DOI: 10.1002/sres.2590

RESEARCH PAPER

WILEY SYSTEMS and BEHAVIORAL RESEARCH SCIENCE

The open theory and its enemy: Implicit moralisation as epistemological obstacle for general systems theory

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Funding information
European Regional Development Fund-ERDF/FEDER, Grant/Award Number: 01.2.2-LMT-K-718-02-0019; Research Council of Lithuania

Abstract

Ludwig von Bertalanffy decisively shaped open systems theory as challenge and alternative to the then-dominant theories of closed systems. This strategic positioning and its success have abetted frequent and frequently implicit moralisations of openness and closeness. In this article, we draw on the concept of autopoietically closed systems to show that the prevailing affirmative bias to openness constitutes an epistemological obstacle to the advancement of general systems theory. We demonstrate how this obstacle can be removed by tetralemmatic decision programmes that facilitate the management of dilemmatic co-occurrences of and trade-offs between openness and closeness.

KEYWORDS

autopoietic systems, Bertalanffy, epistemological obstacles, general systems theory, Luhmann, open systems, tetralemma

1 | VON BERTALANFFY: OPEN INNOVATOR OF SYSTEMS THEORY

A milestone in the development of systems theory, Ludwig von Bertalanffy's (1968) open systems concept was designed as an alternative to the dominant paradigm of closed systems that prevailed in science in general and in physics or engineering in particular. Unlike machines, open systems are defined by the circumstance that they are not walled-off from but necessarily interdependent with their environment as they steadily exchange matter with it (von Bertalanffy, 1950, 1968). This metabolic constellation of inputs and outputs is the prerequisite for their mode of existence and thus the key principle of all forms of organized complexity.

Meanwhile, open systems thinking is intuitively understood and easily applied to all forms of systems. As it facilitates observations not only of systems but also of transformative input–output relationships and thus the embeddedness of systems into their broader social or natural environments (Valentinov, 2013, 2014a), open systems thinking is naturally associated with an ecological perspective (Valentinov, 2014b), with access to markets and political participation (Hielscher & Pies, 2016), or simply with progress (Lasklo, 1972). This is because an open systems approach is "ultimately pragmatic and therefore problem-solving driven," whereas recourse to narrow "binary, rule-driven and self-referential" concepts of closed systems seems to promote reductionism, regress, and retreat in walled-off disciplines or subsystems (Fontdevila, Opazo, & White, 2011, p. 179). The idea of closed systems, therefore, seems to contradict the very essence and purpose of systems thinking in general and general systems theory in particular, which is the provision of a theoretical infrastructure for interdisciplinary collaboration and transdisciplinary knowledge exchange (Mulej et al., 2004; Scott, 2001; von Bertalanffy, 1968).

These and further positive connotations of open systems theory notwithstanding, von Bertalanffy himself has always been very aware that an open-systems thinking approach often leads to severe problems particularly when applied to social phenomena. To him, the main criticism of open social systems theory,

> *"(P)articularly in Parsons' version, is that it overemphasizes maintenance, equilibrium, adjustment, homeostasis, stable institutional structures, and so on, with the result that history, process, sociocultural change, inner-directed development, etc., are underplayed and, at most, appear as 'deviants' with a negative value connotation. The theory therefore appears to be one of conservatism and conformism, defending the 'system' (or the megamachine of present society, to use Mumford's term) as is, conceptually neglecting and hence obstructing social change. Obviously, general system theory in the form here presented is free of this objection as it incorporates equally maintenance and change, preservation of system and internal conflict; it may therefore be apt to serve as logical skeleton for improved sociological theory" (von Bertalanffy, 1968, p. 196).*

Whereas we may happily agree with von Bertalanffy that open systems theory is not necessarily a conservative endeavour, we also must concede that a certain primacy of the environment over the system is inherent to all forms of open systems theory. An open system is conceptualized as being existentially dependent on its exchange relationships with its environment (von Bertalanffy, 1972, p. 19ff), whereas the environment is typically not thought to be dependent on its relationship with one particular system. Moreover, open systems theory is known to fail to explain how open systems maintain the boundary through which they selectively interact with their environment and by which they can be distinguished from it in the first place.

Still in von Bertalanffy's lifetime, although then not yet under its label, the concept of autopoiesis was developed (Maturana, 1970) and has since been discussed as a viable bridge over the open-closed divide in systems theory. The term autopoiesis refers to the capacity of living systems to self-produce and self-reproduce the components of which they consist. There are hence no input–output relationships with the environment as assumed by open systems theory. Environmental components are not first imported, then transformed, and then exported again; rather, environmental components are first transformed by the system before they trigger further systems internal transformations. All system components, including the system's boundary, are produced by the system's own transformations and hence by its own operations. This is why autopoietic systems are referred to as operationally closed systems. At the same time, operational closure is the basic condition for environmental openness: first, because there is no environment of any system without that system and, second, because any observation of an environment or a system–environment relationship is the observation of an "observing system" (von Foerster, 1981), and hence the result of the operations of another observing system or the observing system itself. Any form of environmental monitoring is, therefore, an intrasystem operation and, thus, actually not an observation of an environment but rather an observation of what that environment does or means to a system. Moreover, given the overwhelming complexity of the environment, it is evident that systems cannot monitor their entire environment (Ashby, 1956, 1958) and not even everything their environment does or could mean to them. Rather, systems develop and increase a "sensitivity to selected fragments of environmental complexity along with the simultaneously growing insensitivity to the rest of this complexity" (Valentinov, 2012, p. 539). There is hence no 1:1 representation of the environment within the system as "no system that distinguishes itself from an environment would have at its disposal the 'requisite variety,' (...) that would be necessary to create a sort of matching, a sort of point-by-point correspondence between system and environment" (Luhmann, 2013a, p. 121). Environmental openness, therefore, is necessarily selective and gradable only at the expense of further increased selectivity. The only major difference between open and autopoietic systems approaches is that the latter waives the claim of an either-or trade-off relationship between openness and closeness in favour of a perspective of mutual conditionality and amplification of both openness and closeness.

Notwithstanding that the autopoietic systems approach provides an elegant alternative to the open-closed divide in systems theory, autopoiesis is still not an established concept of general systems theory. Ironically, this is not because there have been no but rather because there have been reasonably prominent and successful attempts to extend the original biological concept of autopoiesis to nonliving systems. Niklas Luhmann's (1995, 2012, 2013b) social systems theory is probably the most prominent example as he abstracted the concept from merely biological connotations and generalized it to demonstrate that living systems are only one of three distinct forms of autopoietic systems besides psychic and social systems. Precisely, this expansion of the concept of autopoiesis, however, is where opinions differ sharply. To some, it is the main reason why Luhmann is considered the most influential sociologist of the 20th century, and to others, it is the main reason to reject his oeuvre. Ironically, again, of all people, the inventors of the very concept of autopoiesis have always belonged, if not to the second camp, then at least to the most consequent

critics of autopoietic exports to the realm of social systems.

> *"(W)hen we first referred to living systems as 'autopoietic systems,' we were claiming that they existed as networks of molecular productions that were closed in the sense that they produced their own borders determining their extension as discrete entities. However, at the same time they are open to the flow of molecules through them. It seems to me that this was well understood by Niklas Luhmann but that he wished to use the notion of autopoiesis in an operational domain different from the molecular one, as is apparent in his proposition that 'social systems were autopoietic systems of communications.' When we talked in 1991, I pointed out to him that the notion of autopoiesis does not apply in the way that he wanted because communications do not interact and thereby produce communications like molecules. I asked him why he leaves human beings out of his proposition, knowing that human beings are the foundation of human social systems and that what we call 'communications' occur as a reflective operation of human beings in conversations about what they do. (...) I told him that I did not want to propose a sociological theory, especially if the theory would leave out human beings as he proposed" (Maturana, 2015, p. 177).*

Luhmann's retrospection on this controversial discussion is astonishingly similar:

> *"I have had relatively long discussions with Maturana on this point. He always told me that, if one speaks of the autopoiesis of communication, one has to show it. That is to say, one has to show that the concept really works in the domain of communication, so that it is possible to state that an individual communicative act can come about only in the network of communication. It cannot be conceived as a one-time event. And it also cannot be conceived as produced externally, in a communication-free context, as it were—say, as a chemical artifact that then has a communicative effect. On the contrary, it must always be produced by and through communication. I believe that this claim does not create much difficulty. It is relatively easy to see—especially if one considers the linguistic tradition of Saussure, for instance, and all that came of it—that communication occurs via its own differences and has nothing to do with chemical or physical phenomena. The only opposition to this viewpoint can be found in Maturana, when he refuses to designate communication systems as social systems. There is a strong emotional moment that is on his side. He does not want to leave out the human being. (...) He does not want to waive the claim that the expression 'social systems' means concrete human beings that form groups and such. This is the only difference" (Luhmann, 2013a, p. 79).*

Both Maturana and Luhmann agree that their major issue was that Luhmann "leaves out human beings" and that his social systems remain closed to them. In other words, both authors recall that even within the context of a discussion between two theorists of autopoietically closed systems, a lack of openness could be used as an —otherwise unsubstantiated[1]—argument against a dissenting approach. This circumstance is even more significant as there is a reason to believe that this particular argument is one of the main reasons why many scholars reject Luhmannian social systems theory (Blühdorn, 2000). There is hence a genuine risk that systems theorizing is guided by a normative bias to openness that acts as an epistemological obstacle for the further development of general systems theory.

2 | OPEN IS BETTER: THE HIDDEN MORAL OF SCIENCE

Negative connotations of closed systems have a strong tradition in science and beyond. Karl Popper's *The open society and its enemies* is a particularly prominent example. Popper (1947, p. 49) blatantly associates closed systems with blind authority, primitive magic, and taboos, whereas open systems are associated with emancipation, science, and progress.

By contrast, Ludwig von Bertalanffy's attitude at first appears less black and white as it accounts for possible co-occurrences of openness and closeness in certain contexts of observation. For example,

[1]Heinz von Foerster reduced Maturana's rejection of Luhmann's concept of communicative autopoiesis to "personal idiosyncrasy" stating that "(Maturana) does not want his ideas even being mentioned by someone else" (von Foerster & Clarke, 2009, p. 29).

> *"Typical feedback or homeostatic phenomena are 'open' with respect to incoming information, but 'closed' with respect to matter and energy. The concepts of information theory—particularly in the equivalence of information and negative entropy—correspond therefore to 'closed' thermodynamics (thermostatics) rather than irreversible thermodynamics of open systems. However, the latter is presupposed if the system (like the living organism) is to be 'self-organizing' (...), i.e, is to go toward higher differentiation. As was mentioned above, no synthesis is reached as yet" (1968, p. 163).*

Yet the persistent paradox of the co-occurrence of openness and closeness is unilaterally resolved by a clear preference to and precedence of openness. Moreover, there is again this association of openness and higher levels of differentiation, and there are even clearer statements such as the one where von Bertalanffy (1968, p. 215) holds that

> *"In contrast to the animal's limited 'ambient,' man is 'open to the world' or has a 'universe'; that is, his world widely transcends biological bondage and even the limitations of his senses. To him, 'encapsulation' (...)—from the specialist to the neurotic, and in the extreme, to the schizophrenic—sometimes is a pathogenic limitation of potentialities."*

Here, the distinction of openness and closeness is ennobled to the dividing line between man and the animal kingdom. Openness is healthy. Openness is essentially human (see also von Bertalanffy, 1967, p. 132).

Similar ideas have prevailed in and shaped science as well as the broader social context for decades now. Open networks are better than closed regimes. An open market is better than a closed shop. Open source software is safer. Open innovation is more innovative. Open-book exams are more popular. Open access, open borders, open hearts, open minds; the list goes on.

These and similar biases towards openness rest on the understandable yet not unproblematic background assumption that openness is typically better than closeness. This moralisation of a guiding distinction mirrors the situation in ethics and moral philosophy, where *the code of the moral* (Luhmann, 1992)—good/bad—is not only studied but often and mostly implicitly also applied to the research field. As a result of this re-entry of the moral code, that is, the cross tabulation of the moral code with itself, the application of the code is typically considered positive and refusal to apply the code negative; moral behaviour typically promoted, and immoral behaviour problematised; and researchers in the field are typically inclined to see their names associated with the positive and not the negative side of the code, witness not least the particularly strong importance of research ethics in ethics research.

The situation in systems research is similar to the extent that one of our guiding distinctions—open/closed—is also often and mostly implicitly cross tabulated with the code of the moral. The typical result of the exercise is the situation presented in Table 1, where open appears as good (1; and not bad [0]) and closed as bad (1; and not good [0]):

In taking a second look at Table 1, however, we soon find that too rigid a coupling between open and good on the one hand and closed and bad on the other hand is inaccurate insofar as there definitely are some situations sometimes when closed is better than open. An alternative and certainly more adequate approach to the moral qualities of openness and closeness is therefore the one depicted in Table 2:

Table 2 allows us to switch between situations where open is good and closed is bad on the one hand and—as expressed by the constellation of bracketed figures—situations where open is bad and closed is good on the other hand. Our observational flexibility is considerably increased by this programme. Now, we see that things can not only be either good or bad but also both good and bad.

What we probably do not see yet, however, is that things also can not only be either open or closed but also both open and closed. In fact, there still seems to be a trade-off between openness and closeness.

3 | OPENNESS AND CLOSENESS: ALTERNATIVES TO MORALISATION AND TRADE-OFF

The observation of this trade-off can only be challenged if we completely dismoralise the observation of the

TABLE 1 Moralisation of openness and closeness

	Good	Bad
Open	1	0
Closed	0	1

TABLE 2 Dynamizing the moralisation of openness and closeness

	Good	Bad
Open	1 (0)	0 (1)
Closed	0 (1)	1 (0)

TABLE 3 Re-entry and tetralemmatisation of the distinction between openness and closeness

	Closed	Not-closed
Open	1 1	1 0
Not-open	0 1	0 0

underlying distinction and rather apply it to itself. An easy way to imagine such a re-entry is to treat a distinction as if it were a false distinction, which, true to the *Laws of form* (Spencer Brown, 1979), every distinction both is and is not. As a result, we can cross tabulate the distinctions open/not-open and closed/not-closed as if open and closed were not mutually exclusive (see Table 3).

If we look at Table 3, we find that we have considerably enhanced our observational margin again, as we can now observe that an "observed system" (von Foerster, 1981) may be open (top right), closed (bottom left), both open and closed (top left), and neither open nor closed (bottom right).

This constellation of openness and closeness is hence an example of the circumstance that a re-entry of a dilemmatic distinction turns that dilemma into a tetralemma (see Figure 1):

The tetralemma is an intellectual tool from traditional Indian logics originally invented to distinguish and indicate attitudes a judge can have towards opponents in a lawsuit (Jayatilleke, 1967; Roth, 2017; Sparrer, 2007; Varga von Kibéd, 2006). In this context, the typical expectation is that the judge rules in favour of either the one or the other opponent. This expectation often creates a dilemma. Yet a judge using the tetralemma could neutralize the dilemma by realising that he might also rule in favour of both or neither of the two parties. Buddhist logicians moreover extended this traditional tetralemma and included a fifth position, which is a nonposition that negates all previous positions. The function of this fifth position is that of a constant reminder that even (and particularly) the most problematic dilemmas often are ill-defined rather than irresoluble problems.

The tetralemma is hence a tool for thinking outside the box that can be used to broaden a narrow focus on taken-for-granted dilemmas and trade-offs such as the one between openness and closeness. In fact, a tetralemmatic review of the bottom-right neither-nor quadrant in Table 3 now allows our observation to cross[2] from the inside to the outside of our table insofar as a neither-nor suggests that the situation at stake is ill-defined by the observed dilemma and, thus, by the underlying guiding distinction(s). This observation is also referred to as the fifth position of a tetralemma. In our context, the fifth position allows us to recall that the distinction between open and closed is not the guiding distinction of systems theory and to assume that the actual problem behind the open-closed divide is a problem of our use of the system–environment distinction.

An only slightly different reading of the re-entry manoeuvre presented in Table 3 results in the commutated versions depicted in Tables 4a and 4b:

In Table 4a, we have translated the concepts of openness and closeness into the negatives of their negatives. This move allows for a NOR gate observation of constellations of openness and closeness. A NOR gate is a binary logic gate that performs logical NOR operations on binary inputs and translates these into singly binary outputs (see Table 4b).

The advantage of the observational mode presented in Tables 4a and 4b is that the probably hard-to-imagine co-occurrence of openness and closeness occurs as soon as we can observe neither the absence of both openness and closeness nor the presence of either exclusively openness or closeness. In the case of Table 4a, the co-occurrence of not not-closed and not not-open is represented by the co-occurrence of two ones ("1 1") in the bottom-right quadrant, whereas in the case of Table 4b, we observe a NOR gate that gives an output as soon as and only if it observes the concurrent absence of not-open and not-closed.

In the context of our article, this intellectual exercise can be interpreted as a weak definition and strong argument for the observation of autopoiesis, which occurs whenever observed systems are neither not-open nor not-closed.

Such a negative definition of autopoiesis may appear strange in the first instance, and yet, negative definitions are not uncommon in science in general and systems theory in particular and include that of such a central core concept as is contingency. In fact, Luhmann (1998, p. 45) is neither the first nor the only one to define the following: "Anything is contingent that is neither necessary nor impossible." Although this centuries-old and commonly accepted definition is actually not a case of a doubly negative definition (but rather one of the mixed types indicated in the bottom-left and top-right quadrants of Table 4a or the middle lines of Table 4b, respectively), it still has in common with doubly negative definitions that it creates both more observational margin and less conflict regarding the pre-existence of "something." A mere co-occurrence of nots is enough and more would quickly be too much. "Only nothing is unstable enough to give origin to endless

[2]George Spencer Brown's (1979) architecture of forms is built on one symbol, the "mark" or "cross" (⌐). In this context, the term cross may refer to (a) the drawing of a distinction, (b) that which is distinguished by this act of drawing a distinction, and (c) the crossing from one side of a distinction to the other side. In the present case, we use the term in the latter sense.

Neither	Either	Or
	Both	

The fifth position

FIGURE 1 The tetralemma

TABLE 4 a. Commutated re-entry and tetralemmatisation of the distinction between openness and closeness

	Not-closed	Not not-closed
Not-open	0 0	0 1
Not not-open	1 0	1 1

TABLE 4 b. NOR gate observation of the re-entry and tetralemmatisation of the distinction between openness and closeness translated into an input–output scheme

Input		Output
Not-open	**Not-closed**	**Not-open NOR not-closed**
0	0	1
0	1	0
1	0	0
1	1	0

concatenations of different appearances" (Spencer Brown, 1979, pp. ix, footnote 5). This is the "origin" of autopoiesis.

4 | OUTLOOK: BEYOND THE EPISTEMOLOGICAL OBSTACLE

If we discover and challenge our more or less implicit moralisations of openness and closeness, we can not only engage in a less moralistic and more truth-oriented reappraisal of the concepts of openness and closeness in systems theory but also considerably increase our observational margins. As a consequence, we may now find it easier to identify and moderate contradictions and tensions of general or particular systems theories.

In fact, one of the inner contradictions of open systems theory is that it builds both on up-to-date principles of physics and thermodynamics (von Bertalanffy, 1968, p. 102) and on rather materialistic definitions of its own core concepts. "A system is closed if no material enters or leaves it" (von Bertalanffy, 1950, p. 23), whereas an open system is "a system in exchange of matter with its environment, presenting import and export, building-up and breaking-down of its material components" (von Bertalanffy, 1968, p. 141). This circumstance is remarkable given that, true to von Bertalanffy (1955, p. 247) himself, solid matter constitutes the "most trivial of the categories of naive physics" and "consists almost completely of holes, being a void for the greatest part, only inter-woven by centers of energy which, considering their magnitude, are separated by astronomical distances."

Thus, the option of a switch from the observation of matters and facts to energies and co-occurrences is already inherent in the Bertalanffian open systems theory. It is therefore not only possible but also not far-fetched to make use of that option. We may therefore safely embark on a cosmos where all forms of systems—including social systems—are structurally coupled to their environment not by material flows or exchanges of matter or information but by self-made information and self-maintained differentials of energy and complexity. Still, this option is not necessarily intended to replace the earlier one. The issue of openness and closeness in systems theory is not a matter of either-or. Rather, the post-Archimedean point is that the actually more basic distinction between systems and environment allows for the observation of a switch between openness and closed and for our ability to use it. The demonstration of this option has been the first main purpose of this article.

Another outcome of this article is the realisation that our ability to observe and make use of paradigmatic switches is considerably increased by the use of programmes. This is indicated by our discussion of the matrices presented in Tables 1–4b. These matrices are indeed simple programmes, and programmes are observers, and they definitely are observing systems as soon as their architecture is based on re-entries. In this tetralemmatic form, a matrix programme communicates not only with itself but also with its environment. This notion of environment refers not only to those other observing systems we may refer to as programme users but—by virtue of the programme's inherent neither-nor option—also to all aspects of the environment that are masked out by the system's own distinction and thus to an environment that is obviously created by the system's own distinction(s).[3] The major implication of the idea that

[3]The implied attribution of agency to programmes might seem esoteric or artificial because we might hold that programmes are allopoietic systems that are not operational before they are used by persons. Yet a Luhmannian counter-argument would be that the agency of programmes does not depend on persons as they can also be used by organisations and that persons are allopoietic systems (Roth, 2013) and therefore not a first choice if it comes to the activation of allopoietic systems.

environments are created by systems and not vice versa is that environment is a plural and nothing but a plural. As much as "anything said is said by an observer," anything observed is observed by an observing system; and each observing system—including those whose autopoiesis is contested—creates its own environment. There is hence no such thing as *the* environment anymore, at least not in a form that would be cognizable to any observing system. As a result, there is as little use for monolithic biological models of the environment as there is for a second-order versions of the dated institutionalist nature-man, nature-culture, or nature-society divides and their revival in the shape of ecosystems theories. For if the environment was a system, then what would be in its environment if not another environment? There is hence an environment for every environment, however, only if we observe it as a system and therefore as only one environment among others. From this multienvironmental perspective, we eventually find that systems theory in general and classical general systems theory in particular assume that the concept of environment may be confused with nature. Nature, however, is only the environment of natural sciences. For social sciences, by contrast, there is a multitude of environments such as the market (the environment of the economy) or the Creation (the environment and world concept of religion).

As long as we systems theorists wish to maintain the Bertalanffian ambition to create a really interdisciplinary, multidisciplinary, and transdisciplinary infrastructure in which the social sciences are peer and not second or auxiliary to the natural sciences, natural sciences have to accept and makes sense out of the circumstance that, to a social scientist, nature—as the environment of the social system called (natural) sciences—does not take priority over the environments of other function systems of society, including that of religion. After centuries of antireligious resentments in particularly the natural science, again, we find that implicit moralisations of and preferences for particular world views constitute considerable epistemological obstacles. Yet to explore these would be another article.

ACKNOWLEDGEMENTS

The author is grateful to the anonymous reviewers for their very helpful comments. The author also gratefully acknowledges financial support from the Research Council of Lithuania and the European Regional Development Fund-ERDF/FEDER (National R&D Project 01.2.2-LMT-K-718-02-0019).

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How to cite this article: Roth S. The open theory and its enemy: Implicit moralisation as epistemological obstacle for general systems theory. *Syst Res Behav Sci*. 2019;1–8. https://doi.org/10.1002/sres.2590