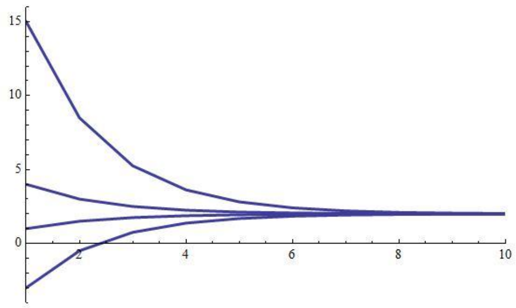

Image 1. 10 Iterations of *op*(x) = x/2 + 1, starting with x = - 3, x = 1, x = 4 and x = 15.

Heinz von Foerster (1976) - who is my source of this example - suggested to regard such operations as having an *Eigen-behavior* leading to an *Eigen-value*. The results of these operations are "*eigen*" (German for "particular" or "innate") in the sense that their dynamics do not depend on their starting values. In other words, 2 acts as an *attractor* for *op* irrespectively of where *op* starts. Or in again other words, the starting point, the origin, that is, the "first", is *irrelevant* for this operation. We do not need it for the operation to find its attractor.

Attractors of course can be much more complex than just a simple number. Sometimes, if this is the case they are called *strange attractors.* Looking at the more or less famous strange attractors in image 2, we might come to the conclusion that cognitive conceptions, that is, terms and notions that we for instance use for ordering our analytical attempts to understand the world, are also some kind of Eigen-values. In our endeavor to philosophize about "firstness" thus, we might hypothesize that "the first" is nothing else but an Eigen-value itself - a semantic concept towards which the aggregation of cognitive operations concerned with a certain kind of analytical order tends to develop. From a conventional point of view it might seem strange that this aggregation does not need a "first" in its own right to do so.

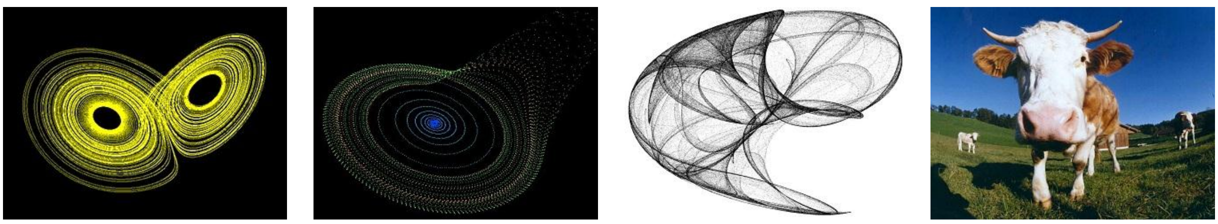
Image 2. Some (more or less) Strange Attractors. From left to right: Lorenz, Rössler, Peter de Jong, complex biological system.

Somewhere *n*+1 = Somewhere *n* - 6 - *Networks*

In order to better understand such "firstless" developments, let's have a short look at another common experience from modern world's pastime. The by now world-famous Page-Rank-Algorithm (Brin/Page 1998) which Google and other search engines use to rank internet search results works as a "firstless" recursion as well. The algorithm defines a sequence of iterations in the course of which the links from one web-page to another are counted. The underlying assumption is that web-pages get their specific relevancy not so much "on-page", that is, from the actual information a web-page contains. The relevancy rather is seen as "constructed" by the users of the World Wide Web who reflect and express this relevancy in terms of their surfing habits. In times of web 2.0, these habits in their turn find their expression in the way users link their own web-pages to other pages. The relevancy of a web-page in the Page-rank thus, is constructed "off-page" by the links a web-page "receives" from other pages. In other words, the Page-Rank-algorithm ranks web-pages in regard to the relevancy they "inherit" via incoming links. A page is relevant if many other pages reference to it and if among these pages are many pages who themselves are amply referenced. Thus, a page is relevant if it inherits relevancy from other pages who inherit their relevancy again from other pages, and so on.

As should be easy to see, among the referencing pages might be - via some degrees of separation - the page in question itself. Relevancy therewith reveals itself as a *circular* phenomenon. A page is relevant because it is *made* relevant by other pages who themselves are *made* relevant by again other pages among which the "first" page might be. A page, we might say, can be made relevant *by itself*, which of course is a rather irritating notion if we think about it in conventional terms. Nevertheless, as we all know, the search engines that use this kind of algorithm work well and are widely referenced - meaning that they are used and therewith made relevant. We seem to believe that the relevancy they detect is relevant.

In respect to our topic, this circular "fabrication" of relevancy means "firstlessness". There is no "first" page on the internet, no page with absolute relevancy. Web-pages find their relevancy *relational*, that is in regard to other web-pages. Relevancy therewith is an *emergent property* of the networked references of web-pages. It does not need "a first" to emerge. It is an *Eigen-value* towards which the aggregation of web-links dynamically develops.

Somewhere *n*+2 = Somewhere *n* - 5 - *Emergence*

Emergent properties often are described as the qualities of a phenomenon which cannot be deducted from the elements that are known to generate the phenomenon (cf. Beckermann et al. 1992, Holland 1998, Kim 1999, Sawyer 2005).[3] Or in other

[3] And yes, there is a background-linkage to Hegel's famous transition from quantity to quality.

words, an *emergent property* is a quality of a phenomenon on *n*-order (or macro-)level which does not seem to be there at the *n* - 1-oder (or micro-)level. 19th-century science for instance discussed the fluidity of water as *emergent* since hydrogen and oxygen were known to have no kind of whatsoever fluid quality.

One of the widely discussed 20st-century examples for emergent properties is *cooperation* (cf. a.o. Fehr/Gächter 2002, Nowak/Sigmund 1998) which has been shown to be conceivable as a consequence of the interaction of "selfish" (that is, non-cooperative) actors. Game theory and even more lately Multi-Agent-simulation vividly demonstrates that cooperation might emerge not in spite, but on the opposite, because of actors interacting selfishly. Of course, we are not allowed to conclude from this that cooperation *is* a (macro-)result of (micro-)selfishness under all circumstances, but at least we can say that selfishness when aggregated in social interactions *suffices* to generate such a seemingly counter-intuitive phenomenon as cooperation.

So obviously, when speaking about emergence in this sense we differentiate two order levels - micro and macro[4] - which could be seen as two steps of a recursive operation. While there is no distinct quality of, say, fluidity or cooperation detectable on level *n* - 1, it suddenly[5] seems to spring up on level *n*. What does this imply for our quest on "firstness"? If we cannot conceive "firstness" absolutely - as the examples in sections 1 and 2 seem to suggest -, could we conceive it *relatively*? Could we consider "firstness" *in respect* to a particular "second", that is, a distinct micro order *in respect* to some macro-order with different qualities? Is "firstness" simply the *n* - 1-order level from which the *n*-order level of a phenomenon emerges?

In some respects - and in particular in regard to the rising number of respective investigations with the help of computer simulations (cf. Füllsack 2010c) - this assumption seems to make sense. In order to simulate a phenomenon one needs to define some kind of "starting values" from which a phenomenon then might emerge - even so this phenomenon then might render starting values irrelevant. In order to see this more clearly, let's have a short look at a proposal by Joshua M. Epstein (1998, 2006) on how to transpose the famous Prisoner's Dilemma-Tournament of Bob Axelrod (1984, 1997) from a temporal to a spatial dimension.

In this so called *Demographic Prisoner's Dilemma* (DPD), Epstein, as Axelrod before him, suggested to confront autonomously acting computer-generated agents repeatedly with each other in Prisoner's Dilemma-interactions. A Prisoner's Dilemma (PD) (cf. Rapoport/Chammah 1965) is defined as a symmetric two-player normal

4 Alluding to Tom Schelling's famous book on "Micromotives and Macrobehavior" (1978).

5 Emergent properties often emerge in the course of a "rapid phase transition", that is, "fulgurative" as Konrad Lorenz called it. The emergence of emergent properties therefore is difficult to observe. Cf. for more on this: Füllsack 2011.

form game in which the pay-off of the action of one player depends on the choice of action of the other player. The particular PD-rules define the pay-off for one-sided defection ("temptation", *T*) to be higher than the "reward" (*R*) for mutual cooperation which in its turn has to be higher than "punishment" (*P*) for mutual defection which again has to be higher than one-sided cooperation ("sucker's pay-off", *S*). In short: $T > R > P > S$. In PDs therefore, defection (that is, non-cooperation) is the dominant strategy, for it is definitely the safe option if the opponent should defect as well, and it still yields a higher pay-off if the opponent should cooperate. Since this is true for both players alike, the question arises how under these conditions cooperation can emerge as a stably established (which means not just a coincidental) behavior. Bob Axelrod answered this question in regard to the possibility of repeating PD-confrontations (IPD for "Iterated PD") and therewith iteratively collecting information about the most likely behavior of one's opponent. The *expectation* of cooperative behavior - the "shadow of the future" as Axelrod called it - then might render mutual cooperation and its pay-off *R* more attractive than defecting (and it's both-sided pay-off *P*).

Other than in Axelrod's famous tournament, Epstein's DPD allows for a stochastic confrontation of players. Agents at start up are randomly dispersed on a 30x30 torus-grid. In each step of the game (in each iteration), they move to an empty grid patch within their vision and play a PD against all Von-Neumann-neighbors they encounter, that is, against all neighbors on the patches immediately to the North, the East, the South and the West of the agent's own field. Thereby they follow an innate strategy. Either they cooperate or they defect. Agents are hard-wired in this regard.

Again differently from Axelrod's tournament, Epstein's DPD allows for negative pay-offs as specified in the following pay-off-table:

		Agent B	
		cooperation	defection
Agent A	cooperation	R = 5, R = 5	S = -6, T = 6
	defection	T = 6, S = -6	P = -5, P = -5

Table 1. Pay-offs in the Demographic Prisoner's Dilemma according to Epstein 2006: 201

Pay-offs accumulate as individual *wealth* of the agents. If wealth falls below zero the agent "dies" and is taken from the game. If wealth grows beyond 10 points agents reproduce. If there is a free patch in their Von-Neumann-neighborhood an offspring is generated who inherits 6 points of the wealth plus the strategy of the parent-agent. Additionally, agents are endowed with a common maximum age and initially are "born" with individual random ages in order to prevent periodic waves from old-age deaths.

When running the simulation, cooperation reliably emerges and solidly establishes even if the initial percentage of cooperators is low.[6] A typical run results in a population of cooperators (white dots in image 3) which is punctuated by some islands of defection (red dots) with an approximate ratio of five cooperators to one defector.

Image 3. Simulation of the Demographic Prisoner's Dilemma according to Epstein 2006, „cooperators" white, „defectors" red; left: initial random distribution of 100 agents, middle: after 15 iterations, right: after 50 iterations.

Somewhere *n*+3 = Somewhere *n* - 4 - *Downward causation*

As said before, Epstein's DPD transposes Axelrod's IPD from a temporal dimension to a spatial one. What in time is accomplished by the "memory" of the agents, that is, by their memorized experiences with the behavior of their opponents, in space is accomplished by the possibility of reproduction. Pay-offs here are seen as a sort of "fitness" which enhances the reproductive success of agents. The fact that agents inherit the strategy of their parents and therewith if successful increase its proportion in the population can be seen as a (statistically dispersed) equivalent to the "memory" of the agents in Axelrod's model. In a certain sense thus, in the DPD evolution seems somehow linearly caused: *at first* (already on level *n* - 1) there are - albeit only a few - cooperators and then (on level *n*) there is - little wonder - cooperation.

True, in a variation of the DPD Epstein considers mutation. With a certain probability, new-born agents do not reliably inherit the strategy of their parent but mutate to the opposite behavior. In this case, with the above-tabled pay-offs, cooperation remains stable even at high mutation-rates, but it does not affect the population in the same way as with no mutation at all.

Mutation, however, in Epstein`s model does not seem to be much more than some kind of perturbation of an otherwise "normal" inheritance of strategies. There is still at least some percentage of cooperating agents "at first" from whose interactions cooperation can emerge as the predominant strategy of the population. In regard to behavior evolution this does not seem to be overly plausible. As the "normal case"

[6] For detailed statistical analyses cf. Epstein 2006: 210. A testable re-implementation of the model can be found at http://homepage.univie.ac.at/manfred.fuellsack/applets/coop.htm

one would rather assume agents who at birth are rather coincidentally determined and only then develop stable behavior habits in dependence of their environment.

However, if agents are considered coincidentally determined, that is, if they are born with a mutation-probability of 100%, cooperation gets transient. It crops up in the population, but keeps rather random character. If additionally agents then are exposed to a somehow "rougher" environment, that is, to pay-off values for instance of $t = 9$, $r = 2$, $p = -5$, $s = -7$, cooperation has no chance to survive. After a few iterations cooperators die out and with them a few time-steps later defectors as well.[7]

Therefore, in a variation of Epstein's DPD (- which vaguely is reminiscent of a "nurture over nature"-principle -), I have suggested to allow the initial mutation-probability of 100% to develop in dependence of the confrontations of the agents with one or the other strategy (cf. Füllsack 2010a). The probability of an agent to adopt the strategy of her parent can then grow with the frequency of being confronted with this strategy. Agents therewith can "learn" their behavior *evolutionary*, so to speak, via several generations.[8]

This, however, means that the emergence of cooperation in this case does not only depend on the social structure that is generated by the interactions of different types of agents. In fact it means that this emergence *feeds back* on the agents constitution as well and changes their probability of how to behave. In other words, there is not only a causality from n - 1- (from "micro-motives") to n-order (to "macro-behavior") but also a "downward-causation" (Campell 1974, Andersen et al. 2000)[9] from the n-order-level back to the n - 1-order level. Or in again other words, there is no steady "firstness" of agent-interactions in regard to a "secondness" of the emergent property - cooperation in this case -, but an intermingled "togetherness" of mutually influencing dynamics. This "togetherness" which cannot be analytically separated in a classical sense gave me reason to try to summarize respective phenomena with the term "synchronous asynchronity" (cf. Füllsack 2010a, 2011). Nigel Gilbert describes similar aspects as „*second order emergence*" (Gilbert 1995) and Cristiano Castelfranchi (1998) speaks of an "*immergence*" with which the effects of emergent properties affect the „cognitive" apparatus of the individual agents whose interactions generate them.

When running this variant of the DPD, the rudimentary possibility of developing mutation probabilities suffices to raise the mutation-probability *in time* high enough for the population to prosper. Whenever in one part of the grid - in a "niche", so to speak - a small island of cooperators coincidentally persists long enough for their

[7] In this setting, the confrontations of defectors with other defectors always yields negative pay-offs. Therefore, if all cooperators are gone, defectors have no sources of wealth anymore. They cannot survive on their own.

[8] For a respective model of the DPD that can be tested with various pay-offs see: http://homepage.univie.ac.at/manfred.fuellsack/applets/coop.htm

[9] Cf. also Abbott 2006 and 2009 who suggests to better speak of "downward entailment".

mutation-probabilities to sink to a level at which at least some of their offspring are reliably born as cooperators cooperation can get a hold and develop. Although it never reaches the levels of the no-mutation variant - its fluctuations show typical Lotka-Volterra-dynamics (cf. Füllsack 2010) -, it establishes a safe enough footing not to die out.

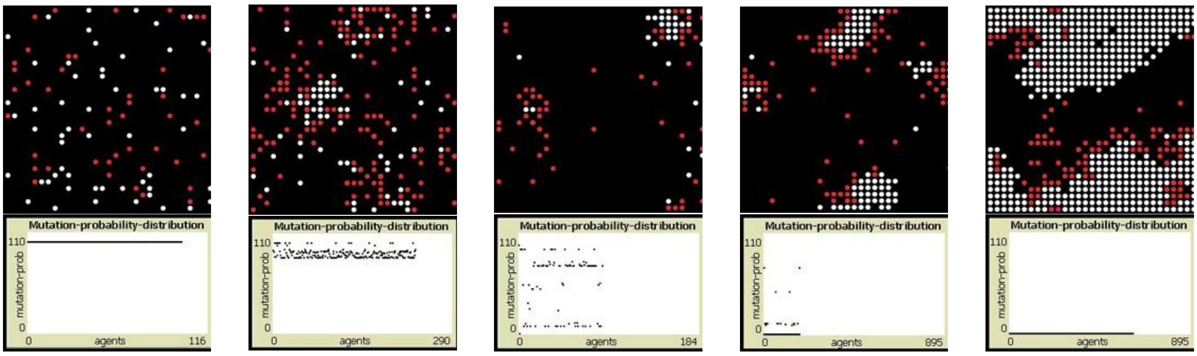

Image 4. Glimpses of a DPD-simulation-run with "learning" at (from left to right) 0, 15, 100, 200 and 500 iterations. The plotter beneath illustrates the development of mutation-probability distributions. Each black dot corresponds to an agent. In iterations 0 and 500 all probabilities are 100% and 0% respectively (a black line).

This DPD-variant illustrates a principle which has been discussed under terms like „co-evolution of mutually conditioning causes" (a.o.: Jantsch 1980: 207) and currently orientates research agendas such as Connectionism (a.o. Bechtel/Abrahamsen 2002), Systems theory (a.o.: Luhmann 1984) or Network theory (a.o.: Barabasi 2003, Csermely 2009). All of these approaches share the concern to change perspective from the "atomism" of final-causation-units towards the "holism" of *distributed*, and this means "synchronous asynchronous" representations. Emergence and immergence of cooperation proceed synchronously, even so (or rather: just because) both depend on each other. None can be causally presupposed to the other. Immergence, that is, the "internalization" of cooperative behavior, cannot happen without emergence of cooperative clusters. And at the same time there would be no emergence of clusters without any immergence. The one depends on the other, but none is a "first" to the other in classical sense.

So then, what can it mean to differentiate micro- (*n* - 1-) and macro- (*n*-) order levels?

Or would it be more correct to say that they differentiate by themselves?

Somewhere *n*+4 = Somewhere *n* - 3 - *Modularization*

Complexity theory often deploys the difficult term "modularization" to denote the widespread phenomenon of systems delimiting themselves due to internal restrictions. The growth of a cell for example is known to be restricted by its surface area-to-volume ratio, meaning that a disproportion of the volume of a cell and its surface constrains the supply of resources the cell needs to grow. The problem is simply mathematical[10]. While the volume of a cell grows with the power of three, the surface grows only with the power of two. Thus from a certain size onwards, the surface can no longer maintain the transport of internally needed resources which causes the cell to stop growing. Most cells therefore are rather small. Cell growth is limited. (cf. Hartwell et al. 1999)

A simpler but may be in regard to modularization more illustrative example gives the famous glass-clinking problem at parties. For five people to clink glasses with each other, ten interactions are needed (meaning that glasses clink ten times. The formula, known as *Metcalf's law*, is $x = n * (n - 1) / 2$). For ten people the number of clinks not just doubles but more than quadruples. The glasses now have to clink 45-times. At bigger parties thus the probability rises that subgroups form, *modules* of party guests, so to speak, who clink glasses only among each other because "transaction costs" for clinking with everybody are considered too high.

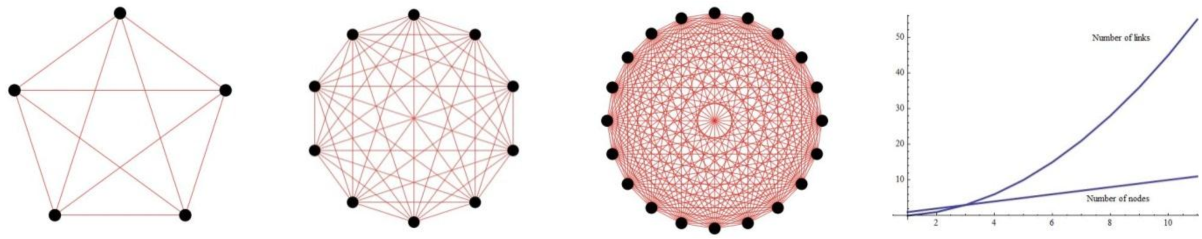

Image 5. Interaction networks, left with 5 nodes and 10 links, center-left with 10 nodes and 45 links, center-right with 20 nodes and 190 links. Right a plot of the curves of nodes and interactions.

Technically, such modules are defined by maintaining more links internally than externally. (Wasserman/Faust 1994, Song et al. 2005). They are nature's way to deal with complexity. Whenever a system grows too big for its capacity to maintain its operations it differentiates into subsystems which sort of close off from the rest of the system. This rest becomes an "environment" for the subsystem. By reducing complexity in this way, the subsystem, that is, the module - or the new system on another order level - maintains a feasible ratio of itself to its environment. It "exists" because of this ratio. Therefore with Luhmann (1984: 48) we might say that a system *is* the difference between itself and its environment. It *is* the difference which it maintains by differentiating from its environment via modularization.

Somewhere *n*+5 = Somewhere *n* - 2 - *The observer*

[10] And in economy, it is often conceived as *transaction costs* (Coase 1937)

But modularization has yet a second, more hidden aspect. In some sense modularization is not only a consequence of a growing system itself. It might also be seen as an effect of the *observer* of this system. The observer's capacity to differentiate a system's elements and its relations and operations is limited as well. The observer therefore "contributes" to the modularization of a system by "abstracting" from aspects which at the moment seem somehow dispensable to him. Whenever we utter the term "scientist" for example, we do not list all details of a human who devotes her live to strange unsolved problems. Using this term means to abstract from these details, that is, to modularize them to an order of complexity with which we can deal at the moment. Words, signs, conceptions, models etc. are our everyday way to deal with complexity. Observing - in a general sense - means modularizing.

Considering this, might cast some light on the popularity to intersperse the old Aristotelian notion of the "whole being more than the sum of its parts" in discussions about emergent properties. Some theoreticians even speak of a "mystery gap" between n-order level and n - 1-order level (cf. Epstein 2006: 37). My suggestion is to regard this "mystery gap" as an effect of the observer's need for modularization. New qualities of an emergent property thus can be seen as the result of an observer's attempt to bring what he observes into a *form* he can handle. The observer, so to speak, adds in-*form*-ation to the observed. Otherwise he would not be able to cope with its complexity. In this sense, the observer "constructs" the new quality of an emergent property. (see for examples and more details: Füllsack 2010a,b, 2011)

Since there is no observation without observer (and therewith also no "world" without an observer), it is somehow difficult to distinguish between the modularization of a system which is "self-made" due to internal capacity restrictions and the "external" modularization affected by the observer. For the time being, I suggest to conceive both possibilities as analytical constructions which find their usability in different contexts.

Somewhere n+6 = Somewhere n - 1 - *Nestedness*

What seems more important for our considerations of "firstness" is the fact that a system once modularized is *nested* in other systems. Like with the glass-clinking-sub-groups at parties, modularized systems or networks remain part (or element or node) of a super-system or a super-network. Nestedness is an important principle for the structuration of order (see Csermely 2009: 40) which repeats itself on multiple levels (see also the older conception of "Holons" by Koestler/Smythies 1969). Famous examples are Fractals, implying something like a general Russian doll-principle of infinite order levels containing each other. Hitherto the consequences and the nature of the relations of these different order levels is rather poorly studied. One suggestion in this regard has been made by the late Niklas Luhmann to deploy a medium/form-differentiation in order to theoretically conceive nestedness. (cf. Luhmann 1997: 190f) Another suggestion concerns the conception of "weak links" as investigated by Peter Csermely (2009) subsequently to famous studies of Marc Granovetter and others. These conceptions give reasons to assume that complex systems manage to make use of their nestedness by deploying what could be called *cross-level operations*. As it obviously is possible to maintain connections from the overall party to the level of the glass-clinking-sub-group, the above example of downward-causation in the DPD implies that it is possible for a complex system to apply particular operations of one of its order levels onto the operations of other order-levels, for instance to the ones of its modules. Considering the delimitational effect of modularization - in particular in regard to time and space - we might say that the system therewith applies this operation, so to speak, "synchronously asynchronous" *onto itself*. In other words, the system behaves *self-referentially*. Common examples for this are the possibility for instance to speak about speaking, to write about writing or to think about thinking.

Conventionally seen, self-referential systems are, as we know, pretty confusing entities. The Cretan Epimenides famously irritated an enemy leader by stating that all Cretans lie. Similarly, questions might irritate whether the utterance that this utterance is wrong is itself right or wrong. As we know, Kurt Gödel (1931) based his famous "Incompleteness theorem" on an analogous self-referentiality which can be summarized with the question whether the statement "this statement is unprovable" is provable or not. Seen in regard to nestedness, however, irritations appear to be consequences of cross-level applications of the operations of complex systems. Due to their modularization (that is, to their differentiation in subsystems), such systems manage to maintain a *n*-order level and its particular operations synchronously with an *n* - 1-order level and *its* particular operations. These operations can differ in several respects, above all in regard to tempus (cf. Rosen 1985), but can be applied to each other across levels of order. Epimenides can say something on a *n* - 1- (or *executive*-) order level and "synchronously asynchronously", that is, self-referentially, can imply something about himself saying something on a *n*-order (or *meta*-)level. Analogously, Gödel can deploy the *n*-order expectations of consistency and completeness onto the *n* - 1-order particularities of the Peano axioms.

Of course, conventionally seen, self-referentialities generate irritating paradoxes. This contrasts to European culture which builds on a long history to either condemn paradoxes, to try to dissolve them or to avoid them.[11] Complex systems, however, have less problems with paradoxes. They even seem to be spurred by them in developing *Eigen-values*.

[11] A remote aftermath of this may be could be seen in the fact that popular spreadsheet applications like Lotus 1-2-3 or Microsoft Excel do not allow to run recursive expressions like A = f(A) or (x = f(y) && y = f(x)).

Somewhere *n*+7 = Somewhere *n* - *Firstness*

And here we are back at the beginning of our journey. Consider the following sentence (which I thankfully draw from Heinz von Foerster (1976) again):

This sentence consists of ... letters

The sentence is "paradox" in the sense that it says something about the "world" (a "world" in which a sentence consisting of some letters exists), and simultaneously it says something about itself. The sentence thereby has traits of what psychologists call a Gestaltswitch. Like the sentences of Epimenides and Gödel above, it sort of induces an oscillation between its meaning on a *n* - 1- (or *executive*-) order level (saying something about the "world", about an *externality*) and its meaning on a *n*- (or *meta*-) order level (saying something about itself, about an *internality*). In other words, the sentence has an *external* and an *internal* reference at the same time. When trying to complete its missing part (which is denoted by the three points), it forces us to repeatedly switch between these two references. If we put a random number into the missing part, say "twenty", the external reference might not be afflicted - the sentence is syntactically correct - but the internal reference is incorrect. The sentence has more than twenty letters. So we change back to its external reference, put an another number in and again check the internal correctness. By iterating in this way recursively the sentence's references, we gradually approach its *Eigen-value* which in this case is "thirty-nine". And again the *first* value is completely irrelevant. The sentence "asks" for its particular Eigen-value regardless from what number we start out trying to find it.

May be a bit more fundamentally, we can grasp this oscillation between external and internal references with the terminology that George Spencer-Brown (1969) suggested in his *Laws of Form*. His dual operation of *distinguishing* something in the "world" and *indicating* one of the two distinguished sides as "world-*n* + 1", that is, as a new "starting point" for the next dual operation of distinction and indication, has been marked as an abstract form of *observation* by Niklas Luhmann (see a.o. 1984: 63) In the next (the *n*+1-) operation of distinction and indication, the operation is deployed onto itself, that is, on the results of its n^{th} step. Spencer-Brown speaks of a *re-entry*. The observation therewith seems paradox from the beginning, for it is a duality as unity, and a distinction between distinguishing and indicating. It is a distinction which is repeated within itself.

Nevertheless, as we know, most of the time observation works without any problems. By definition (- we might also say: because of complexity reasons, see section *n*+5 above -), the observer simply does not observe what has been excluded in the dual operation of his observation (that is, the distinguished side which currently is *not* indicated). *For him*[12] thus there just is no paradox. Only an observer of the observer, that is a "second order observer" (or here more accurately: a n+1-order observer), can see that the "first" or n-order-observer is missing out on the excluded side of the observation. This n+1-order observer therefore can pay attention to the way the n-order-observer deals with the underlying paradox of observation. He can observe *how* the n-order observer invisibilizes or "deparadoxizes" the paradox.

The possibility to ask "*how*-questions" in this regard suggests an *ontogenetic* approach to the results of deparadoxation, which stands in striking contrast to pre-scientific or ontological "*what*-questions". In our quest for "firstness" therefore, instead of asking "What is the first?" or "What is the origin?", it seems more appropriate to ask "How is 'the first' brought about?" or alternatively "What is the problem to which 'the first' is considered an answer?"

Niklas Luhmann (1997: 470) suggested what he called "contingent formulas" ("Kontingenzformeln") as a scientific answer to questions on the general form of deparadoxation. In short, such formulas can be summarized as semantic conceptions representing values which at the time being remain unquestioned in the system to which they belong. Paradoxes (or in other words: "unresolvable indeterminacies", cf. 1997: 866) are "invisibilized" by such conceptions. In spurring paradoxical contexts to develop their *Eigen-values*, these conceptions can be considered a sort of founding pillar for complex systems. The paradox for example of the question whether the differentiation of being and not-being *is* or *is-not* in itself is deparadoxized by the conception of a superior being which just is considered to *be*. This conception is called God and stands as an unchallengeable value of the religious system - meaning that without destroying the system[13] it is not to be questioned *in the system itself*.[14] Or, the paradox of the question whether the differentiation of truth and untruth is true in itself is deparadoxized by the conception of scientific truth which analogously is not to be questioned by science itself. Similarly, the deparadoxation of the question whether the differentiation of justice and injustice is just in itself constitutes a foundation of our legal system. And the self-referentiality of the question whether the differentiation of a first and a second is a first or a second itself is deparadoxized

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[12] It would be much more correct to use "it" in this context, for the observer in the sense of Luhmann is a formal conception and no human. On the other hand, it would *not* be correct - and may be even more misleading - to feminize it by using "her" or "she".

[13] Remember subversive scholastic questions as the one whether God can make a stone too heavy for himself to lift it.

[14] Which of course does not prevent to be questioned from the perspective of another system - science for instance - which itself then might be questioned by another subsystem. Heavily modularized systems can - as I have suggested in section n+6 - apply operations across order levels and therewith entail something like a permanented self-questioning process or, if you want, a "post-modern enlightening of enlightenment".

by the conception of "firstness". We just need such "a first" to get going and can handle it only by at least temporarily invisibilizing that it is *not* "a first".

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