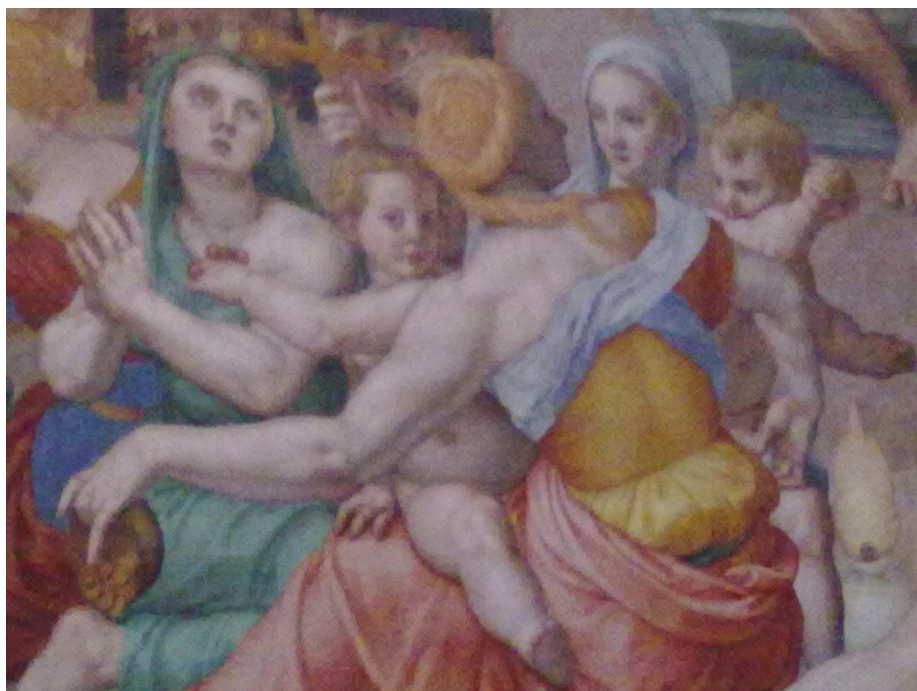# Operational Closure and Philosophy: Ontological and Epistemological issues in Constructivists Systems Theories

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I.   Operational Closure in Hegel's Ontology

A thesis arguing for the 'operational closure' of thought is given credibility via G.W.F. Hegel's conclusions in the *Science of Logic* (and *Philosophy of Mind*) where thought becomes wholly ideal. In its ideality, thought cannot be considered finite inasmuch as it does not depend on an-other for its production.[1] The ideality of thought consists in its infinity,

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[1] *Philosophy of Mind*, § 378, *Zusatz*: "Mind is not an inert being but, on the contrary, absolutely restless being, pure-activity, the negating or ideality of every fixed category of the abstractive intellect; not abstractly simple, but, in its simplicity, a distinguishing of itself from itself."

defined, that is, in its exclusive *self*-production.[2] Indeed, as the 'Doctrine of Essence' had shown, thought posits *its own* reflective determinations and its own conditions of grounding (and sensibility); but the 'Doctrine of the Notion' (the Idea) demonstrates that this activity of positing is staged in order to erase[3] those determinations and conditions and produce *only more of itself*. As Hegel put it:

> Thus, if the Science of Logic considers thinking in its activity and its production (and thinking is not an activity without content, for it produces thoughts and Thought itself), its content is in any event the supersensible world; and to be occupied with that world is to sojourn in it. Mathematics has to do with the abstractions of number and space, but these are still something sensible, though in an abstract way and not as really being there. Thought says farewell even to this last element of the sensible, and is free, at home with itself; it renounces external and internal sensibility, and distances itself from all particular concerns and inclinations.[4]

Here, thought has 'renounced' its attachment to sensibility and eschewed any presuppositions of some natural or mathematizable world exterior to itself. Scholars such as William Maker and Richard Dien Winfield are right to emphasize the foundationless nature of the Hegelian logic. For, only if thought is foundationless—making no recourse to external givens to articulate its nature—can it be said to be fully *self-productive*;[5] only in

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[2] *Science of Logic*, 149: "the image of true infinity, bent back into itself, becomes the circle, the line which has reached itself, which is closed and wholly present, without beginning and end." The circle Hegel has in mind is not the geometric figure of picture-thinking, but is the image of auto-production.

[3] We are fond of David Gray Carlson's characterization of the Absolute Idea as a system of *self-erasure*. "What is true in Hegel's system is that *both* subject and object self-erase. That is the *Idea*" (604). *A Commentary to Hegel's Science of Logic* 2008.

[4] *Encyclopedia Logic*, § 19, Addition 2.

[5] Garaets 1984, 34: "This movement (not some entity or entities) is for Hegel the absolute truth and all truth— it is self-articulation as the all-encompassing, all-generating process....Reality is for Hegel realization,

virtue of its own immanent development can logic lay claim to thought's presuppositionlessness. Additionally, even if thought proves to be an externally-determined being, as it did for Hegel, demonstration of this fact is possible only if thought *shows itself* to be so determined. Thought is externally determined, then, only insofar as thought determines itself to be externally determined. Thought determines its own externality by creating the environment in which it actively produces and maintains itself.

Yet this act of creation, an early form of constructivism, is by no means direct or simple—assessing the way in which this act takes place is a central preoccupation of 20th century systems philosophy, systems theory, and system sciences. In the *Logic*, the disavowal of forms of exteriority applies to thought's genesis, not its objective structural determinations. Hegel characterized thought, or 'mind,' as infinite precisely because it does not *depend* on (external) inputs from its environment in order to conduct its operations of self-production. These operations are immanent and unconditioned with respect to any external environment (e.g., what is given *to* thought). Thus, the Hegelian thesis on the ideality of thought is not the invocation of a human cognition or 'consciousness' writ-large on some God-like mind, but refers to an *operationally closed totality, or system*, that functions in virtue of its self-referential operations (or distinctions). Hegel expressed this thesis in the following terms:

> It can, of course, be said that logic is the science of *thinking*, of its *determinations* and *laws*, but thinking as such constitutes only the *universal determinacy* or the *element* in which the Idea is [simply] logical. The idea is thinking, not as formal thinking, but as the self-developing totality of its own

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Wirklichkeit is Verwirklichkung, ultimately (and originally) not by addition or by interaction of separate identities—be it entities or categories—but only and purely through inner differentiation and articulation."

peculiar determinations and laws, *which thinking does not already have* and find given within itself, but which it gives itself.[6]

Hegel argues that 'thought' is *ideal*, then, precisely because it immanently generates itself as a totality, or system, without recourse to external determination.[7] Hegel clarifies this point:

> [i]n this sense the Idea is the *rational*; it is the unconditioned, because only that has conditions which essentially relates itself to an objectivity, but an objectivity that it has not itself determined but which still confronts it in the form of indifference and externality, just as the external end still has conditions.[8]

Hegel believed that all individuals, grasped systemically, possessed this same self-generating, or autopoietic, character;[9] and his development of an immanent ontology of individuation was meant to demonstrate 1) that thought's systemic immanence *owes to* its operational closure and 2) that the act of thinking, so construed, informs the individuation of all individuals. But what is meant here by operational closure, a concept taken from 20th century autopoietic systems theory?

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[6] *Encyclopedia Logic*, §19.

[7] I have stated the ideality of thought as unconditioned with respect to external determination as a structure of self-determination and autopoietic production in Hegel's *Science of Logic* in three of its moments: in "being-for-itself," "the emergence of the fact from existence," and in the "Idea."

[8] *Science of Logic*, 755.

[9] In this sense, Hegel's understanding of thought is much closer to Aristotle than Kant—he describes it as a process of development, active in its independence. See also Redding 2009, especially 28: "For Aristotle, there are three types of soul found in the living world—plant souls, animal souls and human, rational souls—and here 'soul' means something like the principle of something's activity and movement (*DA*: bks 2 and 3). Thus the Aristotelian 'soul' was not particularly connected with the phenomenon of consciousness...."

II. Cybernetics in its Second Wave: Autopoietic Theory and Operational Closure

In autopoietic systems theory,[10] operational closure holds for thermodynamically open systems that function by recursively generating their own elements, as if in a closed circle of production. Progenitors of autopoietic systems theory, Humberto Maturana and Francisco Varela, describe operational closure for nervous systems thusly:

> All that is accessible to the nervous system at any point are states of relative activity holding between nerve cells, and all that to which any given state of relative activity can give rise are further states of further activity in other nerve cells by forming those states of relative activity to which they respond.[11]

The nervous system, on their terms, neither 'represents' inputs given at the sensory surfaces by the interaction of the organism nor does it constitute an independent medium, least of all a description of an environment. Generalizing this insight, then, the operational closure of systems states the following:

1. Communication between system and environment is never direct, as in some efficient causation.
2. Causation for operationally closed systems is thus akin to that found in cybernetics, with its circular or recursive repetition.
3. All changes in a system are, first, internally determined and generated.
4. The environment thus appears as but a perturbing device or trigger of systemic change, but again, not as a direct or linear cause.
3. What appears to a system as its environment is merely a representation of its own internal states.

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[10] In its original and seminal formulations by Maturana and Varela (1973, 1980, 1987).
[11] Maturana and Varela 1973, 112.

4. There is no exchange of information between system and environment.[12] Information is produced, by systems, from environmental noise.

In terms of elements, and elemental operations, the system is operationally closed because no system operations are conditioned or determined by any elements (e.g., information) outside of the system. Operationally closed systems feature networks of production of elements that recursively, through their interactions, generate their own elements so that everything that is used by the system is produced by the system itself, for the system. Here, biological systems function only through the reproduction of biological parts (cells, tissues, nucleic acids); nervous systems function only through the communicative pathways of nerve cells (their axons and dendrites); and linguistic systems make use of phonemes in the speech production of our natural languages.

Yet the operations characterizing each of these systems are closed off from each other—they are *system-specific*. For example, when we become ill, we consult the physician. It cannot be said that our cells communicate the message to the physician through natural language; moreover, any verbal report we give of an illness does not directly affect the illness at the level of its biological reproduction. Rather, cells function and communicate directly only with other cells (as when neurons receive neuronal messages across synapses), and language forms a system proper with its own means of communication (grammar, speech). Because different systems communicate in different ways through operations (or distinctions) specific to *their own* networks of production, they maintain operational closure. This is not to say that there are no causal interactions between operationally closed systems,

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[12] See Rasch 2000, especially 129-130: "They can be 'perturbed'; they can react to these 'perturbations'; but these 'perturbations' do *not* enter the system as 'units of information' that can dictate the way a system organizes its own reactions. Therefore, systems have no direct access to their environments, cannot 'refer' to their environments, and can make no representation of what is external to them. The problem systems are faced with, then, is not one of adaptation and adequacy but rather one of how the tautology of self-reference can be interrupted and unfolded in a productive manner. Systems are faced with the interesting and circular problem of generating 'meaningful' external references where none exist."

but only that system *operations are unique to systems*. It is not difficult to see, then, that the autopoietic systems of Maturana and Varela replay crucial conceptual features of the Hegelian onto-logical system; yet they do not formulate an ontology of autopoietic systems. Instead, they champion the epistemological limitations of their theory.

Still, if we take *all* systems to be operationally closed (nervous systems, ecosystems, physical systems), then we implicitly accept an ontology of operationally closed systems. In pursuit of formalizing the concept of immanence both Hegel and, in the 20th century, Gilles Deleuze developed ontologies featuring systems that were, *de facto*, operationally closed, but without making explicit mention of the concept of operational closure.[13] Both Hegel and Deleuze specifically described thought (as well as the 'concept')[14] as self-generative (and in this sense autopoietic) and free from external determination, unconditioned by foundational or empirical givens. In a similar vein, such an ontology is not leastwise hinted at by Slavoj Zizek when, in his *For They Know Not What They Do: Enjoyment as a Political Factor*, he suggests the outlines of a generalized ontology for systems theory:

> Contemporary systems theory…its main effort consists in formalizing the so-called "auto-poetic" systems - systems which afterwards, by means of a retroactive "trans-coding," transform their starting, initial conditions. In its "prehistory," a system begins within conditions which determine it in an external way — that is, the signification of which is not determined by the system itself; this "prehistory" is over, the system finds its equilibrium and

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[13] It should be noted that Niklas Luhmann's sociological systems theory was unique in formalizing and generalizing the concept of operational closure for social systems (and for all systems which used communication as a medium). Deleuze did, however, deploy a concept of communication in his account of signal-sign systems in his *Difference and Repetition*, using it as did a key influence of his, Gilbert Simondon, and other cyberneticians of the 20th century.

[14] Deleuze even views Spinoza's *affects* as a form of thought. (Le Cours De Gilles Deleuze (24/01/1978): "Thus we start from a quite simple thing: the idea is a mode of thought defined by its representational character. This already gives us a first point of departure for distinguishing idea and affect (affectus) because we call affect any *mode of thought* which doesn't represent anything."

starts to run its own course, when it trans-codes its initial conditions by transforming them into inherent moments of its self-development.[15]

By specifying this autopoietic process of retroactive transcoding of initial conditions into grounding conditions, Zizek points up the problem of the individuation or actualization of these systems in the dimension of their genesis. We might liken such a movement of production to the image of drawing a circle and monotonously looping around its circumference,[16] yet the thesis of operational closure prohibits our envisioning this circle as monocentric as Deleuze, following Althusser, was wont to in his *Difference and Repetition*: "the insipid monocentricity of the circle in the Hegelian dialectic."[17] However, Deleuze's infamous anti-Hegelianism appeared to soften after his *Difference and Repetition*, where it is most pronounced. In *What is Philosophy?*, co-authored with Felix Guattari, Deleuze would go so far as to endorse, albeit with reservations, a different image of Hegelian circularity, one which places at its center a Hegelian auto-creation or auto-positing of the concept:

> Philosophers have not been sufficiently concerned with the nature of the concept as a philosophical reality. They have preferred to think of it as a given knowledge or representation that can be explained by the faculties able to form it (abstraction or generalization) or employ it (judgment). But the concept is not given, it is created; it is to be created. It is not formed but posits itself in itself—it is a self-positing. Creating and self-positing mutually imply each other because what is truly created, from the living being to the work of

[15] *For They Know Not What They Do: Enjoyment as a Political Factor*, 214-219.

[16] Circularity is a key image in system philosophy and sciences and so can be related to the concept of operational closure. The term autopoiesis was coined to account for the circularity at work in the biological processes of a living system in its organization. See *Autopoiesis and Cognition*, 9: "It is the circularity of its organization that makes a living system a unit of its interactions…and it is this circularity that it must maintain in order to remain a living system and retain its identity through different interactions." See also *Difference and Repetition* discussion on the tortuousness of Hegelian circularity (54-57).

[17] *Difference and Repetition*, 263.

art, thereby enjoys a self-positing of itself, or an *autopoetic characteristic* by which it is recognized. What depends on a free creative activity is also that which, independently and necessarily, posits itself in itself: the most subjective will be the most objective. The Post-Kantians, and notably Schelling and Hegel, are the philosophers who paid the most attention to the concept as philosophical reality in this sense. Hegel powerfully defined the concept by the Figures of its creation and the Moments of its self-positing. The figures become parts of the concept because they constitute the aspect through which the concept is created by and in consciousness, through successive minds; whereas the Moments form the other aspect according to which the concept posits itself and unites mind in the absolute of the Self.[18]

Perhaps there is evidence here in Deleuze's thought of an influence from the autopoietic paradigm. Certainly Felix Guattari drew explicitly on the autopoietic theory of Francisco Varela to describe the emergence of subjectivity, noting, "one is not before a subjectivity that is given, such as the *en soi*, but rather facing a process of assuming autonomy, or of autopoiesis, in the sense given the term by Franciso Varela."[19] Autopoietic systems theory renews concepts of philosophical circularity and circular causation since it concentrated efforts on conceptualizing operational closure as a mechanism capable of explaining the phenomenon of auto-production. Cognitive scientists such as Evan Thompson, and indeed Varela, have argued this point, but without focusing attention on the concept of operational closure as such: "what has emerged in the case of an autonomous system such as a cell [an autopoietic system] is a self-producing entity that also brings forth

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[18] Deleuze and Guattari 1994, 11–12. This quotation continues, becoming a bit critical of the Hegelian Notion.
[19] Guattari Reader 1996, "Subjectivities for Better and For Worse." Guattari is here drawing from F. Varela's *Autonomie et Conaissance*, 1989.

its own domain of interactions. This sort of emergence takes a major step beyond dynamic pattern formation in physical dissipative systems."[20]

We can discern such a form of operational closure for systems with an autopoietic nature in scores of contemporary thinkers, some of whom even wanted to oppose—more and less explicitly—the Hegelian system, such as Deleuze, Luhmann, Maturana and Varela, Foucault and Blanchot,[21] among countless others in the arts and sciences. But we want to distinguish sharply those philosophical accounts of systems that appear to function autopoietically (for instance, self-observing systems) from those systems that empirically describe some autopoietic functioning, such as we find in molecular, biological and social systems which presuppose that the identity of the objects they investigate already belongs to those systems. For example, where Hegel and Deleuze constructed rigorous ontologies using structures that appear to function autopoietically (Ideas, difference), Maturana and Varela are careful to limit the extension of autopoietic systems to the biological domain and end up presupposing the objects described by these systems:

> Like any organization, autopoietic organization can be attained by many different types of components. We have to realize, however, that as regards the molecular origin of terrestrial living beings, only certain molecular species probably possessed the characteristics required for autopoietic unities, thus initiating the structural history to which we ourselves belong.[22]

Michael S. Roth has noted the transition in intellectual history between questions of meaning or significance and those of function. He identifies "...one of the crucial transformations in modern intellectual history: the shift from a concern with questions of

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[20] Thompson, 64.
[21] Blanchot: (*Friendship*) "…movement of intensity that always returns to itself, like the circle." ",,,a unique sign in which thought designates itself." Quotation taken from Hughes 2009, 63-64.
[22] *The Tree of Knowledge The Biological Roots of Human Understanding*, 49.

significance to a concern with questions of use or function."[23] Roth's point can be expressed thusly: not what does it mean, but what meaning does it make, or, how does it work? Roth's study looks at the transformation of this question in the work of French Hegelians (Hyppolite, Kojeve, Weil), and speaks to the consequences of this shift for the study of history. What Roth does not do is highlight the manner in which Hegel presages this transformation, as can be seen in his earlier analysis of the way in which phenomenological shapes of consciousness undergo transformations as they generate knowledge, demonstrating a decisive shift from questions of meaning to questions of function, in the sense Roth gives to these terms. Hegel's turn to questions of function is also replayed conceptually in philosophical constructivism, such as that claimed by Deleuze and Guattari in their *What is Philosophy?*. Furthermore, philosophical constructivism comes closest, we think, to offering accounts of systems that appear to function autopoietically. Niklas Luhmann defines constructivism on clear terms in stating that, "[t]he usual understanding of the observations of observation focuses above all on *what* an observer observes (distinguishing thereby between subject and object, but concentrating above all on the object). Constructivism describes an observation of observation that concentrates on *how* the observed observer observes."[24] In the *Phenomenology* Hegel shows that it is precisely *how* the subject categorizes the world that leads to shifts in knowledge.

In his theoretically impressive *Social Systems*, Luhmann defines the notion of operational closure within what he calls the theory of self-referential systems:

> The theory of self-referential systems maintains that systems can differentiate themselves only by self-reference, which is to say, only insofar as systems refer to themselves (be this to elements of the same system, to operations of the same system, or to the unity of the same system) in constituting their

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[23] Roth 1988, x.
[24] Luhmann 2002, see especially 140.

elements and their elemental operations. To make this possible, systems must create and employ a description of themselves; they must at least be able to use the difference between system and environment within themselves, for orientation and as a principle for creating information. Therefore *self-referential closure* is possible only in an environment, only under ecological conditions.[25]

Indeed, the Luhmannian *oeuvre* has done very much to promote understanding of the concept of operational closure. For Luhmann, operationally closed systems produce their own components so that everything that is used by the system is produced by the system itself, for the system. Luhmann is clear, too, that he takes this concept from the autopoietic theory of Maturana and Varela. We should trace a brief history of the concept of operational closure. While Luhmann appears to take the idea of operational closure most directly from Husserl, we wish to pinpoint its source in the German Idealist tradition.

III. Operational Closure and Philosophy

Why do we focus on operational closure, a relatively recent concept in the history of systems philosophy? For one, various types of operational closure, more and less consciously realized or utilized, more and less formally articulated, have proved a constant over the 20th century systems theories and sciences, including the waves of cybernetics. The concept itself has not been formalized; that is, it has not been the subject of a thematic analysis. Likewise, it has not figured exclusively in any philosophical, and especially ontological, account of systems. Within 20th century systems sciences and theories, operational closure appears to represent a synthesis of concepts of recursive feedback or circular causation and, simultaneously, the genetic production of system complexity, holding for any one

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[25] Luhmann 1995, 9.

(operationally) unique system. What might be at stake, then, in a philosophical examination of operational closure is the philosophical validity of the autopoietic wave in systems philosophy.

Within its philosophical history, operational closure can be traced back to the German Idealists interpretation of the identity of thought and being, and more obliquely, to their particular reading of the law of identity in classical logic (A=A). Because operational closure suggests the sorts of recursive circles that define the individuating identity, or specificity, of systems, the concept is not unlike that German Idealist principle of identity. Here, Jacobi first altered the coordinates by which identity was understood, influencing Reinhold, Fichte, Schelling and Hegel. In turn, Jacobi's understanding of identity was inspired by Kant's ethical law. He thought of the law of identity as a form of agreement with ourselves rather than as a description of an unassailable formal law of thought. Fichte adherence to the formalism of the law of identity marked something of a pre-Jacobian return to the classical, logical law. The German Idealists, and even the later, post-critical Kant rejected Fichte's interpretation of the law of identity because of its residual formalism. Kant discusses this in his 1799 *Declaration* against Fichte. Kant's rejection of Fichtean formalism is not entirely stunning, however, since his larger transcendental logic, in establishing rules of thought, made reference to intuition (in opposition to the formal logic of his time, which did not).

These thinkers were concerned with the limitations of the law of identity as well as with what they saw as two alternative possibilities: 1) the possibility of extracting a "real" object (being) from thought[26] and 2) the possibility of showing an objective connection between thought and what it thinks (the being of thought). The early Reinhold took this latter route while Kant seemed to be increasingly interested in the possibility of the former

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[26] This was essentially Kant's concern, again, from the post-critical period. See Ahlers 2005.

route toward the end of his career.[27] Still, Hegel labeled Reinhold and Bardili as pure formalists in his *Differenzschrift* and criticized their conception of 'thinking as thinking' as a species of logical rationalism.[28] Such logical rationalism represented a non-critical departure from Kant's transcendental logic. However, as Rolf Ahlers has reported, Hegel also used the 'thinking as thinking' formula to describe Schelling's, Fichte's and his own philosophy. The clearest precursor to operational closure, then, appears to be Kant's transcendental logic with its appeal to the matter of intuition or sensation. For, despite the functional closure assigned to operational closure, its structural openness shows the well-night Kantian necessity of a system receiving environmental inputs (noise, matter, energy). Operational closure thus lines up in the same conceptual trajectory as post-Kantian transcendental logic. It is decidedly not a pre-metaphysical or non-Kantian view.

In the 20th century it is Luhmann who makes definitive and explicit use of operational closure for autopoietic systems and even, versus Maturana and Varela, for non-biological systems. He thus goes some way toward generalizing the concept (and so suggesting its possible ontologization), arguing for its presence in, and applicability to, a variety of systems. As Luhmann makes clear, operational closure presupposes a difference between system and environment. If the system's operations are self-referential, this is in relation to an external environment. Luhmann's key insight, and we believe it characterizes the post-Kantian, Hegelian-Deleuzian matrix of operationally closed systems, is that the functional, operational closure is the very condition of the "structural openness" of systems to their environments.

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[27] Ahlers 2005, especially, 217-218: "[Kant] objects to Fichte's *Wissenschaftslehre*, saying it is nothing but 'pure logic' which abstracts from every material content of knowledge. Kant thinks in 1799 that Fichte's *Wissenschaftslehre* is the 'vain effort' 'no one has ever achieved' to 'extract a real object' out of thought. The *Wissenschaftslehre* was then hopelessly abstract speculation (AA XII 370).

[28] Reinhold's formula should be stated more precisely as "thinking *as* thinking *through* thinking." Quotation taken from Ahlers 2005, 224. Moreover, this formula had a direct application to Reinhold's thought of systematicity. Ahlers reports that this formula is 'understood thus in its logical-unity, so that thinking and being, form and matter, subject and object, concept in its determinacy as nature can be systematically unified."

Such openness would be a necessary condition of system formation and maintenance. Luhmann continues:

> The environment is a necessary correlate of self-referential operations because these out of all operations cannot operate under the principle of solipsism (one could even say because everything that is seen as playing a role in the environment must be introduced by means of a distinction). The (subsequently classical) distinction between closed and open systems is replaced by the question of how self-referential closure can create openness.[29]

Accounts focusing solely on the operations internal to systems seem preferable to accounts that distinguish between closed and open systems. Instead of empirically informed accounts that state a distinction between openness and closure based on an external reflection on already-formed individual systems, operational closure offers a theory of how systems themselves, by their own means, immanently, or internally, produce distinctions which then determine their *relative openness* with respect to environments, which environments then appear as results of system operations. This process of producing self-referential distinctions might also be characterized as a "sublation." Luhmann, generally highly critical of Hegelian dialectics, did not reject this application of the term:

> Here too one comes to a "sublation" of the older basic difference into a more complex theory, which now enables one to speak about the introduction of self-descriptions, self-observations, and self-simplifications within the system. One can now distinguish the system-environment difference as seen from the

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[29] See Luhmann 1995, especially 32. Moving beyond a functionalist account, later in his career Luhmann replaced the distinction between system and environment—which had paradigmatic status for systems theory—with a theory of self-reference. "The central paradigm of recent systems theory is system and environment" (32). The paradigm marked by the system-environment distinction in turn replaced the functionalist paradigm since the final reference of all functionalist analysis is the difference between system and environment.

perspective of the observer (e.g., that of a scientist) from the system/environment difference *as it is used within the system itself*, the observer, in turn, being in turn conceivable only as a self-referential system.[30]

Here again we find Hegel's "Doctrine of the Notion" insightful since it indicates how Ideas produce the distinctions that appear to precede them. Such a line of reasoning might compel one to argue, as Andrew Haas has, that the "Doctrine of Essence" should come after the "Doctrine of the Notion" (though not in respect of system actualization, which happens all at once, but in terms of the categorial deduction). After all, it appears that Essence generates the relations and processes Hegel describes under Notion. Furthermore, the abstract nature of the relations and processes within Essence appear more logically advanced than the weightier, perhaps more sensual categories of life, syllogism, teleology, etc., which characterize Notion. One should bear in mind, though, that the Hegelian Ideas produce the distinctions that logically precede them (distinctions such as we find in the "Doctrine of Essence"); but for us, they do so in virtue of their operational closure. Again, because Ideas are closed off from environments, they are enabled to produce and reproduce richer networks of system specific operations (or categories). What the logical Idea produces are the categories of Essence and Being. It produces these categories as posits before showing their inadequacies to stand in for the whole, or system. We might also recall that in Deleuze and Guattari's *What is Philosophy?* the concept is defined on same terms as Luhmann and Maturana and Varela will define operational closure. There, "[t]he concept is defined by its consistency, its endoconsistency and its exoconsistency, but it has no reference: it is self-referential; it posits itself and its object at the same time as it is created."[31] Let us enrich these claims by taking a closer look at the Hegelian and Deleuzian texts. For, Hegel and Deleuze are unique in providing ontologies of systems. They do not indulge the epistemological considerations of Luhmann or Maturana and Varela.

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[30] Luhmann 1995, 9.
[31] Deleuze and Guattari 1995, 22.

IV. Hegel, Deleuze, and Operational Closure in Philosophical Systems

We can observe operational closure holding at once in the Hegelian system ontology when we examine the way the Hegelian Notion constructs a conceptual reality out of its non-foundational immediacy. Hegel stated that "what is implicit as substance is manifested in the Notion. Thus the dialectical movement of substance through causality and reciprocity is the immediate *genesis* of the Notion, the exposition of the process of its becoming."[32] In Hegelian causality, "substance is self-positing, effects itself in infinite reciprocal action or reciprocity."[33] By reciprocity, Hegel refers to the absolute form of self-differentiation, of substance distinguishing itself from itself. He details the process in the Notion on the following terms, "the progressive determination of substance necessitated by its own nature, is the positing of what it is in and for itself."[34] What is in-itself is substance. What is for-itself is this identity as absolute power or self-relating negativity, a distinguishing of itself from itself. In the *Encyclopedia Logic*, Hegel calls the Notion, or "concept," essence that has returned to being as simple immediacy… the substantial might which is for itself the concept .[35] It is easy to identify the recursive nature of the Hegelian distinctions. Here, Notion is a product of result of the distinctions it draws within Essence.

As Hegel says in the *Encyclopedia Logic*, "[t]he progression of the Concept is no longer either passing over (transition) or shining into another (positing); but development (self-positing)."[36] Notional development is self-positing, and it reaches its most refined form in Ideas. Notion is where the immediacy of substance is unhinged from the category of ground and refers solely to its own self-distinguishing or differentiating power. David Gray

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[32] *Science of Logic*, 577

[33] *Science of Logic*, 569.

[34] *Science of Logic*, 578.

[35] *Encyclopedia Logic*, § 159. Furthermore, in the *Science of Logic*, Hegel puts the point, "being once more, but being that has been restored as the infinite mediation and negativity of being within itself" (596).

[36] **Encyclopedia Logic**, § 161.

Carlson adds a helpful gloss on the Hegelian concept of development. He notes, "development implies that '[i]n every transition the Notion maintains itself.'"[37] In development, as Hegel writes, "only that is posited which is already implicitly present."[38] Hegel's opening section on Subjective Logic in his Doctrine of the Notion[39] recounts the genesis of the Notion (Objective Logic), its "immanent deduction,"[40] its absolute individualization,[41] not in terms of oppositions as still appears to characterize Hegelian method back in Essence, but in terms proper to the developmental and genetic, system-organizational logic of the Notion. Here, all vestiges of opposition are replaced by systemic notions of passive and active substance,[42] and inner and outer,[43] and are finally developed, "self-positing" or "self-evolved" in the free and unconditional determination of the notion of the notion, the Idea.[44]

Let us state a simple formula to deliver the essential point: where Being or Quality was affirmative, essence is the first negation and the Notion is negation of negation. Similarly, subjective notion is being, objective notion is essence, and Ideas are negation of negation. We must keep in mind of course that the being-for-self of the Idea requires that development or creation, and not opposition, defines the method by which ideal negation of negation takes place at this stage of the *Logic*. David Gray Carlson borrows this formula when he defines the Notion as "the erasure of the natural world beyond thought. Second, it is the erasure of this erasure" (435). Herbert Marcuse put the point this way: "[e]verything that exists is 'real' only insofar as it operates as a 'self' through all the contradictory relations that constitute its existence." Notwithstanding the variety of these formulations,

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[37] Carlson is here citing from *Science of Logic*, 748. See also Carlson 2007, 463.
[38] *Encyclopedia Logic*, § 161, Addition.
[39] *Science of Logic*, see especially 577-580.
[40] *Science of Logic*, 582.
[41] *Science of Logic*, 583.
[42] *Science of Logic*, 578.
[43] *Science of Logic*, 596.
[44] *Science of Logic*, 596-597.

development most accurately characterizes the being-for-self, the structure of auto-productive repetition marking the genesis of Ideas. Marcuse in fact generally keeps with the term development in explicating the *Logic*. Notion must, as Hegel says, "rise to the Idea which alone is the unity of the Notion and reality."[45] David Gray Carlson elucidates the Hegelian rising of Ideas to the unity of Notion and reality thusly, "[w]hatever Notion is, it is the *outcome* of a self-repulsion that is "*unconditioned and original.*"[46] Carlson does well to focus on the repulsion processes proper to being-for-self. Carlson adds, "[i]n order to accomplish this task, Notion's job is to build up the vanished reality from its own resources."[47] Hegel does assert, "[b]ut its incompleteness does not lie in its lack of that presumptive reality given in feeling and intuition but rather in the fact that the Notion has not yet given itself a reality of its own, a reality produced from its own resources."[48] John Burbidge believes that at this point in the development of the Notion, "[t]hought has reached the point where it explicitly thinks itself.[49]

Note how similar Deleuze's (and Guattari's) description of the creation of concepts is to Hegel's genesis of the Notion in the Idea:

> …the following definition of philosophy can be taken as being decisive: knowledge through pure concepts. But there is no reason to oppose knowledge through concepts and the construction of concepts within possible experience on the one hand and intuition on the other. For, according to the Nietzschean verdict, you will know nothing through concepts unless you have first created them—that is, constructed them in an intuition specific to them: a field, a plane, and a ground that must not be confused with them but that

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[45] *Science of Logic*, 587.
[46] *Science of Logic*, 601.
[47] Carlson 2007, 437.
[48] *Science of Logic*, 591.
[49] Burbidge 1981, 111.

shelters their seeds and the personae who cultivate them. Constructivism requires every creation to be a construction on a plane that gives it an autonomous existence. To create concepts is, at the very least, to make something....Philosophers have not been sufficiently concerned with the nature of the concept as a philosophical reality. They have preferred to think of it as a given knowledge or representation that can be explained by the faculties able to form it (abstraction or generalization) or employ it (judgment). But the concept is not given, it is created; it is to be created. It is not formed but posits itself in itself—it is a self-positing. Creating and self-positing mutually imply each other because what is truly created, from the living being to the work of art, thereby enjoys a self-positing of itself, or an autopoetic characteristic by which it is recognized.[50]

Deleuze adds, "[t]he Post-Kantians, and notably Schelling and Hegel, are the philosophers who paid the most attention to the concept as philosophical reality in this sense. Hegel powerfully defined the concept by the Figures of its creation and the Moments of its self-positing." Thus, we see that *What is Philosophy?* provides a rich formula for *Difference and Repetition*'s task for thought to generate the act of thinking within thought itself. In the signal-sign systems that define that text it is easy to identify a self-referentially closed circle where different is related to different by difference itself—here, difference is operationally closed in virtue of the fact that systems draw solely upon difference. *In Cinema 2*, Deleuze would write that "[t]hought has no other reason to function than its own birth, always the repetition of its own birth, secret and profound."[51] After all, Deleuze wrote in his earlier *Method of Dramaization* essay, "[a]nd thought itself, considered as a dynamism proper to the philosophical system, is perhaps in its turn one of these terrifying movements that are irreconcilable with a formed, qualified, and composed subject, such as the subject of the

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[50] Deleuze and Guattari 2003, 34.
[51] See *Cinema 2*, 165. This formula also recalls the being-for-self of repetition in its clothed, secret form.

cogito in representation."[52] Of course, Deleuze is careful to point out that "dynamisms are not reducible to psychological determinations."[53] Deleuze is referring to the concept's (or Idea's) own genetic individuating processes of auto-production, as it turns out, for self-referential, or better, operationally closed systems. How is operational closure formulated within philosophical systems, more generally?

The thesis of operational closure encounters three notorious philosophical difficulties: 1) skepticism regarding the external world, 2) the problem of intersubjectivity, and 3) the question of whether or not operational closure holds only in instances of "second-order observation," that is, within a transcendental framework, which often relates to questions of epistemological access.

Does the thesis of operational closure seek to defeat skepticism regarding the external world? The thesis of operational closure differs from a dogmatic idealism that positively denies material substance, such as Berkeley's, by taking thought itself as its very material substance. When Hegel, for instance, analyzes the category of being, he is analyzing the being, the material substance, *of* thought. He is analyzing thought's own being. Indeed, in the Hegelian system, thought does prove to be material substance. Operational closure also differs from what Kant referred to as Descartes' "problematic idealism," which proclaims the incapacity of thought to go beyond itself by means of its immediate experience. This is because, for Descartes, experience, characterized in its immediacy, refers yet again to the sensibility of a human subject. Operational closure, on Hegel's accounting, does not hold for the human subject, however, but holds for thought (the nature of which must be determined within thought; thus, it is not as if thought here refers to some primarily mental reality). Operational closure likewise cannot be said of Kant's transcendental idealism. Where the "Refutation of Idealism" seeks to prove "that even our inner experience, undoubted by

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[52] "Method of Dramatization." *Desert Islands and Other Texts: 1953-1974*, 98.
[53] *Ibid*, 107.

Descartes, is possible only under the presupposition of outer experience,"[54] the thesis of operational closure, after the Hegelian injunction of presuppositionless ontology, does not accept such an outer experience of the external world.

We find helpful Alfred Schutz's isolation of two inter-related difficulties inherent to the problem of intersubjectivity: the problem of transcendentalism and the problem of the other. For the former, the difficulty is specifying how the other as such comes to be constituted when all that comes to be constituted, in virtue of being a transcendental constitution, must be traced back to transcendental subjectivity, as its own production. For the latter, the difficulty comes in supporting a claim for the otherness of the other. We might look at this problem as a logical one attending to traditional solutions to the problem of individuation. That is, how do we declare that the other is in fact (an) other, a distinct individual? For, if the other cannot be distinguished from every other individual, it *is not* (an individual). That is, on the condition that an individual is not a distinct individual, it cannot be said to be (an individual) at all. Being an individual thus logically requires any individual to have a distinguishing difference from every other individual. In order that there may be distinct individuals as such, it is required that there be the other(s) to be distinguished from. For the otherness of the other, it holds no less that every other, in order to be (an other) at all, logically depends, in its turn, upon there being an other from which it is distinguished, in order to be a distinct individual in its place. Forgetting the infinite regress this formulation invites, it does well to draw our attention to what is perhaps the central difficulty an ontology of operational closure encounters: dropping the transcendental framework that makes valid the productions of subjectivity,[55] it is hard to see how the problem of the other finds form, consistency, or resolution in anything but a list of descriptions of the subject's

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[54] Kant's *Critique of Pure Reason* (Guyer trans. 1999), 326. The fact of inner experience can only be confirmed by supposing the existence of an external world of material substance.

[55] The validity we speak of here in the transcendental framework refers to the manner in which it enables an elaboration of the conditions of possibility of the knowledge it yields, which I have called its productions of subjectivity.

'encounters' with something 'outside' of it. This mysterious outside then becomes our best evidence of otherness, but so too does this evidence lack philosophical prowess, while the project of constructing any ontology of operational closure seems compromised.

The philosophical topic of the outside has been given both a positive and a negative twist. Horkheimer and Adorno, for instance, describe a "pure immanence of positivism," which is the "ultimate product" of the Enlightenment, and which is a reaction to a fear of the outside. "Nothing at all may remain outside" for the positivist, since "the mere idea of outsideness is the very source of fear."[56] The outside is here figured as opposed to knowledge, or as a source of anxiety or fear. The outside is thought on these terms, however, as a question if epistemological access. Notably, in elaborating a thesis much like the one we find in the Hegelian operational closure outlined thus far, both Foucault and Deleuze spoke of such an outside, though they give it a positive, but also a productive, twist. The outside is the source of novelty, of the new. We take the positivity Deleuze assigns to the outside to be a consequence of his endorsement of a form of operational closure. Furthermore, we do not find it incidental that Deleuze's characterizations of the outside appear as *spatial descriptions* and somewhat mysterious descriptions at that for an author who remained by and large so conceptually precise. Rather, we believe that Deleuze's reliance on more spatial descriptions of the outside owed to his abandoning the transcendental framework when seeking to demonstrate novelty through an account of its real conditions or its auto-production. For Deleuze, the tracing procedure of the transcendental framework—without an injection of some wild or chaotic empirical matter—made it impossible to account for novelty, given the auto-productive nature of difference,[57] or the "autopoetic" nature of the concept. When abandoning the transcendental framework, however, the outside must be confronted in a new way; it is henceforth *encountered*. It emits signs, on Deleuze's accounting.

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[56] Horkheimer and Adorno 1972, 16.

[57] In *Difference and Repetition*, Deleuze had it that different relates to different through difference itself, systemically, thus characterizing difference on terms similar to those from autopoietic systems theory.

Significantly, the outside described by Deleuze is an outside *of* thought (most often described as the 'unthought'), a description that brings him close indeed to the conclusions Hegel reached in elaborating the structure of the *Science of Logic* where we would do well to be reminded, "[t]he Notion is the *absolute foundation*, not subjective presupposition, it must *make itself* the absolute foundation."[58] Of course, for Hegel the manner in which thought accounts for its outside, its other, is not description, but the construction of a systemic, immanent ontology. In this sense, we concur with Will Dudley's charge that:

> Any interpretation of Hegel's systematic philosophy must provide an account of two essential relations and their interconnection. First, we require an explanation of the relationship between the system and that which is external to it. We need to know what is inside the system, what is outside the system, and how the inside and outside bear on each other. How, if at all, does that which is external to the system affect the development of the systematic philosophy itself? And how, if at all, can systematic philosophy inform us about that which is external to it?[59]

For now, let it suffice to repeat that at the heart of Hegel's account of this process is a thesis of operational closure for systems that function autopoietically.

Systems with operational closure may appear as variants of transcendental idealists positions. Luhmann, Maturana and Varela, for instance, show that the distinctions a system draws, as for instance between its inside and outside, produce a world which is always relative to the system rather than a world in itself, independent of that system. This of course recalls Kant's claim about our production of knowledge of phenomena versus things-in-themselves. Anything external to systems is thus unknowable, anterior to the produced world of the

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[58] *Science of Logic*, 577.
[59] Dudley 2007, 49.

system in question. If this externality is anything at all, it is looked at as the source of the raw material used by systems to produce and maintain themselves. Such systems reduplicate the structure of Kant's thing-in-itself. The problem here is expressed in Jacobi's famous criticism of Kant's thing-in-itself as paradoxical cause of appearances, that:

> 'it is not possible to see how even the Kantian philosophy could find entry into itself without this presupposition [of a thing-in-itself] and manage some statement of its hypothesis,' and, at the same time, 'it is plainly impossible to stay within the system with that presupposition.'[60]

Jacobi's expression of the problem might be better formulated on the following terms: what is observed can only be a function of a distinction anterior to the observation. If we cannot observe the thing directly, we can only observe our own observation. Among systems that endorse a form of operational closure, this is known as the problem of second order observation.

The possibility of observation, then, follows from the act of a system drawing its own distinctions. Such a problem recalls Kant's paralogism of reason with regard to phenomenal and noumenal selves, and the production of transcendent subjectivity. Where transcendental idealism could be said to posit universal and necessary conditions of observation for specifically human subjectivity, thus barring any viable form of intellectual intuition for systems, modern systems theories formulating operational closure, such as Niklas Luhmann's, grant powers of observation and distinction to *all* autopoietic systems, such as organisms and social systems. But do these latter systems have powers of second-order observation? It is clear that they do. But here, observation is detached from the human observer, a remnant of the Kantian, transcendental framework. After Luhmann, but also von

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[60] Dudley 2007, 50. From Jacobi's "On Transcendental Idealism."

Neumann, Foerster, etc., second order observation becomes a function of a systems interaction with its environment. Systems undergo coupling—a term Deleuze uses in *Difference and Repetition*—with their environments, but importantly, following the logic of being-for-self which Hegel analyzes, they do so through processes of self-exclusion (and not exclusion from their putative environments). By contrast, in Maturana and Varela's initial formulations of operational closure, such processes were taken to be the results of systems excluding themselves *from* their environments, even if in virtue of their own systemic operations. Luhmann describes this process in his *Social Systems* thusly:

> The environment receives its unity through the system and only in relation to the system. It is delimited by open horizons, not by boundaries that can be crossed; thus it is not itself a system. It is different for every system, because every system excludes only itself from its environment. Accordingly, the environment has no self-reflection or capacity to act. Attribution to the environment (external attribution) is a strategy of systems. But this does not mean that the environment depends on the system or that the system can command its environment as it pleases. Instead, the complexity of the system and of the environment— to which we will later return —excludes any totalizing form of dependence in either direction.[61]

Luhmann thus focuses on the question of how systems are constructed or actualized. Operational closure implies that systems generate themselves by excluding *themselves* from their environments. Operationally closed systems rely on their own operations to generate themselves and any relation to their environments must be determined by the way in which they draw exclusions. Here, the environment of a system is less a product of systems, as in Maturana and Varela. Rather, environments trigger, or *affect*, systems leading perhaps to an

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[61] Luhmann 1995, 17.

alteration of their structure. If Deleuze marks a significant conceptual advance over Hegel it is to be found in the clarity and depth with which he describes such affective encounters. Hegel's system ontology remained largely blind to this aspect of system individuation.

V. EPISTEMOLOGICAL ISSUES FOR SYSTEMS WITH OPERATIONAL CLOSURE

Again, operational closure does not refer to structural closure. In terms of system structure, it specifies the degree to which a system is open to structural change. Systemic self-exclusion refers to the auto-productive distinguishing of system and environment. Environments, too, are affected by such processes. There is no simple opposition here since all emphasis is placed on the operations specific to the system itself. In other words, the Hegelian category of "positing" would apply poorly here. The environment would be better described as *the outside* of a self-referential relation. An environment is, in respect of its form, however, well defined by chaos or noise (it is not some "other of the other"). As well, we are not suggesting that system operations are not passive syntheses, however, because system operations are nonetheless not guided by any active command center that consciously controls system operations.

It must be admitted that Maturana' and Varela's account of systems in *Autopoiesis and Cognition (AC)* affirms a scientific-epistemological version of Kantianism since the operationally closed systems they speak of define systems too purely from the point of view of those systems, and not from the point of view of the system-environment distinction that follows in the wake of the thesis of operational closure (which both Maturana and Varela would attempt to correct in their later work; and Luhmann may suffer a similar criticism).[62]

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[62] *Autopoiesis and Cognition*, 121. "No description of an absolute reality is possible…[because such a description] would require an interaction with the absolute to be described, but the representation that would arise from such an interaction would necessarily be determined by the organization of the observer…hence, the cognitive reality that it would generate would unavoidably be relative to the observer."

One thinks of Varela's work in "embodied cognition." Where Maturana, Varela, (and Luhmann) would later in their careers emphasize that systems produce *their own* environments in complex structural relationships with their environments (structural coupling), in *AC* Maturana and Varela characterize environments as if they were the thing-in-itself which in some vague sense only trigger systemic operations (affecting system structure, and not organization).[63] This position recalls the Kantian one where systematicity pertains to the phenomenal world of the reasoning subject and its categories, but cannot be said to characterize some ontologically robust or actual systematicity in the world.

Hegel and Deleuze, conversely, are ready to grant systematic status not only to natural organisms, but to other systems as well. In Hegel's system, the nation state, for example, consists in a gestalt in the form of its laws and institutions and nature consists in a gestalt of external relations of space. Because each of the systems Hegel outlines use different forms of organization to develop and because they deploy different operations (conceptual, natural, political) to reproduce this organization, Hegel can be said to have anticipated the autopoietic insight that different systems relate to environments in system-specific ways. Hegel's writings on the *Realphilosophie* systems clearly prefigure Luhmann's conclusions that systems are operationally closed. Just as we may wonder whether a Kantian-type regulative ideal can preside over the complexity of systems in our contemporary world, we may pause to consider the fragmentation Luhmann states for the social world. For Luhmann, there is no system of systems. Is there a system of systems in Hegel's view? Is not reason (*vernunft*) or Idea at the conceptual core of what we have been describing as system ontology? Does the Idea penetrate the entire world, does it, as Luhmann would say, interpenetrate it? From where does Hegel derive the ideal unity of the various systems? In short, when we come to view the various systems through reason, or the Idea, in what fashion might these systems be

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[63] *Autopoiesis and Cognition*, 121: "…the activity of the nervous system as determined by the nervous system itself, and not by the external world; thus the external world would have only a triggering role in the release of the internally-determined activity of the nervous system."

linked? What makes any unifying view of systems possible? Should we sneak what look like epistemological concerns through the back door of Hegel's rigorous ontology?

We think not. For Hegel, the categories within a system are ontological and possess systematicity regardless of the manner in which particular individuals deploy them. Hegelian categories pertain to all systemic being, characterizing systems *uberhaupt*. This is the meaning of Hegel's claim that reality is appearances all the way down- system operations are not merely human constructs of phenomenal subjectivity, but pertain absolutely (wholly, vis-à-vis a form of operational closure) to the auto-productive role of systems. This is also the meaning of Hegel's claims of the Absolute, that it is the principle of personality: systems are unique and actively produce reality, that is, themselves. There is no world or system as such external to operationally closed systems. Rather, Hegel's views on systematicity, and any coherent account of system ontology we might wish to develop from out of his *Science of Logic*, lend to an interpretation following Luhmann's turn to self-reference for autopoietic systems. Hegelian systems, in virtue of their operational closure, are self-referential.

The systematicity we describe here and which belongs to a thesis of operational closure for such self-referentially constituted systems also affords us another way of looking at the Hegelian formula that subject is substance and substance is subject. Hegel's critique of any substance independent of the categories, or independent of system-specific operations, does not mean that different systems do not draw distinctions differently, or that the categories he analyzes are written in stone, *sub specie aeternitas*; but rather that anything external to or outside of systems—for instance, some 'thing-in-itself' as Kant understood it—cannot be considered *independent of* systems. Rather, operational closure implies structural openness to interactions with that which is outside of systems, to noise, or to those other systems that can be said to be in the environment of a system. This differs markedly from Maturana, Varela (esp. his middle-period), Luhmann, or Kant, where it is only

legitimate to characterize the operations of those systems that *can* be observed. There can be no reference to the environments of these systems because they must be simply conceived as noise, chaos or an undifferentiated nothingness.   Such is, we note, the conception of otherness for these systems thinkers. Such an other cannot be admitted for Hegel, or for Deleuze, since for these thinkers the individuating categories characterizing systems are the categories of being itself. Being *is* thought, or mind, for these thinkers (their ontologies examine the being *of* the system of thought).   As Hegel has it, "[m]ind is, therefore, in its very act only apprehending itself, and the aim of all genuine science is just this, that mind shall recognize itself in everything in heaven and on earth. An out and out other simply does not exist for mind."[64]

The categories of thought, or mind, *are* the categories of thought, not simply categories for this or that phenomenal world. The development of a system ontology that seeks to avoid the trap of any regional ontology or merely epistemological thesis is helped along by terminological and conceptual rigor. If we keep with the philosophical problematic staged by the couplet of phenomena versus noumena, we distort the dimension of production and creation which became so important to post-Kantian systems philosophy. And, in point of fact, for all of their interest in epistemological problems, Maturana and Varela tended to avoid characterizing autopoietic systems in terms of the phenomena (internal system operations)/noumena (environment) distinction.

The critical philosophy of Kant and the autopoietic systems theory of Maturana and Varela (in *AC*) formulate theories of relations and organization. In a very broad sense, they are thus similar to Hegel and Deleuze, both of whom do the same. Yet for Kant and autopoietic theory, there remains a gap between the in-itself and the phenomenon. However, there also appear to be compatibilities between autopoietic theory and Hegelian

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[64] *Philosophy of Mind*, §377, *Zusatz*.

systems ontology. In Maturana and Varela's concept of systems "bringing forth a world," they intend the bringing forth of an actual world from an environment,[65] a concept more akin to the Hegelian actualization of the potentiality of the thing-in-itself than to the Kantian production of the phenomenal world. The Kantian view holds that any production is, first, a bringing forth of *the* world of the finite, human subject (with its finite intuition). Kant does not admit of multiple worlds for multiple transcendental subjects. As well, for Kant, such a bringing forth of the world is the result of the activity of the abstract understanding, a subjective faculty even when guided by a systemic ideal. Following Hegel, Maturana and Varela outline a process much closer to the activity of speculative thought—for them, perception brings forth *a* world (while there are multiple, other worlds for different systems), one that may be identified as equally subject and substance.

Moreover, the Maturana and Varela of *Autopoiesis and Cognition* define recursive systemic production as the *actual* production of worlds. On their account, all organisms-species employ specific operations that structure the phenomena specific to their worlds, or *umwelts*. If there are multiple *umwelts*, this owes to the operational closure of systems. While there is a robust epistemology in second wave autopoietic theory, the theory does nonetheless claim that *there are* worlds, conceived as autopoietic systems. Hegel and Deleuze extend the kind of operational closure at work in autopoietic systems to all systems, but they do not believe that all systems are autopoietic. Thus, the lines have been drawn between ontological and epistemological issues in 20th century systems theories, across the disciplines. The concept of operational closure, however, provides opportunities to blur these lines and open the space for a new intellectual history that positions systems-theoretical concepts at the forefront of philosophical investigations into this history.

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[65] Already in the preface to *Autopoiesis and Cognition* they assert: "Indeed, we will propose a way of seeing cognition not as a representation of the world "out there," but rather as an ongoing bringing forth of a world through the process of living itself" (9).