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Alexander Bogdanov and the Question of Unity: An Emerging Research Agenda

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Abstract

In this paper, we propose a research agenda to support the recovery of Alexander Bogdanov's philosophical and systemic thinking that culminated in his magnum opus, *Tektology.* Our main reason for doing so is to re-address enduring questions about the unity of science and the unity of the systems paradigm. Since the turn of the new millennium, there has been renewed interest in the ideal of the unity of science. General system theory (GST), cybernetics and complexity science are three significant intellectual sources inspiring this renewal. It is not unusual for these ideas to be grouped under the umbrella terms *systems science* or *systems thinking*, which are two ways to present a single *systems paradigm*, and we will explain why its 'unity' is both necessary and problematic. Bringing Bogdanov's work back to address the unity question can help us to progress towards unity in diversity.

Introduction: The Question of Unity

Since the turn of the new millennium, there have been renewed efforts to revive the ideal of unified science.[1] Aside from the Unity of Science Movement of the interwar period, led by Neurath (1935, 1936, 1937) and other Viennese philosophers of science (such as Morris, 1955; Carnap, 1934, 1955; Frank, 1938, 1949; and Hempel, 1951), the major sources for these efforts have been general system theory (GST) (e.g., von Bertalanffy, 1950a, b, 1951, 1968a, b, c; Boulding, 1953, 1956; Emery, 1969; Ackoff, 1971, 1973; Klir, 1972; Troncale, 2006), cybernetics (e.g., Rosenblueth et al., 1943; Wiener, 1948, 1950a, b; Ashby, 1956; Bateson, 1972, 1979; Beer, 1959, 1972; von Foerster, 1974; Maturana & Varela, 1992) and complexity science (e.g., Weaver, 1948; Simon, 1962, 1969; Holland, 1975, 1995; Morin, 1977, 1992; Prigogine, 1987; Gell-Mann, 1994a, 1994b; Le Moigne, 2000). These three scientific movements are seen as significant intellectual sources inspiring contemporary efforts to unify or integrate the specialized sciences and scientific knowledge.

However, the systems, cybernetics and complexity movements have themselves evolved into different branches and specializations, including the production of a wide variety of methodologies and approaches (Midgley, 2003a, b; Jackson, 2019). There has therefore been a certain degree of fragmentation within the broader systems field since the 1950s. As a consequence, the unity of the *systems paradigm itself* has become the priority problem to tackle, on the way to realizing the unity of science (Midgley, 1992a, b, 1996, 2001; Mobus and Kalton, 2015; Rousseau, 2018; Cabrera et al., 2023a, b).

There have been many individuals and groups of scholars who have proposed approaches to systematize or integrate diverse systems perspectives or

[1] We would like to acknowledge that the idea to reconnect the systems paradigm to the unity movement in the philosophy of science stems from Tompsett (2015). We have built on his work to include the broader unity of science debates that took place in the late 19th Century.

methodologies since the first emergence of GST in the mid-20th Century. Contemporary examples include critical systems thinking (CST), as developed by Ulrich (1983, 2012a, b), Flood and Jackson (1991a, b), Jackson (1991a, 2019), Flood and Romm (1996), Midgley (2000), Midgley and Rajagopalan (2021), and others; the framework of principles for a new GST proposed by Mobus and Kelton (2015) and Rousseau et al. (2016, 2018); the post-Bertalanffy systemics proposed by Minati and his colleagues (Minati, 2016, 2017; Minati et al., 2016); the cybernetics of Scott (2019, 2020, 2021); and, most recently, Cabrera et al.'s proposal for a universal theory of systems thinking (2008, 2015, 2023a).

However, although all this work seeks to address fragmentation at the same time as keeping much of the pluralism of ideas, none of it is fully inclusive. To provide just one example, CST embraces multiple systems methodologies for intervention to address issues of relevance to managers and policymakers, but has little or nothing to say about GST and other forms of systems theory that have not been applied to problem-solving in organizational, social and ecological domains.

Recently, to fulfil the promise of GST, Mobus and Kelton (2015) have provided a framework of twelve 'systems principles', which can be used to unify both science and the systems field. In addition, starting with a series of events (Wilby et al., 2015) and the production of a manifesto, Rousseau et al. (2015, 2016, 2017) and Rousseau (2017) have put forward an ambitious research program for the development of a transdisciplinary and translational 'general systemology', aimed at the establishment of a scientific general system theory as a model for the unification of science.[2] This program refers to the works of an

[2] It should be noted here that a framework developed by Wilby (2011) was part of the initial general systemology proposal, yet it was not carried forward into later work (also see Wilby, 2014).

earlier generation of systems theorists (also see Sadovsky, 1991, and Pouvreau, 2013).

According to Rousseau et al. (2015), a unifying science, which was promised by the founders of GST yet was never fully delivered, is needed even more today than in the 1950s, when it first became popular.[3] Similar to Mobus and Kelton (2015), these authors argue that a general science of systems can be built to overcome the inefficiencies and miscommunications caused by the fragmented specialization of the sciences in general. Since the problem of over-specialization and disciplinary differentiation has occurred within the systems field itself, and dividedness slows down or blocks progress toward unification (by frustrating productive collaboration and exchange between systems researchers who make different theoretical and methodological assumptions, and use different terminologies), Rousseau et al. (2015) call for the systematization of systems approaches as an urgent priority. Although Rousseau et al. refer to Mobus and Kelton's book (2015), they do not engage with the framework offered by the latter.

In their efforts, Mobus and Kelton (2015) and Rousseau et al. (2016, 2018) follow others like Capra and Luisi (2014), Midgley (2000, 2001), Hofkirchner (2005), Hofkirchner and Schafrenek (2011), Pouvreau and Drack (2007), Pouvreau (2014), and Drack and Pouvreau (2015), and they return to the initial ideas of von Bertalanffy (1950, 1968), von Bertalanffy and Rapaport (1956), and their colleagues in order to attempt a wholesale reconstruction. They take the starting point of the systems enterprise to be the emergence of GST as a scientific and legitimate movement, and they begin rebuilding from there. However, while Rousseau et al. set themselves an objective to discover unifying

[3] Indeed, von Bertalanffy (1951) organized a seminal symposium entitled, "General System Theory: A New Approach to Unity of Science". The GST movement also aimed to integrate and unify similar approaches that emerged in the same period, such as cybernetics, game theory, information theory, and operations research.

principles, concepts, methodologies and mechanisms for the construction of a unified general systemology *in the near future*, Mobus and Kelton (2015) do not merely look to the future, but offer a framework and twelve principles that they claim are *already* capable of unifying the field. Scott (2019, 2020, 2021) proposes the same for cybernetics, which he sees as a transdisciplinary meta-science that could integrate the scientific disciplines.

The Lost Paradigm

While these previous and contemporary efforts aiming to revive the ideal of the unity of science (by uniting or integrating the GST, cybernetics and complexity discourses) are laudable, it has to be said that they have all missed the fact that clear principles, concepts and a methodology were already developed several decades before the first of these scientific movements came about. The ideas we are referring to came from the Russian polymath, Alexander Bogdanov. Especially relevant is his *Tektology*, a contribution that is widely regarded as Bogdanov's magnum opus. The first two parts of *Tektology* were written and published between 1913 and 1917 in Russian, while the third part was published in 1928 after his death.[4]

We suggest that Bogdanov already provided what the founders of the later movements, as referenced in the previous section, were looking for. The fact that so many authors have set out to 'reinvent the wheel' is both striking and puzzling. Although almost all the above-mentioned authors, except Mobus and Kelton (2015), refer to Bogdanov's pioneering work as one of the predecessors

[4] The writing and publication of *Tektology* was spread over two decades, although Bogdanov's core ideas and concepts can be found in his earlier (even his very first) publications. See Rowley's (2020) translator's note to Bogdanov's *Empiriomonism* (1904-06) for details. In our paper, we use the dates given by Sadovsky and Kelle (1996) in their foreword to the translation of Book 1 of *Tektology*, edited by Dudley (1996). As an additional note, the first English translation of *Tektology* in 1980, by Gorelik, was based on its publication by Bogdanov in the form of a series of essays that appeared in *Proletarskaya Kultura* between 1917 and 1921.

of later systems approaches (e.g., Midgley, 2003a, b; Capra, 1996, Capra and Luisi 2014; Rousseau et al. 2018; Jackson, 2019), none of them, until very recently, have actually engaged directly with the ideas and conceptual framework developed in the *Tektology*.[5]

Capra (1996) and Capra and Luisi (2014) go furthest by recognizing Bogdanov's magnum opus as the first-ever systematic work to present the systems paradigm. A well-known Capra quotation reads, “Tektology was the first attempt in the history of science to arrive at a systematic formulation of the principles of organization operating in living and non-living systems” (Capra, 1996, p.44), and this was repeated by Capra and Luisi (2014, p.84). However, both books primarily refer to a seminal article published by Gorelik (1975a) on Bogdanov's principal ideas, but they do not discuss the primary sources written by Bogdanov in any depth.

Another example is a four-volume set of books called *Systems Thinking*, edited by Midgley (2003a), that starts with a reprint of the first chapter taken from *Tektology*, in which Bogdanov sets out his conceptual and methodological framework. However, like others, Midgley does not engage with Bogdanov's work in his own theory-building about the unity of science (e.g., 1992a, b, 1996, 2001, 2016). Midgley was aware of *Tektology* before editing the 2003 four-volume set because the Centre for Systems Studies at the University of Hull, where Midgley was working, published a new English translation of the first part of *Tektology* in 1996.[6]

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[5] It should be noted that, since late 2020, Jackson has been actively engaging with *Tektology*, as well as Bogdanov’s earlier works, which have recently been translated into English in a Historical Materialism book series published by Brill. Jackson has given public talks and seminars on this work, and has published several blog posts on Bogdanov’s legacy, where he has identified Bogdanov as a significant predecessor to critical systems thinking (Jackson, 2020, 2021a, b, c). Jackson’s contribution to this special issue are two intriguing articles on Bogdanov’s ideas and their relevance to the unity of contemporary systems thinking (Jackson, 2023a, b).

[6] Midgley’s 1992 writings on the unity of science were written before he met Peter Dudley, who introduced Bogdanov’s thinking to colleagues in the Centre for Systems Studies at the

As of today, there is a consensus amongst scholars who have seriously engaged with Bogdanov's work (e.g., Sadovsky and Kelle, 1996; Gorelik, 1975a, 1975b, 1980, 1983, 1987; Zelený, 1980, 1988; Bello, 1985; Dudley, 1996a, b; Gare, 2000a, b) that his ideas, especially as found in *Tektology*, represent the first emergent moment for the systems paradigm in its near-contemporary form. However, so far, the majority of systems thinkers and scientists outside Russia have discussed Bogdanov's work as if it was merely one of many historical precursors of the later, 'proper' work of Wiener (1948, 1950a, b), von Bertalanffy (1951, 1968a, 1968b, 1972), Ashby (1956), Boulding (1956) and their colleagues. Indeed, one of the most widely-respected historical narratives about the rise of the systems paradigm in the West, by Hammond (2003), mentions Bogdanov's name only once, and that is in a footnote (p.134). Von Bertalanffy, Boulding, Rapaport, Wiener, Ashby and their collaborators are still broadly taken as the 'founding fathers' of GST and cybernetics (Hammond, 2003; Rousseau et al., 2018; Mobus and Kalton, 2015).

The same issue crops up in complexity science too. There was a renewal of the complexity movement in the 1970s, led by authors like Simon (1962, 1969), Thom (1972), Holland (1975, 1995), and Nicolis and Prigogine (1977, 1989). Initially, some of these authors did not even reference early theorists of GST and cybernetics, let alone Bogdanov's *Tektology*. However, the writings of Simon, Morin (1977, 1992, 2008) and Gell-Mann (1994a, b) clearly demonstrate the interactions and continuity between the conceptual tools proposed within the GST, cybernetics and complexity movements. Moreover, Weaver (1948, 1949, 1961, 1962), one of the early proponents of complexity science (and the idea of complex adaptive systems), closely collaborated with Shannon in developing modern information theory (Shannon and Weaver, 1949). These authors were closely associated with Wiener and the other founders of cybernetics, who

University of Hull, but his 1996 and 2001 contributions were written contemporaneously with Dudley's (1996a) editing of the *Tektology*.

formed the Macy group. Information theory was a very significant contribution to cybernetics, as it provided the foundation for the development of modern computing, and it was recognized by the founders of GST as part of the same movement. Knowingly or unknowingly, the founders of these three movements likewise failed to acknowledge an intellectual debt to Bogdanov's prior thinking.

In Russia, on the other hand, tektology was not separated from other studies related to GST, cybernetics, and complexity. Since the 1960s, it has been recognized as foundational rather than being labelled a mere 'precursor' (Susiluoto, 1982; Biggart et al., 1998).

The Rediscovery of Bogdanov

In the 1950s and 1960s, the Western GST and cybernetics movements became very influential in the English-speaking world. However, when the impact of these movements first reached the Soviet Union, they were initially considered to be reactionary pseudo-sciences. This attitude prevailed until the late 1950s, yet they still triggered the rediscovery of Bogdanov and his tektology.[7] Then there was feedback to English-speaking countries, and word of Bogdanov's contribution started to spread. Following these developments, and from the 1960s onwards, a line of work was pursued by a group of systems thinkers and philosophers who published in English. However, they were not really heard by the contemporary, 'mainstream' narrators and historians of the systems movement, discussed earlier. As we saw, these narrators and historians did little more than acknowledge Bogdanov as a precursor to 'proper' systems science and systems thinking.

[7] According to Sadovsky and Kelle (1996, p. xvi), foremost credit in Russia should be given to A.I. Uemov, M.I. Setrov, G.N. Povarov, A.A. Malinovsky (Bogdanov's son), E.G. Yudin, I.V. Blauberg, P.K. Anokhin, A.L. Takhtadzhian, and N.N. Moiseev. See Biggart 1998, for a detailed account of Bogdanov's rediscovery and rehabilitation.

Key systems, cybernetics and complexity authors involved in the rediscovery of Bogdanov were Gorelik (1975a, 1975b, 1980, 1983, 1987), Blauberg et al. (1977), Mattessich (1978, 1982, 1983), Zelený (1979, 1980, 1988), Susiluoto (1982), Bello (1985), Sadovsky (1991), Sadovsky and Kelle (1996), Dudley and Poustilnik (1995a, b), Stokes (1995), Dudley (1996a, b, 1998), Le Moigne (2000) and Gare (2000a, b). These authors not only recognized the importance of the pioneering but forgotten work of Bogdanov, but they also seriously engaged with his ideas and the conceptual framework developed by him. They all argue that Bogdanov, in *Tektology*, not only provided a solid conceptual framework, but the GST, cybernetics and complexity movements were actually significant steps *backward* in comparison to *Tektology*, from the perspective of the development of a unified science. Moreover, following Sadovsky (1991), Dudley and Poustilnik (1995a, b) proposed a research direction for the unity of systems approaches that we suggest should be taken seriously as the starting point for contemporary research on the topic of the unity of science as well.

Gorelik (1975a, 1975b, 1980, 1983, 1987), Bello (1985), Dudley (1996a, b, 1998), Sadovsky and Kelle (1996), Gare (2000a, b), and Poustilnik (2008, 2009) then argued that, even though they may have different names, many of the key concepts in GST, cybernetics and complexity were already present in Bogdanov's conceptual framework. Indeed, concepts such as ‘emergence’, ‘organizing complexes’, ‘disorganizing complexes’, ‘open system’, ‘feedback mechanism’, ‘boundary conditions’, ‘coevolution’, ‘dynamic equilibrium’, ‘stability of forms’, ‘strategic selection’ and ‘bifurcation’, amongst others, were integral to *Tektology*, and yet were later proposed by mid-20th Century systems theorists and portrayed as cornerstones of the developing systems paradigm.

In addition, Jackson (1991a) and Midgley (2000, 2003b, 2006a) talk about three major, successive systems paradigms in vogue since the 1950s, each of which introduced important new innovations: an expert-led, quantitative, objectivity-orientated practice gave way to a more participative, qualitative, intersubjective approach, which in turn gave way to more penetrating critical thinking about the context and an embrace of methodological pluralism (drawing upon ideas from both previous paradigms). It is our hypothesis, to be explored in detail and tested through historical and philosophical research to be proposed later in this paper, that key conceptual and theoretical innovations in the methodological framework developed by Bogdanov already anticipated key ideas in *all three* of these systems paradigms.

In 1928, Bazarov (who was a close friend of Bogdanov and a follower of his work from their youth until the end of his life) wrote a tribute to Bogdanov after the latter's death. In this tribute, Bazarov outlined Bogdanov's achievements as a thinker, and proposed that it was too early to judge the scientific accuracy of the propositions in *Tektology*. Bazarov (1928, p. xxxv) argued that:

> "… to provide a systematic valuation of tektological principles would mean to prove that, speaking mathematically, they are 'necessary and sufficient' for attaining that goal for which the author advanced them. In other words, it is necessary to prove, on the one hand, that each principle formulated by Bogdanov in Tektologiia has universal-organisational significance and, on the other hand, that only the principles stated by Bogdanov can pretend to universal application. It is obviously impossible to resolve such a task by means of abstract logical analysis of concepts. For this, massive concrete-critical work is necessary: it is necessary to test in reality whether or not tektological formulas are applicable to the main spheres of human knowledge and human practice. And only after such a comprehensive verification would it be possible to construct an exposition of universal organisational science that is 'systematic', in the strict meaning of the word."

Almost a century later, many concrete critical studies of organization (in the sense of how systems come into being and evolve) have been delivered. A broad variety of concepts, principles, approaches and mechanisms have been formulated and implemented by Russian and non-Russian systems thinkers and scientists, and these have been well tested in the manner that Bazarov suggested would be needed. In our forthcoming research, we will be attempting to provide the verification that Bazarov suggested above, by comparing and contrasting Tektology with the works of Western systems scientists and thinkers whose ideas developed independently.

The Concept of ‘Organization’

As we are reminded by those who have studied his work (e.g., Gorelik, 1975a, 1980, 1987; Gare 2000a, b), Bogdanov's (1918) starting point was to be critical of the increasingly inefficient fragmentation of the modern sciences into progressively more specialized academic disciplines. It was Bogdanov's explicit objective to develop a unified and universal science that would overcome this problem in a non-reductionist way. Reductionism involves breaking phenomena down into the smallest possible parts, based on the assumption that, if the causalities involving these micro-parts can be explained, then we will finally have found a ‘theory of everything,’ as the whole of reality is nothing more than an aggregation of such parts (for criticisms of such a belief, see, e.g., von Bertalanffy 1968a; M’Pherson, 1974; and Fuenmayor, 1991). This is antithetical to a systems approach because the latter acknowledges that parts of phenomena interact to give rise to emergent properties – properties that can only be explained with reference to a whole system, not to any one part in isolation. Thus, Bogdanov, like subsequent systems scientists and systems thinkers in later generations, was critical of the idea that quantum-scale Physics is somehow the most ‘fundamental’ discipline.

Bogdanov’s scientific monism aimed at going beyond the physicalism that some neo-Kantian philosophers and logical empiricists of the Vienna Circle subscribed to (Neurath, 1931a, b; Carnap, 1934). However, it also opposed *panpsychism*. Panpsychism says that "the mind is a fundamental feature of the world which exists throughout the universe" (Bruntrup and Jaskolla, 2017, p.365). Bogdanov aimed at providing a universal science of organization that was beyond all special sciences, but helped to organize them into one monistic science (Bogdanov 1904-06, 1918, 1923a).

It can be demonstrated that Bogdanov's *Tektology* is able to address all the problems identified by Rousseau et al. (2015, 2016, 2018) concerning the failure of previous generations of GST, cybernetics and complexity science to develop a unifying paradigm and a general synthesis of the sciences: namely, providing a coherent and integral conceptual and methodological framework and a first principle.

Instead of focusing on 'system' or 'systemness,' as von Bertalanffy (1950, 1968a, 1972) did, or 'feedback mechanisms,' as Wiener (1948, 1950a, b) and his colleagues did for cybernetics, Bogdanov asserted that *processes of organization* need to be taken as the subject matter of the most generalizing science (Bogdanov, 1913-1917; also see Poustilnik, 2021). His argument was that only this provides a clear first principle, as the foundation upon which all other disciplines can be systematized and integrated, or better ‘organized;’ i.e., all disciplines study different domains of organization, and realizing this provides a basis for interrelating them. The principle that provides the broadest generalization possible is that "all phenomena may be investigated and understood as organizational processes" (Bogdanov, 1913-1917, p.5-6). Thus, for Bogdanov, generalizations provided by such a universal science of organization could be applied in practice when arranging the sciences and scientific knowledge into a harmonically and organized complex whole (or a system), which is always dynamic and changing.

It is very curious that, in his foundational texts, von Bertalanffy (1968b) too declared the very same principle as the basis upon which all the sciences can be unified. Under the subtitle ‘General System Theory and the Unity of Science,’ to provide an argument that counters reductionist ideas about the unification of science, he wrote: "We cannot reduce strawberry to chocolate – the most we can say is that possibly in the last resort, all is vanilla, all mind or spirit. *The unifying principle is that we find organization* at all levels" (p.49, italics added).

Further, in the third chapter of the book, this time under the subtitle ‘The Unity of Science,’ von Bertalanffy states that:

> “Reality, in the modern conception, appears as a tremendous *hierarchical order of organized entities*, leading, in a superposition of many levels, from physical and chemical to biological and sociological systems. Unity of Science is granted, not by a utopian reduction of all sciences to physics and chemistry, but by the *structural uniformities* of the different levels of reality” (von Bertalanffy, 1968a, p.86, italics added).

In *Robots, Men and Minds*, von Bertalanffy clarified that:

> “In summary: There are recent developments, loosely circumscribed by the concept of system, which try to answer the demands mentioned. In contrast to the progressive and necessary specialization of modern science, they let us hope for a new integration and **conceptual organization**. Speaking in terms of natural philosophy, as against the world as chaos, **a new conception of the world as organization** seems to emerge. This development is indicated by the appearance of a bundle of new disciplines: *general system theory, cybernetics, information, decision* and *game theories*, and others” (von Bertalanffy, 1967, p.63, italics in the original; bold is added).

Cyberneticians likewise agreed on this very same organizational principle as common ground, and Heylighen (1991) says that this is where GST and cybernetics meet, offering the potential for integration.

Moreover, Morin (1977), in the first volume of his *Method*: *The Nature of Nature*, claims that ‘organization’ is a more fundamental concept than ‘system.’ Indeed, Le Moigne, a close friend and collaborator of Morin, suggests that Morin was unknowingly updating Bogdanov:

> “From "*Cybernetic Modelling*" to "*Systemic modelling,*" the **Paradigm of OrganisaCtion**[8] initially formulated by the Russian economist A. Bogdanov and rather completely synthesized today by Edgar Morin in the first four volumes of "*la Méthode,*" gives us a general framework (or "*Method*") which present the basic inquiring principles guiding the intelligible modelling of complex systems, and particularly of evolving socioeconomics organizations” (Le Moigne, 2000, p.3, bolds and italics in the original).

There are several possible explanations for why Bogdanov’s contribution was ignored in the mid-20th Century, and also why it mostly remains marginalized today. One issue is that it has not been possible to evidence a clear chain of influence between the ideas of Bogdanov, on the one hand, and writers in GST, cybernetics and complexity, on the other (Capra, 1996; Sadovsky and Kelle, 1996; Bello, 1985; Dudley, 1996a, b, 1998; Gare, 2000a, b). Another issue in Soviet Russia was the series of public campaigns Lenin launched, before and after the October Revolution, that targeted Bogdanov and caused his works to be ‘buried’ in that country. Also, when GST and cybernetics were first achieving scientific acclaim in the USA, the Cold War was at its height. The fact that Bogdanov was an influential socialist intellectual – one of the founders of the

[8] Here, Morin (1977) creates a new term, ‘organizaCtion’, to highlight the conscious and purposeful human action aiming to organize things. In contrast, Bogdanov refers to both natural and human activities of organizing as ‘organizational activity’.

Bolsheviks (alongside Lenin) – must have made it very inconvenient for Americans to acknowledge his work, if indeed they knew about it at the time.

Today, this marginalization largely persists in the West. While the Cold War is not what it once was, it is nevertheless still an issue for many Americans to identify with the ideas of a self-declared socialist. Kuhn (2000) also makes a point that is relevant to this marginalization: once the boundaries of a discipline or paradigm get established, it is extraordinarily difficult to shift them and require people to open themselves to work that they had previously not recognized as relevant. He says the reason for this is simply that it takes a massive amount of work to master a given specialism, and most people don't have time to rethink the story they tell about their research. Thus, change to the narrative of who is accepted as the 'founder' of systems science continues to be resisted.

With our proposed research agenda, we argue that the exclusion of the first systematic work, the moment of *emergence* for the systems paradigm in the modern world, has constituted a serious boundary problem – especially for the efforts to unify the systems paradigm, as well as science. As in the general systemology project offered by Rousseau et al. (2018), or Mobus and Kelton's (2015) framework, systems scientists and systems thinkers continue to search for the universal first principle (or in Mobus and Kelton's case, twelve new principles) as well as a conceptual and methodological framework that could apply to the study of all reality, thereby allowing us to unite the fragmented paradigm of systems. Alternatively, Scott (2019, 2020, 2021) argues that cybernetics is the integrative and unifying paradigm. In contrast, others search for a conceptual framework that could connect a multitude of approaches, methods and practices from systems thinking and systems science (e.g. Jackson, 2019; Cabrera et al., 2023a). The search for a unified 'systems paradigm' continues.

It should be noted that the subtitle of *Tektology* was *Universal Science of Organisation*. Building on his previous work – *Empiriomonism* (1904-06) and writings on social consciousness (1914) – Bogdanov put forward a first principle and provided a clear and simple set of concepts and methods at the outset of his work. He employed these to define general organizational processes to study formation, regulation, and crisis mechanisms in a variety of organizational forms that are found in all kinds of organized complex wholes (systems) in the physical and social world, as well as in the realm of thought. He also conceived of his universal organizational science as a 'science of practice.'

However, Wiener (1948, 1950a, b), von Bertalanffy (1950, 1951, 1968a, b, c), Boulding (1953, 1956), Ashby (1956) and their colleagues did not build their sciences on this first principle (*organization*), which they all agreed upon. Instead, the systems scientists chose 'systems', the cyberneticists chose 'feedback' and 'control' as their foci, and the complexity scientists focused on 'complexity' as the universal and unifying phenomenon or concept. The result was the failure of all three of these movements, in terms of formulating a unifying science (for discussions of this failure, see Morin, 1977, and Rousseau et al., 2016, 2018).

Theoreticians and practitioners of GST took decades to even formulate a clear definition of the term 'system' (Rousseau, 2016, 2018; Pouvreau and Drack, 2007; Pouvreau, 2014; Drack and Pouvreau, 2015). What von Bertalanffy's 'system' concept refers to is, in Bogdanov's framework, an 'organized complex whole,' which may or may not emerge from processes of organizing. Thus, *the organizational point of view is the one that provides grounds for commonality, not complex wholes*, as the emergence of the latter is only associated with a subset of organizational processes. For Bogdanov, it is *organizational processes* that need to be generalized as the unifying principle.

Confirming Bogdanov's idea, Morin dedicated the first volume of *Method*, his magnum opus, to the concept of 'organization,' and he argued for its central importance (Morin, 1977, p.77). However, rather confusingly, Morin accepted 'complexity' as the label for the emerging new scientific paradigm (Morin, 1992, 2008). Yet it appears that, just as systems scientists struggled to produce a clear and consistent definition of a 'system' in their early work (Rousseau, 2016, 2018; Pouvreau and Drack, 2007; Pouvreau, 2014; Drack and Pouvreau, 2015), complexity scientists have been wrestling with the task of defining 'complexity' in a manner that can generate a consensus in their research community (Ladyman and Wiesner, 2020). In Bogdanov's framework, complexity is something that increases in organized complex wholes, decreases in disorganized complex wholes, and remains stable in neutral complexes. It is important to acknowledge here that Bogdanov's thinking preceded and was confirmed by the founders of complexity science, who talked about 'organized' and 'disorganized' complexity (Weaver, 1948; Simon, 1962).

Turning to cybernetics, Wiener, Ashby and their colleagues initially focused on *feedback mechanisms,* which allowed them to study "control and communication in the animal and machine" (the subtitle of Wiener's 1948 book) in general terms. As Umpleby (2015, 2016) suggests, cybernetics has become a general science of *regulation.* In accordance with this suggestion, in *Tektology*, cybernetic feedback mechanisms are defined as part of the 'regulative mechanisms' involved in organizational processes. Bogdanov (1913-1917) named these as *progressive selection, conservative selection* and *dynamic equilibrium*.

For Bogdanov, tektological theory provided a coherent vision for the integration of existing disciplines as specific fields, each studying organizational forms and processes related to their subject matters. In the preface of the first edition of *Tektology*, written in 1912, Bogdanov explicitly warns that:

> “...the possible failure of the attempt, the false statement of the basic problems or the incorrectness of the first conclusions which would compromise the task for a long time, and for many years would distract the interest and attention of those who will work over it” (1913-1917, p.i).

Thus, he saw that one has to start with the conceptualization of a universal science at the most fundamental level. Not doing so would cause confusion that would take decades of work to correct and resolve. It seems like this is exactly what happened to the systems quest in the absence of the conceptual tools developed by Bogdanov.

The Common Roots of Tektology and Various Systems Approaches

The failure of Tektology to become a scientific movement in the 1910s and 1920s seems to be a defining moment for the development of the systems sciences from the 1940s and 1950s onwards. Had Bogdanov been successful in this regard, it is arguably the case that GST researchers, cyberneticians and complexity scientists would have had a different starting point – organizing processes – already established as a foundation to build their theoretical contributions upon. Ultimately, it could also be argued that this resulted in the development of systems science and systems thinking into a fragmented field with many ‘new starts’ to the systems enterprise.

It is important to highlight that the reason behind the failure of tektology to become a broad and legitimate scientific paradigm was not its inability to deliver a working conceptual framework, concepts, principles, and methodology. It was more to do with the general climate of crisis in the era of its birth. The early 20th Century was marked by ideological, political and military clashes, including the First World War, the Russian Revolution, and the emergence of Fascism and

Nazism. Bogdanov was a prominent socialist thinker, influential in revolutionary Russia. He was one of the founders of the Bolshevik faction of the Russian Social Democratic Labour Party (RSDLP), together with Lenin. He was the leader of the Bolsheviks in St. Petersburg during the 1905 revolution while Lenin was in exile in Europe (Yassour, 1981; White, 2019a, b). However, after the failure of the first attempt at revolution in 1905, the two figures became adversaries – especially after 1908. In 1909, Lenin wrote his lengthy *Materialism and Empiriocriticism* with the principle purpose of attacking Bogdanov and discrediting him politically and philosophically.

In this book, Lenin's indirect target was also the set of ideas advanced by Avenarius, Mach, and Ostwald (Lenin, 1909). These figures were key influences for Bogdanov. In 1920, Lenin re-published his book, this time as a strong leader of the first communist state, as well as the international communist movement. Bogdanov's influence in Russia as a philosopher, economist and sociologist started to decline from 1921 on.

With his early death in 1928 and the beginning of Stalin’s purge, the decline of Bogdanov accelerated. Stalin accused his opponents, like Bukharin, of being “Bogdanovite heretics.” Stalin asserted his claims by building on Lenin's enmity toward Bogdanov. As a result, Bogdanov's name was erased from the official Soviet historiography.

The influence of Bogdanov in the West remained limited too. This was partly because Stalin dominated Marxist ideology, and partly because of the hostility toward Marxism and socialism in general (Biggart, 1998; White, 2019a). Yet there were other reasons behind the poor reception of *Tektology* in Germany in particular, and the West in general. Germany is important in this story because the 19th and early 20th Century debates between the German monist and neo-Kantian movements were inspirational for Bogdanov, and the demise of both these movements happened around the same time that Bogdanov was being erased from Soviet history. Fascism and Nazism were rising to power in Europe, and German lost its place as the dominant language of science and philosophy in the 1930s. The history of monism and neo-Kantianism as key philosophical schools and movements, and the formative role they played for 20th-Century Western thought, was almost totally forgotten as a result (Schaffer, 2010, 2018; Cat, 2017; Heis, 2021).

The authors Lenin was attacking in his above-mentioned *Materialism and Empiriocriticism* were the key names of the monist movement that emerged at the turn of the 20th Century. The figures who were seen as the founders of modern monist thinking were Spinoza (1663), Leibniz (1714), the Encyclopaedists (Diderot and d'Alambert, 1751-1766), d'Holbach (1770), Goethe (1790), Fichte (1794), Schelling (1800) and Hegel (1812). They were followed by contemporary monists like Marx (1844), Fechner (1860), Engels (1877, 1873-1895), James (1878-1899), Avenarius (1888-1890), Plekhanov (1895), Mach (1897), Haeckel (1899), Ostwald (1913), Russell (1903, 1918), Whitehead (1929) and others (see Weir, 2012; Cat, 2017). These names were seen as being amongst the most influential representatives of the international monist movement, which was divided into idealist, materialist and neutral monist camps. Figure 1 schematizes these strands of monist philosophy in relation to their various forms of opposition to dualism. Note that *physicalism*, to which the logical positivists of the Viennese circle subscribed (Neurath, 1931a, b), refers to the materialist monism that Lenin backed in his above-mentioned book.

FIGURE I

Haeckel, who founded the German Monist League in 1906, was also the author of *The Riddles of the Universe* (1899). This book was widely read and was accepted as the founding manifesto of the monist movement in Germany. The term 'tektology' was first used by Haeckel, coming from the word 'tekton,' meaning constructing/building in Greek (Jensen, 1978). From the same Greek word, the term 'architecture' (arkhitekton, meaning master builder) also came. The International Committee on Monism was founded in Hamburg in 1911, in the wake of the First Monist World Congress, and Ostwald (Nobel Prize winner in 1909 for his work in the field of Chemistry) was elected as President (Weir, 2012; Neef, 2012). Ostwald published his monist manifesto in 1913, entitled *Monism as the Goal of Civilisation*, and declared that the 20th Century would be the century of monism (Ostwald, 1913; Cat 2017).

Bogdanov's work was closely associated with monism and the monist movement. He developed his approach to scientific monism in three volumes, collectively entitled *Empiriomonism* (1904-06), which provided a synthesis between the materialist monism of Marx (1844) and Engels (1877, 1873-1895) on the one hand, and the neutral monism of Avenarius (1888-1890), Mach (1897) and Ostwald (1913) on the other (Jensen, 1978; Rowley, 2021a, b; Banks, 2003a, b). It is also worth noting that Fechner (1860) had an influence on Bogdanov in writing *Empiriomonism* (Rowley, 2019), while von Bertalanffy's (1926) doctoral dissertation was on Fechner's ideas on "higher-order integration". Together with Plekhanov, Bogdanov came to be known as a prominent critic of the neo-Kantian revision of Marxist ideas in Russia (Steila, 1991; White, 2019a, b; Rowley, 2016, 2021a, b). Thus, while Bogdanov was a participant in the debate between the monists and neo-Kantians, von Bertalanffy's work came later, when the debate had largely ceased.

According to Schaffer (2010), the fall of monism came after the criticism of Russell, in his "Philosophy of Logical Atomism," first published in the journal, *The Monist* (1918). The categorization of analytical vs. continental philosophies, which has been pivotal in 'contemporary philosophy' (the beginning of which is marked by Russell's work on logic and mathematics and Husserl's, 1900-1901, *Logical Investigations*), was actually an emerging synthesis between monist, neo-Kantian, and pragmatist ideas (also see Riehl, 1894; and Heidelberger, 2007). The synthesis of contemporary philosophy involved other elements from the materialist-idealist and empiricist-hermeneutics debates (which later evolved into the positivist/anti-positivist debate) as well.

The analytical, pluralist and logically- and mathematically-grounded scientific philosophy of Russell (1903) and Wittgenstein (1922) paved the way for neo-positivism and the logical-empiricism of the Vienna and Berlin Circles, which would come to lead the 'Unity of Science Movement' from the 1930s onwards. *The Encyclopaedia of Unity Science* was published as a result of a series of meetings (entitled the International Congresses for the Unity of Science), the first of which was held in Paris in 1935. This indicated that a pluralist approach to a unified science had replaced the program offered by the monists (Neurath, 1931a, b; Cat, 2017). By 'pluralist,' these authors meant that there can be various approaches to the unification of sciences.

It is also worth noting that Neurath (1936) explicitly opposed using the concept of 'system' for unification. Most remarkably, the opening sentence of Neurath's article reads, "One can say that, from the point of view of scientific empiricism, it is not the notion of 'system', but that of 'encyclopedia' that offers us the true model of science taken as a whole" (Neurath 1936, p.139).

The Frankfurt School is relevant too, and this was formed in the early 1920s.[9] Unlike the unity of science movement arising from Russell's work, the Frankfurt School was marked by an anti-positivist position. This position evolved throughout the 20th Century and strongly influenced later debates, such as Adorno and Habermas challenging Popper (1959) and others for focusing only

[9] The Frankfurt School later came to influence the first generation of work in critical systems thinking (e.g., Mingers, 1980; Ulrich, 1983; Jackson, 1985,1991a b; Oliga, 1988, 1996; Flood, 1990a b; Midgley, 1990, 1992a, b; Flood and Jackson, 1991a; Gregory, 1991, 1992).

on questions of truth as the legitimate domain of science, when the Frankfurt scholars had long argued that inquiry into values (what Kant, 1788, called practical reason) has to play an equal role (Adorno et al., 1976). The Frankfurt School developed a strong response to the deterministic, atomistic and reductionist program of positivism and physicalism offered by the analytical philosophers. Thus, the ‘battle lines’ of 20th Century philosophy were well and truly drawn, with positivism (and its neo-positivist descendants) on one side, and the Frankfurt School (and its critical-theory descendants) on the other. The older distinctions between monist and neo-Kantian movements were largely erased.

In this climate of change, Bogdanov's *Tektology* fell into oblivion. It emerged as a response to the debate between monists and neo-Kantians, and could not survive political repression (from both Lenin and Stalin) accompanied by tectonic shifts in the worlds of politics, science and philosophy.

It was in this new world order that Wiener (1948, 1950a, b), Weaver (1948, 1949), von Bertalanffy (1951, 1968), Ashby (1956) and their colleagues came to define systems science, cybernetics and complexity in the aftermath of the Second World War. This new generation of scholars first became academically active during the 1920s when both the monist and neo-Kantian movements were in serious decline (Friedman and Nordmann, 2006). By the time they came to write the works that would form the foundations for the new movements of systems science, cybernetics and complexity, the context had shifted decisively, with the unity of science being a key concern of the analytical strand of philosophy.

We know that von Bertalanffy was influenced by both idealist and neutral-monist views, as well as neo-Kantian ones (Hammond, 2003). Indeed, his views were a new synthesis of neo-Kantian, heuristic and analytical ideas (Pouvreau and Drack, 2007). Von Bertalanffy was close to the Vienna and Berlin Circles, in which prominent figures like Schlick, Carnap and Reichenbach were students of influential neo-Kantian philosophers (Heis, 2018). He was also directly influenced by famous neo-Kantians like Lange (1865) and Cassirer (1918). One of von Bertalanffy's doctoral supervisors, Reininger, was also known as a prominent neo-Kantian scholar (Pouvreau and Drack, 2007; Pouvreau, 2009). Wiener, on the other hand, was a member of the Unity of Science Institute founded by Neurath in the US (Cat, 2017). We can therefore trace direct links between the emergence of GST, cybernetics and complexity and the declining Unity of Science Movement led by Neurath, Carnap, Frank and Morris (Hammond, 2003).

However, the influence of monist ideas on von Bertalanffy has not yet been traced. One negative result of this is that, within contemporary debates on the unity of science in the field of the history and philosophy of science, there is no mention of the systems paradigm (see Dupre, 1993, 2021; Cartwright, 1999; Cartwright and Ward, 2016; and Ruphy, 2016). These scholars are aware of the importance of the Unity of Science Movement and its association with positivism, but not of what was happening in parallel in the systems research community (although a remarkable exception to this is Ladyman et al.'s 2007 and 2013 work on complex systems). Likewise, systems scientists and systems thinkers for the most part do not realize that the systems paradigm has roots in the monist and neo-Kantian movements (plus American pragmatism). Also, judging from the lack of cross-referencing, some seem to be unaware that there was a unity of science debate outside and prior to the systems movement. One of the objectives of our proposed research is to further investigate the links between von Bertalanffy, monism, and 19th Century thinking on the unity of science.

Re-linking Tektology to the Systems Paradigm

When the nascent GST and cybernetics movements reached Russia, and Bogdanov's work was rediscovered there, the similarities between the works of von Bertalanffy and Bogdanov's *Tektology* were noted and came to fascinate scholars (Gorelik, 1975a, b; Blauberg et al., 1977; Susiluoto, 1982; Zelený, 1980, 1988; Sadovsky and Kelle, 1996; Capra, 1996; Jackson, 2019). Because von Bertalanffy did not refer to Bogdanov, the researchers who studied both Bogdanov and von Bertalanffy had considerable trouble explaining how it was possible for von Bertalanffy not to know about Bogdanov's work, given their striking similarities. This is even more remarkable when you consider that the German translation of volume one of *Tektology* was first published in Berlin in 1926 (Bogdanov, 1926), when von Bertalanffy was writing his doctoral dissertation at Vienna University. It was in this dissertation that von Bertalanffy developed his initial ideas about his general system theory. According to Pouvreau (2017), a copy of the German translation of *Tektology* was available at the Vienna University library at that time. It is also worth observing that Angyal (1939, 1941), who is seen as another founding figure of the systems paradigm during the 1940s, received his PhD from Vienna University in 1927. This means that Angyal too might have come across Bogdanov's *Tektology* at the time, during his doctoral studies.

The principal supervisor of von Bertalanffy's doctoral dissertation was Schlick (Hammond, 2003; Susiluoto, 1982; Pouvreau, 2009; Rispoli, 2015), who was the leading figure in the Vienna Circle. Von Bertalanffy was close to Schlick, and Schlick often invited him to join the Vienna Circle's meetings. Reichenbach, who was arguably the leading figure in the Berlin Circle, did the same, and von Bertalanffy gave presentations there (Pouvreau, 2009). Susiluoto (1982) recalls that Schlick knew all about Bogdanov. He was even supportive of Bogdanov in his classes, especially concerning the latter's defence of Einstein's general relativity theory, when it came under attack in Russia after the Revolution. In 1923, a collection of articles about Einstein's theory of relativity was published in Moscow in a volume edited by Bogdanov et al. (1923a, b). The volume's two leading articles were written by Schlick and Bogdanov (Steila, 2021). It would be strange if Schlick had not informed von Bertalanffy about Bogdanov's work, which was highly relevant to the dissertation project his doctoral student was working on under his supervision.

The second part of the *Tektology* appeared in German, in 1928 (Bogdanov, 1928). One of the key names in the systems paradigm, Kotarbiński, was inspired by *Tektology* and referenced the 1926 German edition of the first volume (Kotarbiński, 1955, p.209). One important reviewer of *Tektology* in the German language was Plenge – a well-known professor who had advanced his own general organizational science. Bogdanov referred to Plenge in the preface of *Tektology*. Plenge's (1927) review was written in the form of a harsh polemic. It was Plenge who was the first to suggest, in the context of this review, that the term 'tektology' should be replaced by 'general science' or 'doctrine of systems', which he shortened to 'systematology', meaning the general science of systematizing. It is also difficult to imagine how von Bertalanffy missed Plenge's review of Bogdanov.

We know from Pouvreau's writings (2009) that von Bertalanffy had financial problems and needed income. To keep his job, he had to be pragmatic, which is why he joined the Nazi Party and produced pro-Nazi writings. It would not be too far-fetched to think that, again with pragmatism in mind, von Bertalanffy might have hidden Bogdanov's influence on his ideas, at least initially. In the increasingly anti-Soviet climate in Germany, and later in Western academia (between the two world wars and during the Cold War), it would have been the pragmatic or expedient thing to do to avoid referencing Bogdanov in order to build a new scientific movement that would be perceived as legitimate.

However, having said this, we should also acknowledge one fundamental difference between the philosophical approaches of Bogdanov and von Bertalanffy, as discussed earlier: Bogdanov put the primary emphasis on general *processes* of organization, while von Bertalanffy emphasized systems as a *form* of organization.

Despite this difference, given the many other similarities between the works of Bogdanov and von Bertalanffy, questions have been asked about the possibility of plagiarism. However, these questions cannot be answered definitively either way. Perhaps what is more important is that von Bertalanffy was successful in launching a legitimate scientific movement, as was the Macy group led by Wiener (1948, 1950a, b) in cybernetics. However, both GST and cybernetics emerged into scientific debates without having advanced conceptual frameworks already in place, and this resulted in fuzziness, confusion and incoherence for the development of the emerging systems paradigm (Pouvreau 2013; Rousseau et al., 2016, 2018). Therefore, in forthcoming research, rather than discussing the influence of Bogdanov on von Bertalanffy, Wiener and others, it might be more interesting to examine the fundamental similarities and differences between the various systems theories, which obliges us to think of them comparatively. This is vital if we want to rethink the possibility of a non-reductionist, unified science and worldview.

The Aim of Our Proposed Research Agenda

Over recent decades, a strong case has been made by several systems thinkers (Gorelik, 1987; Sadovsky, 1991; Sadovsky and Kelle, 1996; Dudley, 1996b and 1998 amongst others) for taking Bogdanov's work into account more seriously in evaluating and rethinking the systems enterprise. Yet the work it requires has not yet been undertaken in full, both with regard to the historical roots of the systems paradigm as well as its overall evolution. This is exactly what we intend to do with the proposed research. We will go back to Bogdanov and *Tektology*, and will compare and contrast his thinking with the lives, influences, works and ideas of the initial founders of the systems science, cybernetics and complexity discourses. The outcomes of such a comparison will allow us to re-evaluate the development of the systems paradigm since the 1950s. We will reconstruct the largely-forgotten common history that is shared by the GST, cybernetics and complexity movements, as well as other earlier discourses, like tektology. By doing so, the research aims to contribute to contemporary discussions about the unity of the systems paradigm as well as the unity of science. As Flood and Gregory (1988) observe, historical investigations of the systems sciences are inevitably shaped by contemporary, values-based concerns, and it is important to be explicit about these. As part of the proposed research agenda, we will be bridging the contemporary philosophy of science literature (on monism, neo-Kantianism, pragmatism, and the unity of science) with the literature related to systems science, cybernetics, complexity and tektology.

Propositions and Research Questions

Based on the above summary of the research problem and related issues, we have formulated our principal propositions as follows:

- A critical-systemic study of Bogdanov's ideas about the unity of science question will give us the boundary conditions in which modern systems approaches emerged for the first time.
- Studying the initial conditions in which the systems paradigm emerged will allow us to reorganize the systems approaches into a fully-fledged scientific paradigm, which has coherence as a whole and is therefore more than the sum of its parts.

Below are some sub-propositions:

- The early 20th Century authors (e.g., Bogdanov, 1913-1917; Koffka, 1925, 1936, Smuts, 1926; Kohler, 1929, Angyal, 1939, 1941; von Bertalanffy, 1951, 1968a; Kotarbiński, 1955; and Piaget, 1968) were influenced by common ancestors: mainly monist, neo-Kantian and pragmatist philosophers and scientists of the 18th and 19th Centuries, who engaged in a lively debate about the unity of science. There were monist-dualist and pluralist arguments about subject-object duality; the role of the norms and values of the observer; the science of understanding vs. descriptive sciences; and theorization of part-whole relationships. These themes were at the heart of the early unity of science debate, and they fundamentally informed the emergence of the systems paradigm. From a systems-paradigm point of view, the emergence and initial conditions of the 18th and 19th Century contexts should be taken as significant.
- A coherent conceptual framework for a non-reductionist unified science (as promoted by the founders of general system theory, cybernetics and complexity in the 1940s and 1950s) was first discovered and outlined systematically by Bogdanov (1913-1917) in his book, *Tektology*. The emergence of the first systematically-described systems paradigm was more compact and well-developed in comparison with works from the 1940s and 1950s.
- As a successfully developed universal science model, the conceptual framework of tektology can be usefully applied when studying the emergence, development, regulation and crises of the broad system of thought which can be called the 'systems paradigm' today. Based on this proposition, we can build a systemic intervention into the system that makes up the various systems approaches and paradigms, and rethink the question of the unity of science.

We will be asking the following questions, which have been formulated using some of the main concepts in Midgley's (2000, 2006b, 2015, 2018, 2023) systemic intervention approach:

- What are the common and different philosophical and scientific sources and influences of the tektology, GST, cybernetics and complexity movements, and how should the historical boundary for examining these discourses be defined (taking the principle criterion for a boundary to be that which gives the best prospects for the inclusion of ideas that can help us unify the various systems ideas)?
- What are the key purposes and values shared by the founders and main theorists of the GST, cybernetics and complexity discourses?
- What are the key purposes and values defined or discussed by Bogdanov, and how do these contrast with those put forward later, by other authors in the 1940s and 1950s?
- Is the conceptual framework developed in *Tektology* applicable when modelling the emergence, development and organization (integration/systematization) of the systems enterprise?

Methodology

As already signaled above, the methodology that we will be using to address the above-mentioned research questions and propositions is called systemic intervention, as developed by Midgley (2000, 2006b, 2015, 2018, 2023), Boyd et al. (2004) and Midgley and Rajagopalan (2021). This is a multi-method approach, putting the exploration of purposes, values and boundaries up-front in inquiry, so what is to be researched is not taken for granted but is explored to reveal initially-hidden complexities that might need to be accounted for.

There are several other multi-method approaches in the literature (e.g., Flood and Jackson, 1991a, b; Jackson, 1991a, 2000, 2003; Gregory, 1992; Flood, 1995; Mingers and Gill, 1997; Taket and White, 2000), including some that embrace the idea of an up-front exploratory attitude (Mingers, 2006; Midgley and Shen, 2007; Shen and Midgley, 2015; Ulrich, 2012a; Jackson, 2019). We have chosen systemic intervention in preference to these others because it is the only approach that incorporates a theory of marginalization processes (Midgley 1991, 1992c, 1994), asking researchers to identify and address marginalization as part of the inquiry. This is particularly relevant to the proposed research because, as discussed earlier, most systems researchers do little more than pay lip service to the fact that Bogdanov generated a fully-fledged systems theory prior to the emergence of GST, cybernetics and complexity science. It appears to be a clear case of marginalization. We believe that recovering and mainstreaming the work of Bogdanov is worthwhile because of the promise this offers for providing a new account of the unity of the systems paradigm, as well as the unity of science more broadly.

Midgley (2000) first advanced the systemic intervention approach in the context of *systems practice*, and an assumption that is often made when people talk about systems practice is that an intervention involves changing behavior in some way, and not just knowledge. However, Midgley and Ochoa-Arias (2001) and Vachkova (2021) argue that an intervention can indeed take place in systems of knowledge, which may or may not lead to changes in action based on that knowledge. In the context of the present study, the arguments we will be developing are theoretical and discursive in nature: they are arguments about the unity of science and the unity of the systems paradigm. Hence, this will be an intervention into *the knowledge deployed by the systems research community*. While a successful intervention (i.e., one where our arguments are taken seriously, causing a revision of people's understandings of the past, present and potential future of systems science and systems thinking) *may* give rise to changes in behavior (e.g., the grounding of systems thinking methodologies in systems-scientific principles), bringing about these behavioral changes is a longer-term objective.

The two questions to be focused upon initially (the unity of science and the unity of the systems paradigm) exist in the context of academic debates, which have been taking place in the systems literature as well as within related scientific communities. Our systemic intervention will seek to address the ongoing tensions between fragmentary parts of the systems movement, often experienced as paradigm incommensurabilities (Midgley, 1989, 1992a, b, 2001; Jackson, 1991a, 2000; Jackson and Carter, 1991; Midgley and Ochoa-Arias, 2001; Flood and Romm, 1995; Yolles, 1996; Gregory, 1992, 1996a, b; Mingers and Brocklesby, 1996, 1997; Brocklesby, 1997; Zhu, 2011; Bowers, 2011, 2012; Midgley, Nicholson and Brennan, 2017).

Our chosen methodology will require us to identify common or conflicting boundaries used by systems, cybernetics and complexity theorists, and other academic communities who identify with these paradigms and can be associated either with systems thinking or systems science. Closely linked with boundary judgements are purposes and values (Churchman, 1971; Ulrich, 1983; Midgley, 2000), so exploring the purposes and values pursued by different systemically-oriented theorists and methodologists will also be necessary. This exploration will lead on to a *marginalization analysis* (Midgley, 1991, 1992c; Midgley and Pinzón, 2011): examining (in more detail than we have done in this document) how and why, once Bogdanov's writings resurfaced in 1960s Russia, they continued to be marginalized by almost all systems scientists and systems thinkers in the English-speaking world.

For the first part of the study, we will mainly pursue literature-based research. We will also rely, wherever it is necessary, on archival materials. We will be identifying shared and discrete sources of influences on, and the purposes and values of, the key/founding theorists and thinkers in GST, cybernetics, and complexity. These readings will help us to identify the 'primary boundary' (i.e., the narrowest one), as defined by Midgley (1992c) in his marginalization theory. The primary boundary delimits the well-accepted mainstream. When thinking about the secondary (wider) boundary (the difference between the primary and secondary boundaries shows what is marginalized), our focus will be on the literature on monism, neo-Kantianism, pragmatism, analytical philosophy and neo-Positivism (or logical empiricism). We will draw the link between the earlier (19th Century) debates on the unity of science and the debates that emerged in the mid-20th Century, which resulted in the establishment of the Unity of Science Movement. These readings will allow us to create a network map, which traces the links between key bodies of literature. This will show how Bogdanov and later 20th Century writers on GST were operating with quite different boundaries: time boundaries matter (e.g., whether or not writers looked back to the 18th and 19th Centuries), as do boundaries concerning the bodies of literature referenced, plus boundaries demarcating who was the audience for writings on the unity of science. Essentially, we will mount a ‘boundary critique’ (Midgley et al., 1998; Foote et al., 2007; Midgley and Pinzón, 2011) of the assumptions flowing into historical and contemporary GST, cybernetics and complexity science.

This will give us a view of the philosophical common background for tektology, GST, cybernetics and complexity, as well as the seeds of separation in the views and approaches of the thinkers considered. The boundary critique will provide us with the point of departure for the second part of the systemic intervention. We will be taking the marginalization of Bogdanov and tektology as central here. Based on our knowledge of the literature to date (and this may of course change during the course of the earlier-specified research), our boundary critique will suggest that Bogdanov's work needs to be viewed as 'sacred' (as befitting the first coherent formulation of an idea) rather than 'profane' (a primitive precursor to ‘proper’ systems science, or politically unacceptable because of its association with Soviet socialism). Therefore, our systemic intervention will be built around the recovery and inclusion of Bogdanov and tektology.

The aim of our intervention will be the improvement of contemporary efforts to systematize systems approaches and methodologies. In this way, we will be addressing the problem of the disunity of the systems paradigm. As part of our intervention, we will try to identify how the principles, concepts and methodology Bogdanov proposed could apply to the development of the systems paradigm into the future. We will be doing this in the form of a dialogue with the contemporary literature, focusing on those contributions that have sought to systematize the field (e.g., Mobus and Kalton, 2015; Minati et al., 2016; Rousseau et al., 2018; Jackson, 2019; and Cabrera et al., 2023a, b).

Conclusion

We have started to relate the growing literature on Alexander Bogdanov's work and ideas to ongoing debates in the systems, cybernetics and complexity research communities concerning the unity of science and unity of the systems paradigm. We have therefore formulated the research proposal discussed in this paper.

We contend that this research agenda has been emerging for quite a while in the works of other authors: serious thinkers have already highlighted the historical significance and contemporary potential of Bogdanov's ideas (e.g., Sadovsky and Kelle, 1996; Gorelik, 1975a, 1975b, 1980, 1983, 1987; Zelený, 1980, 1988; Bello, 1985; Dudley, 1996a, b; Gare, 2000a, b; Poustilnik, 2008). However, their research has not yet had sufficient influence on mainstream understandings of the origins of modern systems theory and the potential for unifying the systems paradigm.

Arguably, one reason for this is the amount of work that is required, for instance to understand the equivalence (or otherwise) of the systemic concepts developed by Bogdanov and subsequent authors: not only is the language in Bogdanov (1913-1917) different from that used in subsequent systems theories, but there are also substantial differences between the terminologies used across the various systems, cybernetics and complexity research communities. Achieving any semblance of unity in the contemporary systems paradigm is therefore a difficult enough proposition, let alone revising our understanding of its origins, which would oblige us to do the difficult work of learning Bogdanov's terminology and confronting the challenge of whether it is systems or processes of organization that should be regarded as most fundamental (or whether a synthesis between the two is possible). While we believe that understanding Bogdanov's work will aid the task of unifying the systems paradigm, it probably doesn't seem that way to those who are only looking at the potential for unity among more recent systems ideas: from this perspective, expanding the time boundaries just appears to add more work.

Whatever the reasons have been for the continued marginalization of Bogdanov's thinking in the mainstream systems literature, we suggest that the outcome has been unfortunate, to say the least, for those who care about the history of our research community, the unity of the systems paradigm, and the broader unity of science.

The reader might ask why we believe our research has more chance of success than that of the authors cited in the second paragraph in this conclusion. Of course, we cannot be certain of success, but we believe there are advantages to framing the work as a systemic intervention: this can help us understand our task, not just as scholarship, but also as a *strategic* engagement with the systems research community to address the marginalization of Bogdanov's ideas. Indeed, undertaking the scholarly research becomes just one action (albeit a very substantial one) to be undertaken alongside others that can open a space for rethinking the history of the systems enterprise. We believe that this can help us make real progress in the search for an answer to the wicked problem of unity in both the systems paradigm and science more generally.

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