Aristotle and George Spencer-Brown

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"Concentration. Empty your mind."
(Laurie Anderson, *Homeland*, 2010)

ABSTRACT: The paper deals with Aristotelian logic as the special case of more general epistemology and sociology of both science and common sense. The Aristotelian principles of identity, of noncontradiction, and of excluded middle are to be supplemented by the second-order cybernetic, or "cybernethic" principles of paradox, of ambivalence, and of control. In this paper we collect some ideas on how to evaluate the scope of Aristotelian logic with respect to the laws of thought they tried to determine and to do so within the historical moment of the impact of the invention of writing possibly triggering this determination. We look at some modern doubts concerning these laws and discovering an understanding of complexity that is not to be resumed under any principle of identity. The invention of sociology, epistemology, and the mathematics of communication follow suit in focusing not only on the observer but more importantly on the distinction between observers to further contextualize any talk of identities and operationalize both talk and fact of contradiction, paradox, and ambivalence.

Some laws of thought

The following remarks look at Aristotelian logic as a special case of a more general epistemology and sociology of both science and common sense. The Aristotelian principles of identity, of noncontradiction, and of excluded middle:

$$A = A$$

$$\neg(A \wedge \neg A)$$

$$A \vee \neg A$$

are a single-observer logic which in all cases of multiple-observer epistemology and sociology are to be supplemented by the second-order cybernetic, or "cybernethic" (von Foerster 1993 and 2003), principles of paradox, of ambivalence, and of control:

$$a \neq a$$

$$a \wedge \neg a$$

$$a \vee a$$

Ever since observers discovered they were not alone, both epistemology and sociology have called for principles that acknowledge that observers disagree not only for the sake of disagreement but also because of their respective perspectives, of the issue disagreed about, and of the times that are changing.

As Aristotelian logic calls for a truth to insist on, an exclusive perspective on the world, and decisions to settle matters; second-order cybernetic epistemology and sociology invite contradiction, look for the complementarity of the opposite, and propose to trade identities within different contexts.

As Aristotelian logic is governed by the fear that *ex contradictione quodlibet*, second-order cybernetic epistemology and sociology rather emphasize that *in realitate arbitrium*. The metaphysics we are dealing with is not the ontology of subjects trying to agree on how to look objectively at the world but that of an ontogenetics of issues trying to prove their value. Only when such an issue is substantially and essentially determined to be such and such do the Aristotelian principles apply. But then the issue is already almost dead or technically trivial.

In this paper we collect some ideas on how to evaluate the scope of Aristotelian logic with respect to the laws of thought they tried to determine and to do so within the historical moment of the impact of the invention of writing possibly triggering this determination. We look at some modern doubts concerning these laws and discovering an understanding of complexity that is not to be resumed under any principle of identity. The invention of sociology, epistemology, and the mathematics of communication follow suit in focusing not only on the observer but more importantly on the distinction between observers to further contextualize any talk of identities and operationalize both talk and fact of contradiction, paradox, and ambivalence.

Eventually, the laws of thought find themselves reframed by the more general laws of form, which rely on a logic of supplements and thus resume all three second-order cybernetic principles in a single equation:

$$a = \overline{\overline{a}\, b}$$

The paper therefore concludes with some quotes from George Spencer-Brown's (2008) calculus of indications.

The impact of writing

It is well known that Aristotle's insistence on the law of noncontradiction, from which the two others of excluded middle and identity were to be deduced (*Metaphysics* Books IV and V), is not as dogmatic as it later came to be treated in scholastic philosophy. Aristotle conceded, or, it might be better to say, warned that as soon as one wants to talk accidents, not substance, contradictions may well apply to certain things accidentally determined by further accidents (*Metaphysics* 1007b). In his *Physics* he allowed beginnings to begin in oppositions, and be it only to enable something to become of them (*Physics* 188a). Apparently the principle of *ex contradictione quodlibet* here becomes a sort of anti-Parmenides principle of the possibility of the manifold. And in his *Rhetoric* Aristotle calls the art of persuasion the art of demonstrating the possible truth of things, while acknowledging and even rhetorically drawing on the fact that they could be different as well (*Rhetoric* 1357a).

Thus, Aristotle was possibly as little Aristotelian as, much later, Marx was a Marxist. Yet we leave the task of separating Aristotle from Aristotelian scholastic philosophy to others more competent in these matters and focus on why Aristotle found it necessary to think about laws of thought in the first place (Danaher 2004). His logic was not uncontested in ancient philosophy, either, and is often considered to be about norms of talk, most notably assertions and their complementary judgments (*noumena*), rather than about the becoming and being of real things (*phenomena*) (Janich 2006).

When retranslating the laws of thought into a more general epistemology and sociology of laws of form we first of all have to give these laws of thought an historical index, which may be able to explain the focus on the special case as the fundamental case. Our idea here is that Aristotle's logic is in fact to be considered an important and essential part of his teleological thinking, which again is part of an ancient cosmology, one motive of which was to reinterpret the world after the shock produced by the invention of writing in general and the alphabet in particular, which suddenly and highly paradoxically froze the oral flow of the world into words to look at and inquire into (Ong 1967, 1977), and by the development of an artificial memory through writing that almost exploded the time horizons of past and future since memories and expectations now becoming fixed and at the same time subject to interpretation and reinterpretation (Havelock 1963).

'Philosophy' as distinct from 'myth' (which only now becomes 'myth') is the answer to a world presenting its observers with words and their symbols (letters) becoming as material as previously only things could be and at the same time losing their backing in interaction and thus the certainty of reference to meanings and judgments of people present (Luhmann 1992

and 1997, chap. 2, sect. V and XIV). In order to be able to reject or accept any communication depending on the situation, teleology was invented to ensure that the place and purpose (*telos*) of a proposition, assertion, demand, or expectation can be inquired into at any time. However, teleology makes sense only if it is able to distinguish things in what they are from what they are not. The laws of thought support a rhetorical device, viz. teleology, to deal with written language. Philosophy benefits and suffers from an immense extension of meaning horizons both seeking determination and bringing new indeterminacies.

Modern doubts

The laws of thought, let alone any thinking about them, introduce a reflexive instability and insecurity into philosophical and, for that matter, theological thinking that are not really welcome despite the fact that they manage reliably to fuel the problems to which this very thinking claims to have answers. One cannot develop clear and sharp thinking based on the laws of noncontradiction, excluded middle, and identity without noticing that, in being formulated, these very laws exclude other possibilities, which in being argued about become as attractive as repelling. To this day, multivalued and paraconsistent logics monitor the scope of the laws of thought, frame them, but have nonetheless never gained much of a reputation of their own. Yet by logically arguing about Aristotelian laws they perhaps constrain any thinking about thinking even more than these laws within their shifting contexts manage to do.

It seems rather to be the principle of doubt itself, performed and made famous by René Descartes, which in parallel to the superposition of writing by the printing press proved its value as a fundamental principle in reflecting both talk and thought and in reassuring that somewhere, and be it in God, all doubt and reflection must find their end. Doubt, well known from ancient skepticism, supersedes *telos* as a perfect tool for translating reading into criticism, for comparing one book with other books, and for dealing with the criticism brought forward by others who fortunately do not escape criticism themselves.

The search for 'method' carried on by Descartes in his *Discours de la méthode* as well as in his *Meditationes de Prima Philosophia* does not find a method for gaining certainty in judgment, let alone new laws of thought or at least an affirmation of Aristotelian laws of thought, but it reveals that there are at least two things to consider at any time, *res intensa* and *res extensa*, thinking and being, neither of which is ever to be reduced to the other. The Cartesian coordinate system, which owes its name to Descartes' development of an analytical geometry, Gottfried Wilhelm Leibniz's invention of functions, $x = f(y)$, as much as his

monads depending on a communication with God to communicate with each other, Immanuel Kant's transcendental ego relying on X to be able to relate A and B, Hegel's insistence on crossings to describe the becoming of a being, and even Nietzsche's *Wille zur Macht* all prove the fundamentality of difference, not identity, when thinking about thinking and talking about things.

One may well deplore the 'nonsense of reflection' (Blau 2008) in the first place, but once it is in the world, there are only indeterminacies and paradoxes to begin with, and no identities and excluded middles to end with.

And what is more, modern thinking ever since Descartes has been at least dual in describing a world, a function, an ego, a crossing, or a will. This means that it basically opts for complexity instead of for unity if any complexity consists of at least two units, elements, variables, or factors determined not to be reduced to each other.

Yes, but

Slowly but surely a logic of necessary if arbitrary supplements in dealing with any identity gained ground. It was eventually be formulated in Heidegger's (1967) and Derrida's (1982) philosophy but it first defined a new academic field: sociology. Sociology is a science based on just one logical operation or logical connective, which may be called 'yes, but'. I am not sure whether this connective fits any truth table. It certainly does not fit in with any principle of identity either in talk or in substance. It is like a principle of contradiction inviting excluded middles just for the sake of making sure that no actor definitely escapes attention in whatever game of the social. "Not because they are they, but there," Thomas Hobbes (1968: 75) wrote in his Epistle Dedicatory to the *Leviathan*. Ever since social games have been defined not by exclusion but by how they include exclusion.

Sociology or more precisely sociological theory uses and develops the 'yes, but'-principle in many ways. Friedrich Schleiermacher (1995) discovered an easy-going limbo between minutest details and biggest picture without any attempt at determination as the rule of sociable conduct, which invites both 'yes' and 'but' as its links between issues and contributions. Auguste Comte (1979) proposes looking at statics and dynamics at the same time when analyzing a social phenomenon, since any one phenomenon has statically (or horizontally, so to speak) to make sure it keeps contact to its surroundings, distinguishing and re-embedding itself constantly, and has dynamically (or vertically, so to speak) to make sure it develops in such a way that it is recursively able to relate, by cutting and linking, its future back to its past. Gabriel Tarde (1962) counts on errors of imitation (due to biographical

inertia) to ensure that social association fosters heterogeneity as much as homogeneity. Emile Durkheim (1984) formulates the laws of social division consisting as much in distinction and repulsion as in complementarity and solidarity as if he wanted to provide the empirical and operational translation of Aristotle's thinking about the logics of genres, which, as it were, included the distinction from other genres in the definition of any one of them (*Metaphysics* 1037b-1038a). Max Weber (1968) defines the meaning of any action as given not by the actor but by the observer as if he wanted to make any future intentionality theory of action (which, however, did not take notice) impossible. Georg Simmel (1950) envisions individuals being only partly socialized as the indispensable precondition for any social order relying on socialization. And Erving Goffman (1952) sees action as being possible because actors reassure themselves of being able to learn from the experience of having been deceived.

'Yes, but' in all these cases means that there is a basic understanding of complexity as opposed to identity and as including both contradictions and middles, if we again understand by 'complexity' any manifold which constitutes a unity by never collapsing any part of the manifold into any other. We end up with a necessarily 'holistic' and 'systemic' thinking if this kind of thinking consists in saying that one may never be sure of not having to include further aspects in a phenomenon when trying to describe and explain its behavior. This thinking is not saying that 'wholes' and 'systems' govern the behavior of their parts and elements but that these parts and elements entertain a never to be determined relationship with further parts and elements which any moment may again escape our attention.

Selected from a set

Claude E. Shannon's and Warren Weaver's *Mathematical Theory of Communication* is important because it provides that kind of holistic and systemic thinking with a notion of information calling 'information' any message "*selected from a set* of possible messages" (Shannon/Weaver 1963: 31). This becomes the starting point of a calculus of communication the moment one drops Shannon's assumption that the set of possible messages is externally and thus technically given and instead assumes that this set is socially and thus internally constructed along with the selection of a specific message (Baecker 2005). Now any information stems from, or is produced by, a relation between a specific message on the one hand and a set of possible messages on the other.

Aristotelian laws of thought are congruent with Shannon's assumption. An externally and thus technically given set of possible messages calls for noncontradiction, excluded middles and identities to be able to be specific about a selected message. Coding and decoding

following the same rules and "reproducing at one point either exactly or approximately a message selected at another point" (Shannon/Weaver 1963: 31) are only possible if the laws of thought are carefully obeyed. Any ambivalence can stem from only noise interfering, so that all control focuses on eliminating noise. Paradoxes are deliberate attempts to provide this kind of technical communication (or, rather, signaling) with self-reproducing devices of noise production (Krippendorff 1984; Luhmann 1999).

As soon, however, as we assume that the set of possible messages is not given but to be constructed along with any specific selection, we need contradiction and included middles (called 'means' by Latour 2005) to be able at any instant to generate further possibilities of selection out of those already realized. Paradoxes guarantee the necessary agitation along with their invitation to any observer to step in and produce a creative way out of them. Noise, just to stay creative, is better called a part and element of the system (Serres 1982). We call 'play' any attempt to use frames while never losing sight of their form (Bateson 2000: 177-193).

Sociology follows suit. Talcott Parsons (1978) knows enough about cybernetics, the sister theory to the mathematical theory of communication, to in fact cross Comte's distinction between statics and dynamics with a cybernetic hierarchy of energy and information to come up with a necessary set of at least four aspects (not counting the inner differentiation of any one of these aspects into a further four aspects) of any action describing its choice of possible messages while attending simultaneously to demands of adaptation, goal-attainment, integration, and latent pattern-maintenance and conflict-management (AGIL). Harrison C. White (1992) writes an uncertainty calculus of network links, ties, decouplings, and embeddings just to make sure that depending only on ecological siting nothing else restricts identities to control identities including their own. Grammar providing for reflexivity and indexicality is quoted to lend structure to meaning always on the go (Fontdevila/Opazo/White 2011). And Niklas Luhmann (1998; 1997) considers nothing less than contingency to be the *eigen*-value of a modern society monitoring its autopoiesis in terms of interaction, organization, and functional sub-systems to self-contradict its blindness via a multiplication of most improbable first- and second-order observer perspectives.

Call it communication, network, or system. They all explore selections to be specified with respect to further selections within moving horizons of still further possibilities to be included as excluded. Paradox keeps any specific meaning alert. Ambivalence checks for exclusions to be included. And control maintains that for the time being even some laws of thought may apply.

Operational research

Modern logic, while in quest of mathematization, is basically all-inclusive. It attempts to know of only two cases, Nothing, 0, and the Universe, 1 (Boole 1958), and calls for an infinite community to exclude the possibility of fallacious judgments based on incomplete probabilities (Peirce 1878). Another Aristotelian law of thought, viz. the *dictum de omni et nullo* (Boole 1958: 4), still governs a search for a method to gain certainty even if this certainty cannot be that of mortal beings but only of some immortal community. Pragmatism thus falls short of being another version of holistic and systemic thinking, because any operation or sign is already governed by this community, the Universe, 1, without considering the possibility that it may be creating its own universe, a marked state, ⌐ .

A second-order cybernetic epistemology and sociology opts for a different kind of mathematics, which considers Aristotelian logic a special case by in fact looking at Nothing and the Universe, 0 and 1, as the borderline cases of all cases of interest, namely universes of all kinds, i ∈ ℂ, which know of no general case but that of a *dictum de uno*. This means that we propose to adopt a scientific method not out of abstraction and generalization but out of observation and evaluation (Korzybski 1994). Paradox, ambivalence, and control define principles that prove their value not in policing the opinions and assertions of a community of observers but in monitoring the way any observer approaches a phenomenon while taking other observers' distinctions into account and considering the phenomenon as possibly able to observe and observe observers as well.

This translates into W. Ross Ashby's (1958: 97/8) concept of 'operational research' recommending (not unlike Descartes' *morale par provision* and Epictetus' [1994] distinction between *prohairetic* and *aprohairetic* things) to look at what happens, not at why it happens, to never collect more information than necessary for the job at hand, and not to assume that the system does not change, that is to only try to solve the problems of today. The simplicity of such procedures of operational research allow, on the other hand, paradox, ambivalence, and control to be accounted for, or, better, to apply these principles to the observation of the phenomenon (action, network, or system) of interest in order to attract as much variation and thus as much information as one is able to muster.

Thus, instead of working with Aristotelian laws of thought we may try Spencer-Brown's (2008) laws of form, which present a calculus of indications able to operationalize self-reference and, thus, paradoxically, to translate ambivalence into oscillation, and to gain control from indeterminacy.

Operational research begins with your acknowledgment as an observer drawing distinctions to indicate and distinguish your phenomenon of interest. Your first operation, not the operation of the phenomenon, is the use of an equal sign, "=", which Spencer-Brown (2008: 57) proposes to read as "is confused with", just to be sure that the observer does not forget about himself doing what he is doing. In fact, the equal sign indicates that you, an observer, are searching for a specific interaction with a phenomenon, an interaction, moreover, that will try to 'define' the phenomenon, that is to constrain it firstly in accordance with your observation and, secondly, in accordance with possible interaction you are going to offer to, and experience from, the phenomenon. Heidegger (1969), as well, thus proposes to read 'A = A' as 'A *is* A', or, using a notation used in computer sciences (Knuth 1996), 'A := A', to emphasize the placing of the copula as an operation of its own kind, necessarily involving an observer designing and describing his own *Dasein* when doing so.

Taken together, the operation of crossing a boundary and an observer, yourself, watching it amount to assuming that the phenomenon, say *i*, crosses a boundary from unmarked to marked, which may be written as follows:

$$i = \overline{}$$

As we assume that the phenomenon is somehow able to observe, that is to indicate and distinguish itself, as well, we also write:

$$i = \overline{i}$$

This reads, *i* is confused with *i* indicating itself as being distinguished from the unmarked state. Note that in Spencer-Brown's (2008: 91) reading of the cross this means that *i* is confused with *i* negating itself to imply the unmarked state. We have here our paradox, a ≠ a, if *i* is taken to be itself and not itself at the same time. And we are stuck, as any observer should be, when hitting on a paradox.

In order to start any inquiry whatsoever we have to be creative to escape the paradox. Our creativity, self-controlled by watching other observers and by watching the phenomenon itself, takes the form of an assumption about what exactly the unmarked state may look like if implied by the phenomenon negating itself. We mark the unmarked state. We introduce *j*:

$$i = \overline{i} \, j$$

However, this tells us nothing except something about our own observing if we now do not try to figure out how *j* informs *i* on how to distinguish itself:

$$i = \overline{\boxed{i}\, j}$$

We need no more to begin our inquiry of, or better, the story of our relationship with *i*, which we take as non-identical with and thus contradictory to itself while still indicating itself as itself, which, moreover, we define by its ambivalence of needing itself, *i*, as much as something else, *j*, to define its identity, and which thereby we call to be able to control itself via a control of *j* and of its distinction from *j*.

The operation, which allows us to begin this story of our relationship with *i* (which will be the story of a relationship with *j* as well) is an operation called 're-entry' by Spencer-Brown (2008: 53). It indicates the crossing of a distinction into its own space of distinction, the condition of which is taken to be an infinite iteration of the first cross within its context of implicit crosses (Varga von Kibéd 1989). Thus, "self-reference is the infinite in finite guise" (Kauffman 1987: 54). Paradox, ambivalence, and control are possible and creative as long as we deal as in a Turing machine with an autopoietic form only to be stopped from without.

Actually, our both general and highly special case, $i \in \mathbb{C}$, becomes imaginary and thus complex only by the very operation of re-entry. Due to the infinity of its operation it becomes impossible to pin down its oscillating and self-memorizing form to either the marked or the unmarked state, but this loss of determination is compensated by an indeterminacy calling upon time to realize the spectrum of what it is possible for *i* to do.

Accidental worlds

Thus, we are back to Aristotle's world of accidents being accidents to accidents without any contradiction being impossible (*Metaphysics* 1008b). Yet we do not have to search for a law of contradiction nor of excluded middles and identities to be attached to it because there are two other limitations to every proposition claiming any kind of truth. Those are limitations, to be sure, not unknown to Aristotle. The first is the limitation of the observer. We are only talking about accidents as indicated and distinguished by a specific observer, such that in observing this observer we always have the choice to take an interest in the accidents he singles out or in the distinctions he uses to talk about accidents.

The second limitation stems from the assumption of self-organization. We are only talking about accidents as they emerge in the context of other accidents and regard emergence as the one proposition about the world that is unconditionally true because it is identical with the

fact of world itself. Things happen, they coalesce, and they separate again. Our cybernetic principles of paradox, ambivalence, and control are not laws of things, but laws of form. They concatenate our observations, including our observations of other observers, with accidents coalescing. And they make sure that any proposition we may put forward at any time cultivates degrees of freedom with which we invest our objects to keep them with us as well.

The heuristics we are here describing is still tied to Aristotelian teleology, if *telos* means that there are ends as well as purposes, that is: limits, to any proposition (*Metaphysics* 994b; see also Rosenblueth/Wiener/Bigelow 1943). But these limits are not about the perfection of a cosmos, nor are they reasons attached to this perfection of the cosmos; they are about an ecology of improbable possibilities. Any proposition we may put forward is part and element of this ecology, and proves its value depending on observers adopting it and accidents seeming to obey its predications.

Spencer-Brown's laws of form in distinction to Aristotelian laws of thought benefit from two other media shocks reconfiguring the world and its observers after the introduction of writing had its impact on a tribal world, transforming it into the ancient world. The impact of writing was doubled and tripled by that of the printing press and electronic media. Our trust and mistrust of symbols was doubled and tripled by trust and mistrust in mass distributed letters and trust and mistrust in digital connections. We were certainly able to handle all three of them only due to hundreds of thousands of years of societal evolution focusing on trust and mistrust of the spoken word. We have known ever since that communication depends on being able to refuse and reject most of it when receiving and accepting some of it. Any new media shock helps us to update this insight. Paradox, ambivalence, and control prove to be techniques to both practically and scientifically deal with accidental worlds.

Bibliography:

Aristotle (1984): The Complete Works, ed. J. Barnes, 2 vols., Princeton, NJ: Princeton UP.

Ashby, W. Ross (1958): Requisite Variety and Its Implications for the Control of Complex Systems, in: Cybernetica 1, pp. 83-99.

Baecker, Dirk (2005): Form und Formen der Kommunikation, Frankfurt am Main: Suhrkamp.

Bateson, Gegory (2000): Steps to an Ecology of Mind, Reprint Chicago, IL: Chicago UP.

Blau, Ulrich (2008): Die Logik der Unbestimmtheiten und Paradoxien, Heidelberg: Synchron Wissenschaftsverlag der Autoren.

Boole, George (1958): An Investigation of the Laws of Thought on which are founded the Mathematical Theories of Logic and Probabilities, New York: Dover Publ.

Comte, Auguste (1979): Social Statics & Social Dynamics: The Theory of Order and the Theory of Progress, Albuquerque, NM: American Classical College Press.

Danaher, James (2004): The Laws of Thought, in: The Philosopher LXXXXII, no. 1, pp. 3-7.

Derrida, Jacques (1982): Différance, in: Jacques Derrida, Margins of Philosophy, transl. Alan Bass, Chicago, IL: Chicago UP: 3-27.

Descartes, René (1985): The Philosophical Writings, 2 vols., transl. John Cottingham, Robert Stoothoff, and Dugald Murdoch, Cambridge: Cambridge UP.

Durkheim, Emile (1984): The Division of Labor in Society, transl. E. D. Halls, introd. Lewis A. Coser, New York: Free Press.

Epictetus (1994): A Manual for Living, a new interpretation by Sharon Lebell, San Francisco: HarperSanFrancisco.

Fontdevila, Jorge, M. Pilar Opazo, and Harrison C. White (2011): Order at the Edge of Chaos: Meaning from Network Switchings Across Functional Systems, in: Sociological Theory 29, pp. 178-198.

Goffman, Erving (1952): On Cooling the Mark Out: Some Aspects of Adaptation to Failure, in: Psychiatry: Journal of Interpersonal Relations 15, pp. 451-463.

Havelock, Eric A. (1963): Preface to Plato, Oxford: Blackwell.

Heidegger, Martin (1967): Being and Time, transl. John Macquarrie and Edward Robinson, Oxford: Blackwell.

Heidegger, Martin (1969): The Principle of Identity, in: Martin Heidegger, Identity and Difference, transl. and introd. Joan Stambaugh, New York: Harper & Row, pp. 23-41.

Hobbes, Thomas (1968): Leviathan, ed. C. B. Macpherson, Harmondsworth, Middlesex: Penguin.

Janich, Peter (2006): Der Satz vom Widerspruch, in: Peter Janich, Kultur und Methode: Philosophie in einer wissenschaftlich geprägten Welt, Frankfurt am Main: Suhrkamp, pp. 105-134.

Kauffman, Louis H. (1987): Self-Reference and Recursive Forms, in: Journal of Social and Biological Structures: Studies in Human Sociobiology 10, pp. 53-72.

Knuth, Donald E. (1996): Algorithms in Modern Mathematics and Computer Science, in: Donald E. Knuth, Selected Papers on Computer Science, Stanford, CA: Center for the Study of Language and Information, pp. 87-114.

Korzybski, Alfred (1994): Science and Sanity: An Introduction to Non-Aristotelian Systems and General Semantics, 5th ed., Lakeville, CT: Institute of General Semantics.

Krippendorff, Klaus (1984): Paradox and Information, in: Progress in Communication Sciences 5, pp. 45-71.

Latour, Bruno (2005): Re-Assembling the Social: An Introduction to Actor-Network Theory, Oxford: Oxford UP.

Luhmann, Niklas (1992): The Form of Writing, in: Stanford Literature Review 9, pp. 25-42.

Luhmann, Niklas (1997): Die Gesellschaft der Gesellschaft, Frankfurt am Main: Suhrkamp.

Luhmann, Niklas (1998): Observations on Modernity, transl. William Whobrey, Stanford, CA: Stanford UP.

Luhmann, Niklas (1999): The Paradox of Form, in: Dirk Baecker (ed.), Problems of Form, Stanford, CA: Stanford UP, pp. 15-26.

Ong, Walter J., SJ (1967): The Presence of the Word: Some Prolegomena of Cultural and Religious History, New Haven, CN: Yale UP.

Ong, Walter J., SJ (1977): Interfaces of the Word: Studies in the Evolution of Consciousness and Culture, Ithaca, NY: Cornell UP.

Parsons, Talcott (1978): A Paradigm of the Human Condition, in: Talcott Parsons, Action Theory and the Human Condition, New York: Free Press, pp. 352-433.

Peirce, Charles Sanders (1878): The Doctrine of Chances, in: Popular Science Monthly 12, pp. 604-615 (CP 2.645-668).

Rosenblueth, Arturo, Norbert Wiener, and Julian Bigelow (1943): Behavior, Purpose and Teleology, in: Philosophy of Science 1, pp. 18-24.

Schleiermacher, Friedrich (1995): Friedrich Schleiermacher's 'Toward a Theory of Sociable Conduct', and Essays in Its Intellectual-Cultural Context, ed. and tr. Ruth Drucilla Richardson, Lewiston, NY: Edwin Mellen Press.

Serres, Michel (1982): The Parasite, transl. Lawrence R. Schehr, Baltimore, MD: Johns Hopkins UP.

Shannon, Claude E., and Warren Weaver (1963): The Mathematical Theory of Communication, Reprint Urbana IL: Illinois UP.

Simmel, Georg (1950): The Sociology of Georg Simmel, transl., ed., introd. Kurt H. Wolff. Glencoe, IL: Free Press.

Spencer-Brown, George (2008): Laws of Form, 5th engl. ed., Leipzig: Bohmeier.

Tarde, Gabriel (1962): Laws of Imitation, transl. Elsie Clews Parsons, introd. Franklin H. Giddings, Gloucester, MA: P. Smith.

Varga von Kibéd, Matthias (1989): Wittgenstein und Spencer Brown, in: Paul Weingartner and Gerhard Schurz (eds.), Philosophie der Naturwissenschaften: Akten des 13. Internationalen Wittgenstein Symposiums, Wien: Hölder, Pichler & Tempsky, pp. 402-406.

von Foerster, Heinz (1993): KybernEthik, Berlin: Merve.

von Foerster, Heinz (2003): Understanding Understanding: Essays on Cybernetics and Cognition, New York: Springer.

Weber, Max (1968): Economy and Society: An Outline of Interpretive Sociology, ed. Guenther Roth and Claus Wittich, transl. Ephraim Fischoff et al., New York: Bedminster Press.

White, Harrison C. (1992): Identity and Control: A Structural Theory of Action, Princeton, NJ: Princeton UP (2nd ed. 2008).