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Ludwig von Bertalanffy and his enduring relevance: celebrating 50 years *General System Theory*

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2018 was a year of celebration. Although, not too many people took notice. 50 years earlier, Ludwig von Bertalanffy's *General System Theory* was published, towards the end of a rich career. Von Bertalanffy was born and raised in Austria but spent his post-war career in the US and Canada. *General System Theory* represents in a streamlined way most of his career, the key ideas he developed, the most important applications and developments in a variety of fields. We as editors believe that the book, the man, and their influence deserve attention and renewed praise. Not only because of their historical value, past contributions to the formation of systems theory, complexity theory, and other fields, but also because von Bertalanffy's theory of open systems can still contribute to a myriad of disciplines and, importantly, to discussions crossing disciplinary lines, from climate change to mental health. Indeed, the twisted and often obscured genealogies of systems theories and the disciplines borrowing from them, suggest all too easily that the theory of open systems is *passé*, without much relevance.

The contributors to this special issue wholeheartedly disagree and believe *General System Theory* has been systematically underrated and misunderstood. The different papers in the issue will tackle this problem from different angles, but in this introduction, we can already mention that the open systems are in fact not entirely open, but, in terms later used by Varela, Maturana and Luhmann, operationally closed. Von Bertalanffy's conception of a system is essentially *metabolic*, that is, processual, so the structures, elements, boundaries of a system are the product of, and upheld by metabolic processes, interactions within systems and between systems and their environments. In those interactions, transformations take place, yet in the *steady state* systems von Bertalanffy is keenly interested in, the transformations do not alter the system identity. This in turn is related to the maintenance of system boundaries, which impose a selectivity of inputs, and initial transformation of inputs into elements which can start to play a role in the metabolism. Biology, as the reader will have noticed, was important in developing these notions, but von Bertalanffy was from the early years interested and immersed in other disciplines, from philosophy to chemistry and psychology. Von Bertalanffy's *General System Theory* may be one the most ambitious 20th century attempts to construct scientific interdisciplinarity. In fact, the Viennese-trained theoretical biologist was one of the firsts to develop concepts and models for systems that can be both natural, socio-cultural or technical systems. Whilst the difference between these different systems has never been disputed by him, the guiding concepts of his general system theory were sufficiently abstract and designed to make comparison possible, so that they could easily transcend the boundaries of different types of systems and the disciplines studying them.

Von Bertalanffy's ideas on the unity of science, a need for trans-disciplinary science which can help societies to address problems involving many coupled systems, rings true still, and his ideas on perceptual and cognitive limitations of people and any type of system still deserves attention in a world eager to identify simple facts, problems, solutions. If we understand the world as systems in systems and systems besides systems, and if all of these systems are more fragile than they appear, due to their metabolic nature, then insight in couplings and metabolism is not only interesting, but essential. If, moreover, more problems show up in our globalized society which transcend system boundaries and the limits of understanding and of policy intervention (think climate change, think pollution, think mass migrations), then a renewed acquaintance with von Bertalanffy might be the right thing to do. Moreover, it could be that the significance of von Bertalanffy's ideas, especially those of openness, steady state, and metabolism, can be even better appreciated in the light of the later systems-theoretic scholarship. The relationship between the

ideas of systemic openness and closure, for instance, has been a central concern in the work of diverse system theorists such as Francisco Varela, Gregory Bateson or Niklas Luhmann. It is also an example of a profound issue which potentially generates novel insights into the conceptual understanding of current debates such as sustainable development (cf. Valentinov, 2014). K.W. Kapp's (1975) emphasis on the open systems character of the economy and R.U. Ayres' explorations of industrial metabolism (e.g., Ayres and Simonis, 1994) provide cases in point.

Of course, von Bertalanffy and his General System Theory are not entirely unproblematic. The man himself was member of the Nazi party for several years, mostly to further his academic career (it worked, for a while), and he relentlessly lobbied for himself and his ideas, sometimes not eschewing the odd manipulation. Some of his insights, such as the exact logic underwriting of the relationship between 'levels of organization' in a given system remain ambiguous and not fully developed. In comparison to the later developed 'second order cybernetics' (Heinz Von Foerster) General System Theory does insufficiently account for the unavoidability of the observer. Whilst Von Bertalanffy insists that systems are defined relative to an observer's intentions and personal constructs, it remains the case that General System Theory tends to assume the natural world has a form and structure that scientific investigation will reveal, albeit in an approximate way. It also remains mysterious why the General System Theory does not refer to Alexander Bogdanov's *Tektology* which is widely recognized to anticipate a number of crucial systems-theoretic insights. The lack of contact with the latter work may be one reason why the General System Theory was left unfinished, not entirely a cohesive theory yet. Von Bertalanffy found time to publish (expertly) on stamps, while not committing the time to rewriting and reconfiguring the chapters of *General System Theory* (which included many older publications) to come to a new synthesis. Nevertheless, the book did have a great impact, and von Bertalanffy did make friends, actively participating in the formation of a systems *movement*. In 1954, he conceived, together with economist Ken Boulding and a few others, the *Society for General Systems Research*, which greatly amplified the development and reach of systems thinking. While his ideas reached fruition in the fields of psychology and psychiatry, his conceptualization of the social world is woefully underdeveloped, so the linkages between individual, society, and encompassing social- ecological systems remains weakly understood as well. As several authors in this issue argue, von Bertalanffy did provide foundations for a development of social theory which could adequately link individual, group and environment in a way called for by the early systems theory.

Whilst Von Bertalanffy's GST never presented a fully developed theory of social systems, Vanderstraeten (2019), Hofkirchner (2019) and Cadenas (2019) argue that the insights from Bertalanffyian GST still have relevance for the social sciences. Vanderstraeten (2019) notes how the attractiveness of Von Bertalanffy's approach has to do with the fact that it focuses attention on the embeddedness of social processes, enabling researchers to describe the behaviour of complex, open systems as the result of an interaction between these systems and their environment. He also discusses how the most famous social systems theorists, Talcott Parsons and Niklas Luhmann, have elaborated upon these insights, and, in each in their own way, demonstrate the lasting relevance of General System Theory as a crucial tool for building reflexive sociological theories.

The papers of Hofkirchner (2019) and Cadenas (2019) both argue that von Bertalanffy's GST provides important suggestions for how to think about the integration or unity of the social sciences. Hofkirchner (2019) points out that it was von Bertalanffy's hope to advance the unity of science in order to yield solutions to global challenges, and discusses how his GST puts forward methodological, theoretical as well as more applied ideas towards this end. Cadenas (2019) argues that von Bertalanffy's main contribution to the integration of the sciences consists in creating a common language for the world scientific system, thus facilitating relations between different disciplines and inspiring a genuine 'scientific cosmopolitanism'. For the social sciences in particular this helped in overcoming the opposition between Enlightened and Romantic science.

The papers by Roth (2019) and Valentinov et al. (2019) explore some of the organisational, informational, and moral implications of the Bertalanffyian theory of open systems. Roth (2019) argues that the concepts of openness and closure are highly amenable to moralization with adverse implications for the development of the present-day systems-theoretic thought. Valentinov et al. (2019) point out the parallels between the concepts of openness and transparency which is often touted today as an element of good governance. According to the authors, however, these parallels are less convincing than they seem to be on the first blush. The authors note that von Bertalanffy's work on open systems suggests a number of limitations of the transparency idea and thus foreshadows some of the later systems-theoretic scholarship on operational closure and self-referentiality.

Hammond (2019) further explores the moral implications of the general system theory. Von Bertalanffy's critique of mechanistic science is important in more than an epistemological sense. Mechanistic science is seen as partly responsible for many catastrophes, including the environmental issues facing us. Engendering an inappropriate reverence for technology and technological solutions to problems, producing understandings of issues which miss the unity of the person and the unity of science, mechanistic science tends to be coupled to administrative systems which can magnify the anti-humanistic tendencies, the effects in the real world. His outlook on a humanist science remains valuable. Hammond emphasizes the enduring importance of von Bertalanffy for the life sciences, enabling to connect social and natural sciences. Van Assche et al (2019) follow a similar logic, stressing the importance of von Bertalanffy for understanding linkages between social and ecological systems. Just as Hammond, they believe in the power of General System Theory to grasp the unity of systems, the embedding of systems in systems, and from there, the ways problems can be addressed in new manners. Van Assche et al focus on the value of von Bertalanffy to the understanding of adaptive governance of social ecological systems, as both the whole and the parts look different, and as the ideas on steering towards adaptation add to current discourses on adaptation and resilience.

Baecker (2019) in turn goes back to some of von Bertalanffy's earliest works, and finds new connections with his later work, but also with pertinent issues for the further development of systems theory, its dialogue with the scientific disciplines and its quest to elucidate real world problems. Baecker analyzes von Bertalanffy's early theory of form formation and a treatise on the medieval philosopher Nicholas von Cusa, who is presented as the first thinker to consider both infinity and the smallest scales of time and space. Baecker then focuses on the question of individuality, of the distinction between system and environment for living beings, and deploys Spencer- Brown's calculus of forms to rethink what an individual life can mean in the context of systems it is always dependent upon.

Tramonti et al. (2019) argue that the Bertalanffyian insights have lost nothing of their relevance in the modern fields studying mental functioning and mental health. In contrast to some of the present reductionist interpretations of many developmental processes in these fields, the biopsychosocial approach inspired by von Bertalanffy underscores the multiple dimensions of biological, psychological, and social complexity as well as the multilayered interaction between genetic constraints, developmental trajectories, and life contexts. In a comment on Tramonti et al.'s (2019) argument, Froehlich (2019) draws on the Bertalanffyian general systems theory in order to discuss the possibility of a non-reductionist interpretation of the concept of elements.

Linking to Baecker and Tramonti, on their Bertalanffy- inspired perspectives on organismic biology and holistic psychology, Tretter (2019) re-introduces systems medicine. Tretter aptly identifies a series of gaps in the knowledge of mechanistic medicine and biology which entwine, and which render a full understanding of certain medical issues nearly impossible. He argues for a

reconsideration and further development of systems medicine and gives clear indications in which medical issues the greatest difference, the greatest added value can be expected

The contributors of this issue thus explore many avenues in von Bertalanffy's thinking, and many ways his ideas can still elucidate current academic and societal debates. They do not always share the same interpretation of von Bertalanffy and of the value of his work, yet, taken together, they do make a strong claim that 50 years after publication, *General System Theory* still has much to say. Overlooking the spectrum of contributions, we as editors are impressed by the capacity of the theory to re-link individual people and other creatures, people and their social environment and their ecological environment. Despite all his flaws, von Bertalanffy did genuinely aspire to be a humanist, and make great strides towards a humanist science (as eg Hammond in this issue explains), a science which is not blind for the wholeness of the person, an ever changing cloud of connections which cannot simply be reduced to one of its traits or components, nor for the wholeness of science, continuously building itself up to become more complex, to get hold of an order which is, as yet, beyond us.

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