ALFRED LOCKER

toasts his guests at his 8oth birthday on 19 May 2002.

Professor Dr. Dr. Alfred Locker
passed away in Vienna at 4:30 in the morning on 12 February 2005.

He was the last student of von Bertalanffy in Vienna and eventually succeeded him as professor at the Institute for Theoretical Physics, University of Technology, Vienna. For half a century he was a prominent contributor to the intellectual and professional systems and cybernetics community in several countries. Recently he was engrossed in an attempt to develop a "Trans-classical Systems Theory". A partial bibliography of his sytems theory publications follows.

His scientific estate will be administered by his son, professor Markus Locker. Messages and queries concerning Alfred Locker should be sent to him at
mlocker@ateneo.edu .

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The Present Status of General System Theory, 25 Years after Ludwig von Bertalanffy's Decease

A Critical Overview

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ABSTRACT

The development of General Systems Theory (*GST*) since v.Bertalanffy's death (in 1972) is being described. Among the problems this meta-science deals with that of the *observer* assumes the first rank; equally important are system's *origin* and *logic*. It is asserted that the development of *GST* will fruitfully profit from her collaboration with pragmatical thinking.

KEYWORDS

1. INTRODUCTION

1.1 SOME PERSONAL REMARKS

In the oration at the funeral service held for L.v.Bertalanffy (in Williamsville, near Buffalo) the systems theorist A. Rapoport, co-editor of „General Systems", called the deceased a „peace maker". He was absolutely right since just at that time IIASA (the International Institute for Applied Systems Analysis) had been established in Laxenburg near Vienna as an attempt at inducing the representatives of the two political blocks to enter into peaceful negotiations on world problems possibly solvable only by methods stemming from General Systems Theory *(GST)*. The founder of this meta-theory has been, as is generally known, the born Viennese Ludwig v.Bertalanffy.

I had the fortune to be present at this service, not only because of having been personally acquainted with this great man, but as his former student and later his disciple and finally as being deigned by his friendship. Thus, I feel entitled to give an overview (a) on v.Bertalanffy's *work* and (b) on the *development* and *elaboration GST* underwent when the primary assumptions that v.Bertalanffy initially made have been pursued further and influences from other lines of research have been successfully incorporated into the *GST*.

However, the way this meta-science took cannot be described in full. Since it offers today an imposing conceptual construction, only the main lines may be drawn. That the building (c) reveals, in addition, also some *cracks* in its wall should not be denied and must give reason for criticism. Equally well should be mentioned, that there have been forrunners to v.Bertalanffy's efforts, viz. A.A.Bogdanow in Russia [19] and Ch.I.Barnard in the USA [20] with, however, only little influence on the development of the meta-science known as *GST*.

1.2 Ludwig v.Bertalanffy's Foundation of *GST*

By shortly looking at history [3] may we focus a line of argumentation that is starting from the Aristotelean dictum of the „whole which is more than the sum of its parts" and going via Leibniz' „monadology"- with viewing the world as a cosm of closed unities mirroring the whole in dependence of their respective degree of perfection - to the vividly waged quarrel between „vitalism" and „mechanism". These two positions differed passionately in the interpretation of the living organism but at that time, it clearly turned out that these ideas have always been implicitly contained in the concept of the system. It was L.v.Bertalanffy who made the *implicit* assumptions *explicit* by proposing a definition of system which was not based on empirical findings but rather on the intuitive understanding of the fundamental character of a living organism. The definition based on this insight was (and still is) much more elaborate and concise than other approaches which neglect the origin of the system concept in the human mind. Having taken cognizance of this basis the definition must utter something about man and the organism and evade any naive attempt at coming near to the problem by comparing the animal with the machine. The Bertalanffyan approach - an outflow of his entanglement in the dispute mentioned viz. that between mechanism and vitalism - views the system as a *complex* entity which (a) *refers to itself* and (b) *resists* through this means any influences exerted by its evironment and thus (c) *persists* in its composition. This comprehension was the starting point (1) for conceiving the organism as an *open system* and elaborating on the theory of the „flux equilibrium" or „steady state" [1] and (2) for problems of *self-reference*.

Thus, we see just at the beginning of the development of *GST* that it diverted into two lines which may also be characterized as the one, dealing with *formal* (and abstract) reality and the other dealing with *material* (and concrete) reality but both being apt at an application. Because of the much more scientific garb the first mentioned line wears it was relatively easy for v.Bertalanffy to circumscribe its *aims* to be realized whenever particular problems are to be tackled. It was thought of the possibility that - because of being a logico-mathematical construct - *GST* could prove its usefulness in several tasks: By destroying the boundaries between science and reality and thus bridging the gaps mostly artificially ripped open, it could promote the progress by diagnosing isomorphy (or formal analogy) between concepts of various fields and help in useful *transfers* from one to the other. This aim would be supplemented by minimizing the theoretical efforts. Such properties pave the way for an application of *GST* to diverse sections of science. In spite of her inclination towards formal representation, it is unnessesary to mention her sharp distinction from mathematical *ST* (e.g. [21]) which is a purely technical discipline dealing e.g. with control problems.

In order to detect isomorphic structures in several realms of reality the *observer* (O) - or judge of the situation (in particular: the systems theorist) - has necessarily to assume a *position above* the domains whose structures he compares one with the other. Would he belong to these structures he could not discern them! This fact means that he has to place himself into a proper domain of his own. The difference between him (as O) and the object he observes (or more correctly: judges) has to be interpreted as a difference between (a) *objects* - which must by no means only be physical bodies, but also can be formal structures or relations - and (b) *presuppositions* which allow for figuring out these very same objects.

This *distinction* - simultaneously to be seen as *unity* between the two opposing positions - is v.Bertalanffy's most important achievement in laying fundamentals for *GST*, viz. (a) their anchoring in epistemology and ontology and (b) the possibility to see all disciplines anew. Although he did not expressly mention the role of the O, we feel justified

to call this state of affairs the *cardinal point* of *GST* which enables unfolding in two directions: (a) as a *linear* development with arraying of topical themes and concomitantly (b) as *circular* moving around this axis with recurring to perennial themes. However, the situation is still deeper if trans-classical *ST* will be taken into consideration, an item to be discussed later.

In a visionary glance on the future of the intellectual life of mankind L.v.Bertalanffy saw in *GST* a means to promote the unity of science, through improving the communication between scientists and by embracing different, yet even conflicting world views and thus erecting a mental edifice which mankind could savely dwell in.

1.3 HINTS AT THE DEVELOPMENT OF *GST*

Since v.Bertalanffy's death *GST* has made a tremendous development and many branches have been formed such that it is nowadays rather difficult to draw a uniform picture, but it is beyond doubt that the whole accomplishment became possible through v.Bertalanffy's seminal ideas that are still implicitly contained in all coming expositions.

However, an important fact should be mentioned. For *GST* a certain split in her methods and interests can be detected. She was, from her beginnings, strongly inclined towards structural considerations whereas the treatment of the functional traits of the system has been put into the background. The former research was mainly oriented towards science, whereas the latter - and with less enthusiasm - was searching for a basis in philosophy. From this diversion - which optimistically can be brought to unity - it was quite natural that *GST* finally took up the role of a *bridge* between science and philosophy and this is indeed the top elaboration of the aims of *GST* which v.Bertalanffy still had in mind [9].

GST exhibits the same *double-face* when the problem is to be made explicit which implicitly has been hinted at with the systems'definition. It is not always clear what the system really means or represents. This problem has possibly obtained a satisfactory answer in recent times only but, also then, it forms an elaboration of *the* idea already initially contained in L.v.Bertalanffy's understanding of system. Indeed, it appears that some decisive hints at the themes *GST* is dealing with today were contained already in v.Bertalanffy's doctoral thesis occupied with Fechner's philosophy and the problem of higher organization.

It remains to us the task to outline the several *topics* and thus to design the present picture of *GST* . The topics are the following (and can be tagged also by quoting the relevant authors): (1) the problem of the observer (and subjectivity) which (a) let arise a cybernetics of 2nd order (v.Foerster)[4] and is (b) able to distinguish an endo- from an exo-world (Roessler) [13]; (2) the problem of the system's origin, together with a discussion of the so-called Radical Constructivism (v.Glasersfeld)[5] and the much disputed „autopoiesis"-theory (Maturana)[10], (3) the problem of systems logics which possibly may divide into two sub-problems, viz. (a) the logic of forms or distinctions (Spencer Brown)[15] and (b) the trans-classical logic (G.Günther)[8], 4. the problem whether or not a *GST* can be considered as a purely empirical theory (Luhmann)[14]. After having given brief descriptions of the several approaches (that are, of course, intimately interwoven) and after having added critical remarks where it appeared necessary it remains to us (5) to give a final portrait of the present status and the possible future lines of *GST*. At this point it will be necessary to speak of the collaboration of *GST* with pragmatical philosophy (Stachowiak)[17].

2. THE MAIN THEMES OF PRESENT-DAY *GST*

2.1 CONTINUATION OF RESEARCH BY DEALING WITH THE OBSERVER

This turn towards something apparently new in *GST* dealt with an age-old problem, viz that of *subjectivity* and of *cognition*. In approaching the question what is the original „entity" that is represented by the (concept of) system it became clear that the human being was entering the scene and the pseudo-ideal of de-anthropomorphosizing science had to be abandoned. This insight paved the way for a kind of research the founder of *GST* still hesitated to exert. The garb which the topic of subjectivity assumed, facilitated its systems-theoretical treatment and thus was the reason for preferring to speak simply of the *observer* (O).

A closer look at the observer soon revealed that it could be considered in a three-fold way: first as *external* observer (O(e)), second as *internal* observer (O(i)) and third as *participant* (P) who, although standing next to the latter, still plays a role of his own.

The O(e) obeys the criteria of objectification, whereas the O(i) remains alien to the O(e) but rather designs his own criteria by being a part of the system he observes. He realizes the fact that he knocks against boundaries. By observing the system which he belongs to, he cannot observe his own position within the latter and is thus confronted with the problem of the *blind spot*. Being entitled to set equal the O(i) with the self-observer of the system, we may state - what Goethe already knew — that systems cannot recognize themselves completely. This problem will occupy us again. But the situation of the P is quite a different one.

Indeed, at a certain stage of research in *GST* the problem of the O aroused attention from which two ramifications grew out, one (a) which has been called Cybernetics of the *second order* [4] - at this place should be supplemented that the terms *GST* and Cybernetics can roughly be used interchangeably - and the second (b) which has been tagged with the term endo-physics [13], although it dealt with much more than with physics alone viz. with the O's role in *GST* and the different results he may obtain by assuming different positions.

This state of affairs is preliminarily characterized by distinguishing cybernetics of *observed* systems from that of *observing* (and finally self-observing) systems. The main result of so-called endophysics (or the version of *GST* which directs its interest towards *Endo-* and *Exoworlds)* [13] has been circumscribed by the fact, that the O(e) observes discernible objects whereas the O(i), because of his belonging to the system, deals with a homogeneous entity (better said: a wholeness), the interior of the system itself and only by transforming himself into an O(e) will he perform the dissevering activity resulting in isolated objects. However, this view seems to be too lopsided because of the neglect of the P himself.

Nonetheless, the separation of different worlds is indeed very valuable. Whereas the exoworld is the limited world of the O(e), so is the endoworld not uniform in itself. It is a world which does not require an O (in the pejorative sense) and is still recognizable; this job being done by P. Here no distancing and disturbing activity from the part of an O entails since the P is immediately connected with the material he senses. Because of the fact, that the O still belongs to the empirical world, he has no access to the reality as such. The *presuppositional* side of the world opens up only for P, whereas for the O, because of his remaining in the exoworld, only the *objective* side is accessible. We find, thus, on the

one hand, totality and concreteness, as the properties of the endoworld, belonging to the P, and on the other hand only partiality and extreme abstraction as the features of the exoworld, forcibly burst open by the O. This process means mostly a mutilation of the system and we are caused to speak of the O's *dilemma*.

In this respect we have to beware us from *exaggerations* of otherwise right statements. There is, for instance, a very often repeated dictum known, which reads thus: „An O cannot see, *that* he cannot see, *what* he cannot see". But this remark fuses *observation* with *reflection* on observation, i.e. cognition, and thus levels down distinctions that have to be necessarily made. This objection has to be equally raised with regard to the frequently uttered phrase that *everything* what has been said *is said by an* O. This, again, is an exaggerated expression, since, especially with figuring out the role of th P , we have to state, that the human subject may be able to recognize things which are not observable.

2.2 THE PROBLEM OF THE SYSTEM'S ORIGIN AND RELATED PROBLEMS

Another one-sidedness is met when - as is done by the representatives of the so-called „autopoiesis"- theory [10] - it is only spoken of an O(e) and at the same time contended about the system that it is determined by laws which do not allow it for getting off its operative closedness. Therefore, the system would contact its environment only via the *perturbations* the system would suffer. This should be the reason for the pretended circumstance that for the system *no difference* exists between its inner and its outer world, respectively, because this distinction could only be drawn by the O(e). We may critically say that this strongly perverted view is based upon the fact that the meta-O, i.e. the author asserting this, projects only his knowledge about the closedness of his own perceptive field into (or onto) the system. He then falls prey to a kind of totalitarism which any other source of cognition, except that one stemming from empirical research, rigorously excludes.

This glimpse at a problem of the O simultaneously opens up the very essence of the problem of the *origin*. It offers again two aspects:(a) origin as such (occurring e.g. spontaneously in reality) and (b) the origin set by the O, therefore bearing a subjective component.

It is certainly not amazing to begin with the second aspect since its starting point touches upon the bulk of questions the so-called *radical constructivism* opens [5] According to this view there is no reality at all which we could passively recognize, but instead it is being actively constructed by the O via the process of cognition. This statement is again an exaggeration since indeed there is a constructive component in cognition; however what is blatantly false with this particular view is its radicality, the assumption that nothing has to be presupposed for cognition except the O's capacity to construct. We have nonetheless to admit a boundary to such an attitude represented by the fact that just the capacity to construct cannot be constructed. This evident finding may be called the *boundary theorem*.

This theorem allows to conclude that for the mental design of a system and just the more for its material realisation *something already existing* need be presupposed. However, some distinctions have to be made. We discern (a) *presuppositions* from (b) *preconditions*. The latter are empirically detectable, whereas the former cannot be reached by an empirical approach but rather found by cogitating about what preceeds the empirical sphere. What is graspable must be distinguished from pure abstract concepts usually

obtained by successive elimination of particular and concrete properties until only something empty and very general emerges. Therefore, the presuppositions we have in mind are called the „concretely general” concepts and can, for instance, be set equal with the *unity* or the gestalt of a system. Whenever an origin comes about those fundamental characters should come into play. Since they cannot be coerced by the O - who would, in this respect, assume the position of a *designer* -, we have to admit that a *true* origin cannot be produced by man (a statement which may be called another boundary theorem).

Thus, we speak of the *spurious* origin when man believes to act as originator although he is only able to (a) reconstruct something existing beforehand and (b) has to realize that the constructs falls strongly behind the original in that a *model* never can be a copy but solely something similar to the original with respect to selected aspects of structure or function [16].

The theory of so-called „autopoiesis” faces a difficulty when ist states - beyond its pretension to correctly describe the system - that the latter forms from its elements in that (in a circular way) one be the producer of the next. The problem of the *beginning* is missed which can be seen (a) as the *precedence* of the program being given as instruction to a system prior to its execution. But it is in addition (b) to be stated emphatically as a *theorem* that the first and the last products of this circular chain - like means and ends - must arise at the very same moment, that is to say *instantaneously* . No consecutive build-up is sensibly possible.

3. A GLIMPSE AT DIFFERENT SYSTEMS-LOGICS

In a particular approach a British author (G. Spencer Brown) laid foundations to what he calls „laws of form” [15], more recently and possibly more correctly called logic of *distinction* [7]. The problem of the beginning is touched upon, a beginning standing entirely at the disposal of man, the O. The author develops, by means of only two instructions, formal systems from which certain branches of mathematics can be deduced. Much more important than this is the fact that at the act of beginning, a homogeneous space is divided into an unmarked and a marked part, respectively, being tagged by an indication of two entities which resemble strongly that of system and evironment. By continuing this process the space is consecutively structuralized. A *system* enters the scene at the very moment when the original distinction is repeated and transferred to the space as a so-called *re-entry* and thus a loop, delineating the system's boundaries, is formed. With re-entry the difference between system and environment becomes disponible within the system itself such that now this system's capability is interpretable as its possibility for recognizing itself by *referring to itself*. In this respect the approach gains connection with other - universally accepted - views of *GST*.

In contrast with approaches undertaken in connection with *GST* being still based on 2-valued (propositional or predicate) logic there has been made an advance towards 3- or many-valued logic but not in the usual way such that to the existing two values a third one is being added but rather by articulating the (formal/ideal) space of logic into several realms, called *contextures*, such that this logic - introduced by G.Günther - bears the name of PCL (polycontextural logic) [6][8]. Within each of the several contextures, different occupancy places are given two locical values that alter with transition from one contexture to another.

In order to give the PCL a supporting frame at least 4 relations are introduced by whose arrangement in the space it is possible to circumvent the difficulty the O(e) faces when he equally acts as O(i). The problem is solved when the two positions are - with the

aid of an exchange relation - consecutively assumed; the role of the P being, however, neglected.

Also here - where the author has the privilege to belong to the group which continues Günther's work - some objections must be made. The critical question has to be posed whether (or not) this approach restricts itself unnecessarily to formal methods whereas a real turn towards *trans-classical* view should incorporate non-formal methods, too. The resulting break-trough towards recognition of non-formal entities - called presuppositions - would connect to v.Bertalanffy's approach. This question will be reassumed later.

2.4 *GST* AS EMPIRICAL THEORY

Although appearing as an extreme contraposition to v.Bertalanffy's view of *GST* the Luhmann [14] version offers some intriguing aspects useful for the understanding of the system from another point of view. It is solely based on empirical findings and interprets itself as a sociological theory, being absolutely free from any ontological assumptions. Nevertheless, it describes in an interesting way the *emergence* of a system out of subjective structure, e.g. the structure of human consciousness. Just the way the latter refers to itself, viz. the „I", so the system refers to itself by *self-reference*, that, however, should be considered as an objective finding which may get rid of the subjective structures that have led to its conception.

Of course, it could be considered a question of taste whether or not one accepts the Luhmannian view. However, the objections that need be made are crucial and not dependent on one's liking. The points of view of the system's structure and of system's genesis, respectively, must not be mixed up. But we are confronted here with the origin *paradox* which states that that very same entity whose emergence should be investigated presupposes itself prior to its existence. Therefore, it cannot sensibly be said that the system produces its structure unless is exists already. The situation becomes more acute if the system should produce itself - as it is maintained in the theory of so-called autopoiesis. In order to avoid the paradox one has to affirm that any origin is only a *manifestation* of the already present, comparable to a programm which is - after having been formulated - afterwards executed. The mutual togetherness of (non-objectifiable) presuppositions and objectifiable, i.e. empirically describable entities (and the dependence of the one on the other) is, of course, strictly denied by the Luhmannian approach.

Seen in retrospective the following may be said: although the Luhmannian version of *GST* finds much acclaim in scientific public it does not really contribute to an understanding of *GST's* role in present times, since it confuses and seriously reduces the possibly correct onset it initially tried.

3. OUTLOOK AT THE FUTURE OF *GST*

The look at *GST* as a whole confronts us with an imposing edifice with many floors and compartments within wich we may walk around amazed about the multitude of aspects it offers. Admiration alone of this jointly erected building whose foundations have been laid down by the secular genius Ludwig v.Bertalanffy would, however, not suffice if it were not possible to bring the knowlege contained and stored in it to fruition.

This will certainly be done if the theoretical insight of *GST* will mate with the practical one put forward by *pragmatical* thinking. As is known the roots of *GST* are

stemming from the Old Continent although its further development mainly was brought about by workers of the Anglo-Saxon world. Presently systems theorists gather together in the International Society for Systems research (ISSR), whose Yearbook (Proceedings) comprises this year the 42th volume. The initials of pragmaticism are found in the USA where the greatest American thinker, Ch.S.Peirce, by conceiving of the *semiosis* as a ground figure of human action, achieved a break-through towards a world view determined by acting. In contrast with *GST* which - superfially seen appears as being split in many diverting directions and only by deeper reflection reveals the picture of „Unity through diversity"-, by the way, the title of the Festschrift for L.v.Bertalanffy - the pragmatical thinking is rather uniform since it comprises the whole bulk of philosophy of our times. The name of the main worker in this field schould again be mentioned, it is Herbert Stachowiak [17]. When it was spoken of the nature of a brigde that *GST* should perform, then the one pillar, viz. science, meets the other pillar in pragmatical thinking. When v.Bertalanffy is the engineer of the whole bridge, so is Stachowiak the builder of the pragmatical pile and in this respect his significance comes close to that of v.Bertalanffy. Pragmatics provides us also with arguments for founding peace [18].

This kind of thinking nothing excludes and accepts also those assumptions which apparently contradict empirical evidence. If we visually imagine a bridge then it is a construct horizontally extending, but there is still another direction of spiritual movement to be borne in mind which can the thought of as extending vertically, being connected with the *transgression* of acquired knowledge and advancing into something uncertain and new. This vertical direction should give a hint at the fact that the joint spiritual adventure of mankind, *GST* and *Pragmatics*, can never be confined to pre-given structures. It dissolves any fatters and audaciously aspires to the today not yet thinkable. Thus, *GST* contains an explosive tension holding it alive and certainly delivering us in time to come results which can presently neither be preconceived nor predicted. The horizontal and circular and vertical development, *GST* in connection with Pragmatics will undergo, gives us the justification to speak of *Transclassical ST* [11][12] (as has been hinted at at the beginning of this essay).

One should not forget about the fact that this development has been initiated by L.v.Bertalanffy whom we owe with *GST* a tool with the aid of which certainly many of the problems mankind faces today and in the next future will be mastered.

ABBREVIATIONS

GST: General Systems Theory, <u>O</u>: observer, <u>O(e)</u>: external...,
<u>O(i)</u>: internal ..., <u>P</u>: participant, PCL: polycontextural logic.

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