



Multistable Figures: On the Critical Potential of Ir/Reversible Aspect-Seeing, ed. by Christoph F. E. Holzhey, *Cultural Inquiry*, 8 (Vienna: Turia + Kant, 2014), pp. 113–40

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Two Aspects of the Human in the Age of Experimental Systems

CITE AS:

Benjamin Dawson, 'Cognition and Volition: Two Aspects of the Human in the Age of Experimental Systems', in *Multistable Figures: On the Critical Potential of Ir/Reversible Aspect-Seeing*, ed. by Christoph F. E. Holzhey, *Cultural Inquiry*, 8 (Vienna: Turia + Kant, 2014), pp. 113–40 <https://doi.org/10.37050/ci-08_06>

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ABSTRACT: In his major theoretical work on experimentation, *Towards a History of Epistemic Things* (1997), Hans-Jörg Rheinberger writes: 'If experimental systems have a life of their own, precisely what kind of life they have remains to be determined.' Rheinberger is alluding to the slogan Ian Hacking gave to the post-Kuhnian 'practical turn' in the history and epistemology of science.

COGNITION AND VOLITION

Two Aspects of the Human in the Age of Experimental Systems

Benjamin Dawson

If life is meaning and concept, how do we
conceive of the activity of knowing?
G. Canguilhem

In his major theoretical work on experimentation, *Towards a History of Epistemic Things* (1997), Hans-Jörg Rheinberger writes: ‘If experimental systems have a life of their own, precisely what kind of life they have remains to be determined.’¹ Rheinberger is alluding to the slogan Ian Hacking gave to the post-Kuhnian ‘practical turn’ in the history and epistemology of science.² Hacking had asserted, in *Representing and Intervening* (1983), that ‘experiments have a life of their own’; they mature, evolve, adapt, are not only ‘recycled’ but, ‘quite literally, [...] retooled’.³ Just as the components of an organism change, while its identity remains, so, over time, the components of an experimental set-up change, yet the experiment subsists. Subsisting through multiple variations, the experiment itself has a life. Rheinberger, however, thinks that such determinations of the ‘life’ of an experiment remain, in both their form and substance, insufficient. And he intends, with his concept of ‘experimental system’, to make good this deficiency. In relation to Hacking’s dictum, Rheinberger’s basic gesture seems twofold: his approach to the relation between experimental and biological processes is oriented towards concrete affinities that would subtend and support Hacking’s analogy; while, at the same time, it operates with a more ‘molecular’, less ‘organic’ (or organism-related) logic of living systems.

To the extent that the practice of experimentation constitutes a ‘system’, it has become animated by difference, which in the case of *experimental* systems means the difference – understood dynamically as ‘reciprocal action’ (*Wechselwirkung*) – between technical objects or instruments, and scientific objects or ‘epistemic things’.⁴ In Rheinberger’s conception of science, there is a kind of intermittent but (ideally) chronic alternation between instrument and object, and an experimental system sustains itself so long as it can maintain the difference between

them. The system ceases or ‘dies’ when the research object is fully determined or ‘instrumentalized’ in the sense that it no longer produces the surprises that distinguish it from known effects of the instruments. At this point the experimental object vanishes, since it no longer resists its technological constitution, manipulation, and cognition. When resistance ceases and the object disappears, so too does the system, since the system was nothing but the difference of the object with respect to the instruments soliciting surprises from it – the difference, in other words, between knowledge (qua instruments) and objects (qua material embodiments of ‘what one does not yet know’).⁵ The aspect of experimentation that interests Rheinberger is the crystallization and localization of the unknown in a material form. The epistemic thing is the precarious outcome of an operation that, using the instruments of existing knowledge, draws a distinction in ignorance, isolating a known unknown from the ocean of unknown unknowns. And what is essential for the continuation of this process, for the survival of the system, is the avoidance of any unambiguous or unprovocative confirmation/rejection of hypotheses. ‘To remain an experimental system, an experimental arrangement must be managed in such a way that it keeps being governed by difference.’⁶

If we widen our perspective, for a moment, from experimental systems to the modern society in which they emerge and subsist, we can see that this management, manipulation, or government by difference, characteristic of modern experimental science, is consonant with the mode of government that maintains or secures the self-reproduction of a variety of functionally differentiated systems across the ‘empire of management’ (Legendre) that is modern global society. In his governmentality lectures, Foucault speaks of ‘[a] constant interplay between techniques of power and their object’; he unearths that administration of difference by difference (the ‘practico-reflexive prism’ as he calls it) into which the medieval ‘state of justice’ was transformed or, as he famously put it, ‘governmentalized’ in the sixteenth century.⁷ It was then, in the midst of religious and scientific anti-dogmatism (driven and guided by the idea of reform), that the modern state emerged as ‘a way of doing things’, ‘an active, concerted, reflected practice’.⁸ Picking up Foucault’s intuition that the model of this governmental power was the Christian pastorate, Giorgio Agamben has exposed certain theological prototypes anticipating this triumph of governance (to the diminishment of sovereignty) in secular society, by retracing those vistas of

church history in which the paradigms of modern power/knowledge appear to have been preformed.⁹

The results help one see something new, both significant and undeveloped, in Rheinberger's vision of science: we see that the scientific researcher has been placed under the same '*minus*' as that special decision-making agency completely peculiar to Christian/post-Christian society – the 'minister' (servant).¹⁰ When the essence of science becomes 'research', its office is a ministry. We may ask: with respect to what or whom is the scientific researcher, tasked with administering experimental systems, 'less'? The most obvious answer is that this figure, the scientific executive or functionary, is 'less' with respect to the traditional transcendent subject of natural philosophy, the infinite intellect of classical (and still popular) science. Unlike the thinking thing, today's experimental researcher is neither a substance nor a subject but rather a performer or, better still, a *performance*. This non-being and non-subject, this performance, is immanent to a fully operationalized science, in which what is produced is a difference, while that from which this difference is produced is likewise a difference. An experimental system lives as a difference that makes a difference (to redeploy Gregory Bateson's famous definition of information), and the researcher is the one who, located entirely within the element of the experimental system, manages its emergent effects. 'Nothing is known – only realized.' So Latour has put it.¹¹ But what is realized, in this sense, has no *being* – which is why the project of developing an 'object-oriented ontology' or 'speculative realism' out of Science Studies and Actor Network Theory seems misguided. The temporalized components of modern science (experimental research) are purely 'effectual' (or, if you like, 'unreal'); they constitute a performance that can, within its limits, be reflectively regulated, concerted, and maintained.

Now, it should not escape notice that, if this structural congruence with governmental power holds, modern experimental science stands in opposition to 'science' as tradition has understood/transmitted it. For Aristotle, as Agamben elucidates, the paradigm of 'economic' relations is "administrative" [*gestionale*], and not epistemic'. In other words,

it is a matter of an activity that is not bound to a system of rules, and does not constitute a science in the proper sense. This activity rather implies decisions and orders that cope with problems that are each time specific and concern the functional order (*taxis*) of the different parts of the *oikos*.¹²

When, early in his *Security* lectures, Foucault accidentally referred to economy (the Physiocratic doctrine of ‘economic government’) as ‘the science of government’, he took pains, the following week, emphatically to correct himself, calling this ‘a thoroughly bad and disastrous word’.¹³ Henceforth, he would always speak of the art(s) of government. It is in the light of the sharp distinction between administration and science that the gesture involved in the ‘experimental turn’ in historical epistemology may be understood. (For the time being, the question of the real history of scientific activity to which such developments in its epistemological semantics respond and/or enable can be left aside.) ‘Research’, which Heidegger rightly saw as ‘the essence of what is today called science’, may be grasped as a sublation of the ancient and medieval distinction between science and administration. This distinction might be observed, over a very long *durée*, from the distinction between *epistēmē* and *paideia* at the opening of *De partibus animalium*, through the patristic opposition of *scientia* (a category from which ‘mechanical arts’ were strictly excluded) and *peritia*,¹⁴ via the scholastic differentiation between *cognitio rei* and *cognitio modi tractandi*, to the (increasingly fragile) modern analytic separation of truth and know-how (expertise). The semantic evolution of this opposition provides the basis, perhaps, for a genealogy of ‘research’ as the gradual convergence, accelerating since the sixteenth century, of these poles of Western knowledge.¹⁵ While it seemed, for all the world, that certain traditional ‘arts’ (notably, mechanics) were ‘epistemicized’ at the threshold of scientific modernity, the opposite process – a deconstruction of science, equivalent to its ‘experimentalization’ – occurs seemingly as part of the same movement. When authors as philosophically and historically informed as, say, Alexander Koyré and Alfred North Whitehead can offer diametrically opposed views of the same ‘scientific revolution’ – the one seeing an epistemological rupture with ordinary phenomenal experience in the service of abstraction, the other seeing a thoroughly anti-intellectualist rejection of the ‘rationalistic orgy’ of the Middle Ages – perhaps the task is not to decide which is true, but to find the distinction that annuls this alternative in favour of another. These, however, are propositions and jobs for a later study.

The first section of this essay sketches part of the theoretical background of Rheinberger’s determination of the life of an experimental system. Two epistemological traditions are highlighted: first, that to

which Rheinberger himself professes allegiance, namely, historical epistemology and, specifically, the work of Georges Canguilhem; second, the differential systems theory associated with Humberto Maturana, Heinz von Foerster, and others, of which Rheinberger never makes mention. The purpose of highlighting these epistemological contexts in particular is to indicate the ‘metabiological’ (and as such post-metaphysical) foundations of the experimental systems described by Rheinberger. A term introduced by Habermas in his controversial reading of Luhmannian systems theory, ‘metabiology’ takes the reflexivity and organizational closure of the biological object as its starting point and paradigm, and develops the conditions of such self-relation/-regulation/-reproduction as the non-ontological, purely operational foundations of both observed and observing systems.¹⁶ Like the evolutionary biologist before the panorama of living systems, the epistemologist of experimental science (qua historian of epistemic things) observes a ‘universe of drifting, merging, and bifurcating systems’.¹⁷ The reflexive historical epistemologist, Rheinberger notes, is ‘Darwinian’: ‘in his or her realm of empirical investigation, [s/he] has to account for contingent events, which result in a scattered field of variants that establish their own filtering regime on the basis of their finite possibilities of extension.’ The research systems with which he is concerned are characterized, he argues, ‘by a kind of differential reproduction by which the generation of previously unknown things through unprecedented events becomes the reproductive driving force of the whole machinery.’¹⁸

Inasmuch as differential self-reproduction appears, in the era of the interpenetration of the discourses of life and information, to have a distinctively biological derivation,¹⁹ experimentation, here, is not so much endowed with a ‘life of its own’; more literally, it is reconceived as a performance that ‘life’ performs on itself. The moment at which the generation of differences becomes the ‘reproductive driving force of the whole machinery’ would here coincide with a moment – whose form would not be out of place in Schelling – in which ‘life’ takes hold of itself as its own epistemic thing. In this sense, then, Rheinberger’s conception of experimental systems might well be described – indeed, on this level, more adequately than Luhmann’s sociocybernetics – as ‘metabiological’. More important, however, to the larger thesis of this paper are the ways in which experimental systems can be seen along these lines to exemplify a peculiarly modern mode of cognition: intrinsically temporal (rather than situated in an independent external time zone),

self-reflexive, differentially reproductive, and operationally closed. The notion of the 'metabiological' is used, in the service of such a thesis, to designate the de-ontologized status of systems that are self-grounded on the operational reproduction of internal differences. While not all such systems are 'living', their operational (non-ontological) status has (not coincidentally) lent itself to observation and description using abstractions or formalizations of biological processes. And, as the later sections will indicate, the idea of 'inner difference' (which is basic to the processes of de-ontologization, operationalization, and temporalization formally characteristic of scientific, societal, and governmental modernity) and the idea of 'life' (acknowledged, finally, less as a biological concept/object than as a metabiological policy) were parties of an engagement that long preceded the marriage of cybernetics and biology in the mid-twentieth century.

In pursuit of this longer-*durée* genealogy, Section II seeks to elongate the modernity within which such systems operate by returning to Kant. For it is the irreducibly temporal and differential character of the self-consciousness at the centre of Kant's theoretical philosophy that first announces the modern epistemological condition. This reading of Kant is obviously partial, and is intended primarily to enable the attempt, introduced in this section, to think that which is 'outside' and constitutively absent from the temporal, differential form of cognitive systems (including, exemplarily, experimental systems) in modernity. This 'other scene' of scientific and societal modernity will, after Kant, be called 'pure practical reason' or 'will'. With this antinomy, the essay endeavours to indicate the ground upon which, in the wake of late twentieth-century developments in historical epistemology and systems theory, as well as the genealogy of governmental power, a new speculative anthropology may be posited.

The thesis is that modernity is an age of voluntary and involuntary humanity, an age of 'anthropolarity'. This proposition is speculative, since while pure practical reason (resting at one pole) would be the unexperiential underside of cognition in modernity, from within the modern episteme it is possible neither to determine the concrete historical becoming of this polarity nor to construct potential mediations of the relationship. Certainly, one can suppose the existence of any number of social conditions for such an emergence of involuntary humanity. Yet an impenetrable, ahistorical dimension of this divergence seems signalled by the remarkable consistency with which the basic idea of an essen-

tially autonomous practical reason has been described by the tradition of political voluntarism that has accompanied or shadowed, step-by-step, the evolution of a scientific and societal modernity within which volition has precisely no function, no effect, no power whatsoever. Perhaps, though, (and this is the thought pursued here) it is its very unchangeability that places practical reason simultaneously inside and outside modernity, as if it were caught in a process that purifies it in the same measure as it is deactivated, rendering it more timelessly universal as it is less effective, and making it disappear from actuality in the same measure as it *coincides* with it.

Equally paradoxical is the function of distinction, here, which itself stands on one side of the core distinction (volition/distinction) towards which the essay tends: a distinction of distinction and, further, the positive specification of that from which ‘distinction’ as such is distinguished – these are the moves essayed here. Volition is posited as the substance that not only remains undestroyed in the present, but that is, furthermore, in a bipolar relationship with any and every experimental (or other differential, involuntary, cognitive) system. Humanity is will and cognition, and the claim made here is that modernity has the structure of an unmediated alternative between these two aspects, rendering anthropos comparable, in certain ways, to a multistable figure. Bistable figures – such as the famous duck-rabbit drawing which so intrigued Wittgenstein – offer visual metaphors for a kind of emaciated dialectic in which two poles interpenetrate so completely, and without remainder, that they seem not to touch, not to have any contact with each other. Mediation is figured in the impoverished form of the mere flipping of aspects, and is itself split and isolated at the extremes – in our case: distinction and volition as the incommensurably coinciding sites of anthropos today. This comparison suggests, of course, the possibility of something akin to an aspect-shift in which the lineaments of the insubstantial actuality from which pure practical reason is constitutively absent would be re-recognized as the lineaments of that very substance. The apparent paradox, here, is that this re-cognition of will could happen only at the point at which cognition is grasped as an entirely involuntary process. In this respect, Rheinbergian experimental systems seem promising sites of inquiry, since they outline the alienated mind in an extreme form – the cognitive process once called ‘science’ diminished, now, to a ‘world of research’ that persists as the material self-reproduction and recursive performance of distinctions.

I. THE BIOLOGICAL DIALECTIC

It is also in this sense that the contemporary biologist speaks of writing and *pro-gram* in relation to the most elementary processes of information within the living cell. And, finally, whether it has essential limits or not, the entire field covered by the cybernetic *program* will be the field of writing. If the theory of cybernetics is by itself to oust all metaphysical concepts – including the concepts of soul, of life, of value, of choice, of memory – which until recently served to separate the machine from man, it must conserve the notion of writing, trace, grammè [written mark], or grapheme, until its own historico-metaphysical character is also exposed.²⁰

The immediate background to Rheinberger's theory is the entanglement between biology and epistemology in the mid-twentieth century. There are two important sites at which this entanglement may be observed, both of which exert an influence on the theory of experimental systems, even while both were themselves conditioned by the actual existence of such systems. One is the biological twist given, in the thought of Georges Canguilhem, to the 'philosophy of the concept' (a tradition in France associated with the work of Gaston Bachelard, Jean Cavailles, and others).²¹ The other is the different yet comparable series of constructions of the relationship between cognitive and living systems in the articles of the Macy group, and, subsequently, the Biological Computer Laboratory of Heinz von Foerster.²²

In an article of 1966 entitled 'Le Concept et la vie', Canguilhem clarified one of the fundamental gestures of his thought. Epistemic production – the practice of concept formation known in the modern age as scientific research – is not, Canguilhem suggests, the activity of a disembodied cogito traversing the world in 'the lightning flash of an infinite understanding' (Foucault's contemporary description of the epistemological subject of the 'Classical age'); rather, it is that of a living being. If intelligence is 'de-Platonized' and given a place among the forms of nature, then, Canguilhem writes, 'science, and in particular the science of life, is an activity of life itself.'²³ The particularity of bioscience is that it is, as such, life's knowledge of itself. In 'Le Concept et la vie', therefore, the genitive in the syntagma 'science of life', first proposed by John Brown in his *Elements of Medicine* of 1795, becomes a *double* genitive: life is both the object and, at bottom, the subject of bioscientific research. We could say that, from Canguilhem's (Aristotelian) perspective, the scientific orientation toward the world is one of

those 'states' referred to by Thomas Beddoes in his definition of 'biology' as 'the doctrine of the living system in all its states'.²⁴

During the same years as Canguilhem was developing his 'biologized' epistemology, on the other side of the Atlantic, complementary machinations between cognition and life were advancing in cybernetics. Here, computers were beginning to materialize, in the reflexivity and recursivity of their operational structure, aspects of the organization of living systems. And, side by side, biologists such as Humberto Maturana were reflecting, epistemologically, upon the embodiment of cognition, introducing the biologist into biology, and observing themselves as observing systems. The abstraction/appropriation of living machines into epistemologies was coupled to the materialization/externalization of such cognitive models as computers.²⁵ A biology inclusive, from the outset, of the biology of cognition, and an epistemology formalizing itself out of the problems and paradoxes encountered in such biology were tending toward the single paradigm, beyond the residues of ontology in concepts of self-generation and self-organization, of purely operational epigenesis and differential self-reproduction (autopoiesis).

In *The Postmodern Condition*, Lyotard seems to register the feedback loops or reciprocal exchanges taking place in those years when he observes, first, that genetics 'owes its theoretical paradigm to cybernetics', and, later in his report, that cybernetics had expanded the theory of the self-regulating system beyond the functionalist form of the organism.²⁶ Biology learns from cybernetics, which learns from biology. The medium of this dialectic between living and cognitive systems was, of course, the vocabulary of linguistics and the discourse of 'information' that had increasingly penetrated biological science from the time of the discovery of the double helix. As Canguilhem summarized, by the mid 1960s, '[m]essages, information, programs, code, instructions, decoding' and so on had become 'the new concepts of the life sciences'.²⁷ As biological science was appropriating the conceptual terminology of communication, epistemology – in the form of second-order cybernetics – was drawing upon the form of living self-organization in order further to unmoor itself from metaphysical foundations, to 'operationalize' itself. A mutation of the metaphysical foundations of science was taking place which would ultimately dispense with such foundations; this science was not so much disenchanting as 'de-ontologizing' the world.²⁸

Similarly, Canguilhem's basic gesture shifted 'the concept' – the formal, impersonal element of science in its discontinuous history – from

its mathematico-metaphysical foundations (a Platonism extending through the philosophies of Bachelard, Koyré, and Cavailles) onto a ‘metabiological’ ground whose primary philosophical expression was to be found in Aristotle. ‘Metabiological’: the concept, here, is folded *into* life but is not simply or exactly in itself ‘alive’; it is a question, rather, of the paradoxical location of ‘order’ or ‘form’ within the order of forms, and, unfolding from this, of a logos entangled with the living, inseparable, ultimately, from its actualization in the logic of the living.

If the *a priori* is in things, if the concept is in life, then to be a subject of knowledge is simply to be dissatisfied with the meaning one finds ready at hand.²⁹

This de-foundation or deconstruction of the concept, re-grounding it in life, ought to be placed alongside the dialectical movement (sketched above) through which the theory of differential systems evolved, in the middle of the twentieth century, both *from* and *as* the experimental cognition of living systems. Each was the site of the same interleaving between the ‘systems’ of *bios* and *logos*. Together, the biologized epistemology extending from Canguilhem, and the epistemologized biology extending from the Macy group constitute the semantic space within which the self-reflection/self-description of experimental science advances in work such as Rheinberger’s. For this mid twentieth-century tendency, it was as if mind and life had been subject to some originary bifurcation, a fall, which, only now that their languages had rediscovered one another, was to be sutured.³⁰ The ensuing structural coupling between biological systems and metabiological (cognitive) systems might not have an end. If Novalis’s millenarian version is believed, we may be stuck with this disaster:

Here that *living* reflection comes into being, which with careful tending afterwards extends itself into an infinitely formed spiritual universe – the kernel or germ of an all-encompassing organization [*alles befassenden Organisation*]. It is the beginning of a true *self-penetration of the spirit* [*Selbstdurchdringung des Geistes*] which never ends.³¹

Such a self-penetration of the spirit seems concretely to take place in the emergence of experimental systems (once again, treated here as paradigmatic for a variety of metabiologically founded systems). And, it might be said that, deepening the subversion of representational thought (or

‘picture thinking’) in post-Kuhnian historical philosophies of science, Rheinberger’s historical epistemology gives both the deconstructivist variant of the philosophy of the concept and, less explicitly, the parallel constructivist theory of differential systems (second-order cybernetics) an axial rotation toward the ‘object’.³² While post-structuralism, radical constructivism, autopoiesis theory, and other styles of second-order observation have tended to assert their post-metaphysical character by carefully bracketing ‘objectivity’ (shifting ‘from being to doing’ as Maturana puts it), Rheinberger’s rediscovery of *différance* in the lab embeds, and in a sense re-materializes, the form of a purely operational system of differential self-reproduction in experimental set-ups containing organic materials. Moreover, driven perhaps by the same ‘abhorrence of abstraction’ that is the hallmark of biologists (according to a quotation from François Jacob that Rheinberger uses as a chapter epigraph), his deconstruction of bioscience seems, at times, to shade into a kind of philosophy of living nature, in which ‘life’ would be determined, beyond all representationalism, as a material–conceptual process of differential reproduction through (or as) continuous auto-experimentation. Reading Rheinberger, one has the impression (often, yet in a manner that isn’t easy to isolate with precision) that the ‘life’ of experimental systems is not ultimately distinguishable from the ‘life’ of their biological objects of study.³³ These systems are ‘governed by difference’ (and are managed in such a way as to remain so), and the differences governing them arise from the errant (auto-deconstructivist) behaviour of living bits of unknown knowledge, as they continuously derange or defer containment by the mutable assemblages of technical objects surrounding and soliciting them. Rather as Marx’s materialist science pivots on the discovery and analysis of the commodity-form as both the condition and result of capitalist production, Rheinberger’s historical epistemology hinges on the internally differential character of the epistemic thing, concretely flickering between representation and reality, as both the prerequisite motive and the resulting product of the experimental machine.

Scientific objects have the precarious status of being absent in their experimental presence [...]. A mixture of hard and soft, like Serres’s veils, they are ‘object, still, sign, already; sign, still, object, already.’ [...] Experimental conditions ‘contain’ the scientific objects in the double sense of this expression: they embed them, and through that very embracement, they restrict and constrain them.³⁴

Objective knowledge is constructed. But, moving beyond the first-*Kritik* Kantianism of that recognition, such knowledge refers to things whose epistemic potentiality is not exhausted in the constructions they excite, since every construction (at least those that are experimental rather than definitive) distinguish what is known from the material unknown of that knowledge. Epistemic things manifest the difference between indication and generation – that is, the essential tension of every constructivism – but as a real difference, a tension between signification and existence at work in the real.

While radical constructivism, cybernetic epistemologies, and theories of second-order observation have sought to generalize and formalize the reflexivity explicit in the knowledge of life, Rheinberger's thought moves in the other direction. In line with a basic insight which, reaching back to Kant, emphasizes the reflective character of functional explanation and of the cognition of self-organization, the essentially reflective form of theory construction characteristic of paradox-embracing, second-order theories like that of 'autopoiesis' renders the attribution, to the systems they describe, of attributes such as self-reference, internal difference, recursive functioning, organizational closure, and the like, radically non-equivalent with the ordinary intellectual attribution of predicates to objects (i.e. what Kant had called constitutive or determinate judgment). Rheinberger, however, in contrast with cyberneticians working further to abstract and generalize these systems theories, transposes or (as he might prefer) 'regrafts' this de-ontologizing reflexivity (back) onto the 'real'.³⁵ In a kind of inverted constructivism, which is subtracted from traditional oppositions of the material and the mental, the vital differences he calls epistemic things become the engine of research machines. "Differential" reproduction in the sense of a permanent dislocation of epistemic entities is precisely what endows a research system with its generative power, and what renders the process genuinely *historical*.³⁶ As such statements reveal, Rheinberger's thought is – at last – less a 're-ontologization' of post-metaphysical discourses as it is an *advance*, into the bracketed domain of things in themselves, of an operationalization of the world. It is consistent, in other words, with an epistemological shift from substance to function which has been accelerating – at least in self-consciousness – since the 1950s.

Now, Rheinberger's transposition of constructivism/deconstruction onto experimental bioscience takes place, decisively, under the influence of Canguilhem, insofar as the programme of his epistemology is con-

densed in the early formulation: 'transposing the dialectical process of thought onto the real, one can maintain that it is life, the object of study itself, that is the dialectical essence, whose structure thought must espouse [*la pensée doit en épouser la structure*]'.³⁷ Surveying the contradictions within which biological thought has seemingly always moved, and re-projecting this dialectic onto the object of study itself, Canguilhem isolates and suspends a zone of material reality (i.e. that which is 'self-preserving by means of self-regulation'³⁸) between multiple intellectual determinations (e.g. mechanism vs. purpose, atomism vs. totality, continuity vs. discontinuity) in a manner that renders 'life' the dialectical essence of science, the concept itself, or a kind of biological imperative given to science. For the present essay, it is important to hold onto this '*must*': why *must* thought espouse the structure of life? One is reminded, here, of the Luhmannian advice: rather than 'search for the egg from which it emerged, the chicken should lay another and cackle'.³⁹ Is this '*should*', relating to reproduction, the bare metabiological norm, which remains beyond a certain modern liquidation of norms?

Either way, in light of the theoretical developments in biology since the mid twentieth century, the attribution of 'life' to an experimental system (on the basis of its differentially self-reproductive form) can no longer be interpreted as simply or stably metaphorical: it is not exactly a metaphor, since the *vehicle* of the metaphor, biological life, is itself defined in more or less the same terms as the metaphor's apparent *tenor*, experimental systems. To repeat: insofar as the form of 'life' of an experimental system is this errant self-repetition, the autopoiesis or reiteration of a difference, the system ceases to be merely metaphorically 'alive', since this characterization tendentially approximates the regulative principle or 'project' of the errant or mutating self-copyists of study, actual biological systems. 'Evolution is built on accidents, on chance events, on errors', writes François Jacob, in a sentence that might easily have come from Rheinberger's description of scientific evolution, and continues: 'The very thing that would lead an inert system to destruction becomes a source of novelty and complexity in a living system.'⁴⁰ By like token, experimental results that seem merely destructive for science (when self-construed as an essentially theoretical enterprise) are a source of surprise and potential regeneration for experimental systems. Since the particular experimental systems to which Rheinberger is referring are (in the first instance) precisely those of

mid-twentieth-century molecular biology, from a higher standpoint, the regulative differential principle of the experiment as a system can be seen to coincide with the regulative differential principle of the living objects studied within it. And, crucially, in *both* cases:

There is no Mind to direct operations, no Will to order them to continue or stop. There is only the perpetual execution of a programme that cannot be dissociated from its fulfilment. [...] There is no longer a cause for reproduction, simply a cycle of events in which the role of each constituent is dependent on the others.⁴¹

From a perspective cognizant of the coupling of epistemology and biology in the twentieth century, it would seem that the model of the experimental system developed by Rheinberger is abstracted, via the intermediary of certain post-metaphysical theories, from the very self-reproducing differential systems discovered/invented within these experimental systems. From this standpoint, then, the distinction between cognitive and living systems begins to recede, making way for the thought of that which is distinct from both.

These elementary notes concerning the doublings and re-doublings of cybernetics, post-structuralism, and biology in the second half of the twentieth century indicate only the most obvious way in which the metabiological 'life' of experimentation, which is (implicitly) de-metaphorized in the shift between Hacking and Rheinberger, might be further determined. Yet such a historicization, while certainly to be desired, would remain insufficient. For it is a significant premise of this essay that the dialectical conjunction of the concept and life runs deeper than any twentieth-century machinations.

II. INNER DIFFERENCE AND INVOLUNTARY SCIENCE

Habermas's provocative suggestion that Luhmannian systems theory appropriates the very philosophy of the subject it rejects as 'Old European' points to a particular – potentially very precious – connection between metabiologically founded systems and the 'self-consciousness' described in the German philosophical tradition extending from Kant to Hegel.⁴² At the same time, Habermas's reading of Luhmann seems to underestimate the shift, at the core of the Luhmannian gesture in theory, from the metaphysical paradigm of the subject to the post-meta-

physical paradigm of *performance*. Then again, if the Critical philosophy was itself a break with metaphysics, the constructivist and deconstructive descriptions of biological, social, and experimental systems that have emerged and developed since the 1950s may represent a continuation, rather than either a break or ‘appropriation’, of the transcendental philosophy of self-consciousness.

Taking up an interpretation offered by Foucault, Deleuze, and, more recently, Béatrice Longuenesse and Peter Osborne, one can lay stress on how Kant forecloses the possibility of direct self-cognition. As Longuenesse puts it, Kant’s Copernican turn is ‘an internalization within thought of the relation between *matter* and *form*’. For Kant, “‘matter” and “form” characterize the two *poles* of the activity of representation: the given (“determinable”) and the act of combining this given (“determination”). The distinction is now a polarity, that is, a relation that Kant has ‘internalize[d]’, relocating it from ‘being’ to ‘the activity of thinking’.⁴³ The interpretation of this interiorization offered by Foucault (‘The Analytic of Finitude’) placed Kant at the threshold of the modern episteme and, on the platform of the transcendental philosophy, drew a series of anthropo-centring connections between difference, life, historicity, and cognition. In Foucault’s as in Deleuze’s reading of Kant, the de-ontologizing (or operationalizing) re-entry of the logical dichotomy (form/matter) into the activity of thinking coincides with the insertion of that activity (thought) into *time*. The Kantian self-consciousness, so the interpretation runs, is the first finite (or ‘secular’) form of subjectivity. Kant’s rigorous denial of Cartesian self-cognition is premised on the fundamentally *temporal* relation between determination (form) and the undetermined (matter), or between ‘I think’ and ‘I am’. Deleuze writes:

To ‘I think’ and ‘I am’ must be added the self – that is, the passive position (what Kant calls the receptivity of intuition); to the determination and the undetermined must be added the form of the determinable, namely time. Nor is ‘add’ entirely the right word here, since it is rather a matter of establishing the difference and interiorising it within being and thought.⁴⁴

Whereas the Classical subject (as ‘thinking substance’) was capable of immediate self-determination, Kantian self-consciousness takes time. The interiorization of form/matter renders the problem of a post-Kantian or modern philosophy the problem of the relation between *faculties*. Time, for Kant, is not only a form of intuition; it also foregrounds,

for the first time, the medium of the process of determining the undetermined. In addition to being a pure form of intuition, time becomes, as Deleuze puts it, a ‘third logical value’ separating and relating form and matter.⁴⁵ This interpretation of the decisive significance of Kant’s gesture in philosophy hangs on a footnote to the B-Deduction in which Kant defines time, not as a pure form of intuition, but as ‘the receptivity of the determinable [*Rezeptivität des Bestimmbaren*]’.⁴⁶ In Kant’s philosophy, undetermined existence (or ‘matter’) requires something in order to be determined: it requires the *receptivity* or determinability of the determinable. This is Kant’s ‘discovery of the transcendental’, his ‘discovery of Difference’; the footnote lays bare ‘the fracture of the I’ and the ‘passivity of the self’, which is to say, the emergence of ‘inner difference’.⁴⁷ As the ‘receptivity of the determinable’, the temporal, finite self is an inner difference between determination and the undetermined, a ‘polarity’ in Longuenesse’s (and Schelling’s, Novalis’s, Ritter’s ...) terms.

What has this to do with the metabiological, with experimental systems, with a science, a society, a form of power, and a subjectivity that have all, so to speak, gone into administration?

Well, the entire conception of an *operational* system, a system that has no ontology, since its actions (differences) are not grounded in a substance but rather in other actions (differences), evidently depends on the notion of such a system’s *intrinsic* temporality, as opposed to any location *in* space and time.

[E]very system of material entities, and therefore every system of actions concerning such entities that can be said to possess reproductive qualities, may also be said to possess its own intrinsic time. [...] Internal time characterizes a sequence of states of a system insofar as it undergoes continuing cycles of nonidentical reproduction.⁴⁸

The complete identification of ‘being’ and ‘operation’ that is transcribed here applies equally to biological and metabiological systems. In Jacob’s *Logique du vivant*, we read: ‘Inanimate bodies do not depend on time. Living bodies are indissolubly bound up with time. In the living world, no structure can be detached from its history.’⁴⁹

The shift from a Cartesian cogito to a Kantian self-consciousness, a shift involving a certain ‘doubling’ of time, is situated at the threshold of an age to which, however precariously, the systems observed by Jacob and Rheinberger belong. Within such an economy, as Julian Roberts puts it, ‘rationality is *essentially* temporal’; “‘truth” is something

inescapably sequential; and “reference” is not so much to something outside, as to the outside of boundaries produced within thought itself.⁵⁰ This temporalization of cognition, conjoined to a ‘diminution’ of the subject of knowledge and to the irreversible emergence of the boundary-producing character of the activity of knowing, is the *arché* of experimental systems and their epistemic things, governmental systems and their crises, and, ultimately perhaps, of the differential form of modernity’s global-societal communication system. Such systems consist of performances that serve the differential arrangement of their apparatuses by sustaining the difference that governs them. Already with Kant, the conditions for this situation are in place: the subject of science, the ‘agency’ of cognition, is a transcendental *difference*, not a substance. Substantial subjectivity, in Kant, characterizes only the *practical* subject. And it is therefore no accident that Deleuze complains of Kant that he ‘did not pursue his initiative: both God and the I underwent a practical resurrection.’ That is, for Deleuze, Kant’s conception of practical reason remains unsecularized in its ‘substantial’ determination.⁵¹

Unsurprisingly, then, it is with reference to the famous ‘great gulf’ separating theoretical and practical reason that a preliminary line drawing of ‘anthropolarity’ may be attempted. In this drawing of a bipolar or bistable figure, the substantially wilful human being interpenetrates-without-touching an involuntary operation of differential reproduction.⁵² A concept reduced to life, a science operating as pure research, a subject bounded to the reflexive establishment, expansive interiorization, and ceaseless reiteration of difference – this aspect is so dominant as to have made its other unobservable.

In experimental systems, if not in modern social systems generally, rationality becomes ‘the ensemble of the conditions that make system maintenance possible’.⁵³ This formulation, which registers Habermas’s appreciable distress at a ‘despairing rationalism without reason’ (Gillian Rose), almost exactly mirrors that with which, on the threshold of our episteme, Bichat famously defined life, ‘the ensemble of functions that resist death [*l’ensemble des fonctions qui résistent à la mort*]’. Metabio-logical systems are, in this light, descendants of a critical vitalism that emerged precisely via the separation of ‘life’ from ‘volition’, a division of the living soul as it was still theorized, for instance, by Stahl. Since it identified life (contra mechanism) directly with the purposive reason of the soul, Stahlian animism could never be convicted of irrationalism in the way that modern vitalism has been. While the tasks of this essay are

not properly historical, one may note that, prior to the Kantian formulation of the central antinomies of bourgeois thought, the development of neurology and physiology had proceeded, since Thomas Willis's paradigm-changing work on the nerves, as an increasing separation of the higher rational faculties from, in Robert Whytt's terms, 'the vital and other involuntary motions of animals', that is, the reflexes. It is from the latter, from a radically will-divested vitality, that the metabiological *ratio* of modernity will abstract and formalize itself. Such a rationality without reason will be immanent to a form of order that is, as Hume beautifully put it, spun, like a spider's web, from the belly not from the brain.⁵⁴

In a dialectical history that has never fully been told, as practical reason (volition) was separated from the operations of thought, rationality was naturalized, inserted into the immanence of life, where it thus became an intrinsically temporal, effectual, insubstantial, and (from the standpoint of its increasingly impotent and exposed substance) irrational logic of differential reproduction or system maintenance. This history of the de-voluntarization of life coupled to the metabiologization of reason is unfinished; it continues, today, in the management of experimental systems and in the functional performance of administration (*oikonomia*) at diverse sites of the modern global Inspection House, the house of experiment or 'Elaboratory' (Jeremy Bentham). If this practice isn't a science, as Agamben and Foucault have stressed, still less is it formative activity (transcendent work). It is rather a form of immanent drudgery, a drudgery divine, which, like the unwinnable battle against the dust described by de Beauvoir, is aimed at reproducing an actuality whose transience makes its upkeep unceasing: purposive without a purpose.

III. THE BIOLOGICAL IMPERATIVE AND ABSOLUTE IMPOTENCE

'Multipliez, multipliez: vous finirez bien par croître, comme espèce et comme individus.'⁵⁵ With these words a 'wholly New Testament of biology' is announced – the new age of differential reproduction that Foucault (as also Canguilhem) discerned in François Jacob.⁵⁶ It was essentially the same good news that, *qua* the paradigm of 'autopoiesis', was concurrently enabling what Luhmann would call 'sociological enlight-

enment'. System: difference. In modernity, multiplication, reproduction, or self-division is not a secondary, more-or-less subordinate property of nature and society. On the contrary, rather as exchange value comes to precede and outrank utility in the production of commodities, so, in biological, experimental, and governmental systems, difference comes to precede individuation itself. Reproduction is not, so to speak, the compensation that living beings receive for their incapacity to continue growing eternally; the aleatory differentiation of reproduction traverses biological systems (as also metabiological systems) all the way down.

Perhaps Foucault was right to locate a shift going on around him, a shift in the foundations of biology from the primacy of growth/individuation to a conception of pure differentiation; and perhaps, too, the new paradigm enabled him to see something in the history of power absent from his earlier researches. Insofar as disciplinary apparatuses aim, precisely, 'to increase and multiply' the productive powers of the body, it would seem that his development of the subtly contrasting concept of governmental power (whose essential interest is not in production and growth but rather reproduction and security) contains decisive echoes of the 'New Testament' of biology.⁵⁷ Government, as he begins to theorize it in the mid-1970s, in contra-distinction to disciplinary power, does not fundamentally aim to increase anything, but only to reproduce the difference, the correlation, the interplay between techniques of power and their object. This is why it is so appropriate and revealing that Rheinberger, in the sentence around which this essay has circled, identifies the existence of the experimental system with its capacity to 'keep being governed by difference'. At the same time, the notion that Foucault's development of the concept of governmentality was in some sense enabled by his reading of the new biology opens a complex question about the relation between the genealogy of government and the epistemology of biology. For it suggests that twentieth-century machinations in the latter (sketched in Section I above) provided thinkers like Foucault and Luhmann with the conceptual instruments with which to perceive a somehow comparable 'paradigm shift' in society itself at the onset of modernity. In a still slightly mysterious typology or historical index, the archaeological breaks of the *Sattelzeit* seem not to have become properly legible until the biological, epistemological, and sociological 'enlightenments' beginning c. 1950.

If, as Foucault put it, the threshold of modernity is biological, it is because cognition in general, in this regime, is an inner difference, while

inner difference is, will be, and will have been the simple essence of life.⁵⁸ Whether in the structure of power or the practice of experiment, the ground of modernity is division, distinction, difference: no longer the difference between two positive terms, but difference itself, immanent difference, ‘life’:

This simple infinity, or the absolute concept, may be called the simple essence of life, the soul of the world, the universal blood, whose omnipresence is neither disturbed nor interrupted by any difference, but rather is itself every difference as also their supersession [*selbst alle Unterschiede ist, so wie ihr Aufgehobensein*]; it pulsates within itself but does not move, inwardly vibrates, yet is at rest.⁵⁹

One should not be deceived by the mystical language here – which is, in any case, already highly self-conscious – into assuming that Hegel speaks from some earlier and other ‘world we have lost’. This ‘mystical’ foundation of reality is ours, inescapably according to Novalis’s prophecy. By like token, the fact that, as Hegel highlights, the absolute concept ‘may be called’ by different names (infinity, life, world-soul, universal blood, etc., to which list, after Marx, one can add capital) should not deceive us into thinking that ‘life’ is merely one (modern) philosophical nomination of this inner difference, as some have suggested.⁶⁰ ‘Life’, in this episteme, is neither a pure concept of the understanding, nor an empirical concept under which a specific intuition can be brought. It is, on the contrary, part of the apparatus, the temporal self-affecting process of cognition. Life is not only ‘more-life’, but also ‘more-*than*-life’ – biologically multiplying and metabiologically interiorizing.⁶¹ Thus, at least in modernity, the ‘naming of being’, as the apparently primary gesture of theory construction, is already captured by difference, is already a distinction; nothing happens without a distinction.⁶² Schmitt reacts against modernity when he maintains that *divisio* is not *primaeva*, that division (distribution) is preceded by a taking (appropriation, *Nehmen*).⁶³ For our age, the opposite is closer to the truth: ‘taking’ presupposes (and enacts) division. By the same token, the basic desire to strip power of its power can no longer coordinate a meaningful political project, as it has done for so long, and as the young Hegel still thought it could.⁶⁴ A power stripped of its form *as* power, and a science stripped of its form *as* science, constitute today precisely *the normal situation of normal change*. The historico-transcendental condition of this order may be discerned in the Copernican revolution

in philosophy, and its introduction of time (the receptivity of the determinable) into being and thought. Agamben is alive to this significance of time when he presents, through a simultaneous reading of Paul with Benjamin, the Messiah as a division of time's division.⁶⁵ And time's division is not merely past and future, but is rather the immanent difference, the receptivity of the determinable, subtending all positive differences. Then again, time (as inner difference) may itself be founded on life's injunction, a biological imperative. In modernity, in the time-zone already inhabited by Kantian thought, cognition (including scientific cognition) has been penetrated by the mode of receptivity and self-activity which has no other name but 'life'. The concept receives its law, as an injunction to distinguish, from here.

Empirical cognition's origin in a biological imperative to keep being governed by difference may be placed alongside the categorical imperative with which it is strictly contemporary.⁶⁶ Life, as the structure of differentiation or dialectical process that thought *must* espouse, is the metabiological para-imperative of the age of anthropolarity. In their deontologized performances, the differential systems described by Rheinberger are, if they wish to occur and recur, subjected to this injunction. The purpose of making such connections is not merely to underline once more that Kant's thought crosses the threshold of a modernity in which we remain, but, further, to point, from these later incarnations of 'inner difference', back to the subjectivity from which they have been subtracted. This latter may still be called by its Kantian names, 'pure practical reason' or 'will' (*Wille*), so long as it is acknowledged that, in calling it as much, one recognizes not a power but an impotence. If, as Deleuze begins to contend, Kant is the first to present cognition as insubstantial (non-theological) effectuality (i.e. as an economy), his system also contains the clearest formulation of the cognitive 'outside', a substance absolutely incapable of effects: pure practical reason, or will.

Even if this essay can do no more than point to this aspect, indeed barely so much, this modern impotence, this voluntary human being – or human nothing – must on some level exist. Here, the distinction between volition and the power of choice (*Wille* and *Willkür*) needs again to be reinforced. For there are, of course, multiple displays of agency and decision-making at the ministerial level; indeed, these non-rule-following selections are the essential operations of the performance of governmental and experimental systems. Without them, everything stops. But these are, one and all, the basically arbitrary operations of a

morally, rationally, and ontologically ungrounded power of choice. And between the timeless impotence of pure practical reason and the real-time empire of decisions and distinctions, there can be no difference of degree. The ‘minus’ of ‘ministry’ is not a quantitative lessness of power or being; it is *less than* power or being. The Son is not less substance than the Father; as substance, the three persons are one (monotheism); yet, God is not only substance, but also an effective activity, or, to use the technical term, an *economy*. When our world became Christian, or rather when it became (so to speak) seemingly unstoppably auto-Christianizing, a split was introduced between being and practice which modernity, in both its governmental form of ‘power’ and its experimental form of ‘science’, has not ceased to radicalize. Today, this world can be presented as a polarity without a field of tension or space of mediation between the will – the sole reigning and remaining substance – and the multiverse of ‘drifting, merging, and bifurcating systems’.

In Agamben’s speculative genealogy, the theological and the *oikonomic*, substance and effectuality, form a bipolar ‘machine’ in which neither is possible without the other – so that, even in a situation such as ours in which all power has taken the form of an economy, the radically emptied substance of a useless, exclusively pompous sovereignty (on show for instance in the recent wedding of the second-in-line to the British crown) not only remains, but remains indispensable, structurally, to the functioning of the machine. If we uphold the thesis of this polarity, then the differential-metabiological-*oikonomic* ‘life’ of experimental systems implies the persistence of an annulled and emptied transcendence. The proposition, here, is that this ineffectual substance has not only a religious and a constitutional designation (i.e. Father and King, respectively), but also an anthropological value as *voluntary* humanity. Volition absently remains; it is even, perhaps, all that remains. It remains, however, unobserved, while, on the face of things, the human appears gradually more involuntary, gradually less distinguishable from the performance of recursive distinguishing, from the careful management of apparatuses so that they, and therefore it, keep being governed by difference. The problem is how to conceive the relation of the two (volition/distinction). When an opposition between two terms is operated by one of its sides, the other is excluded not only internally but also externally, for it is excluded from the very form of the exclusion. In this situation, which has been described here, the whole is to be con-

ceived as an *unmediated, tensionless* polarity without field; and for this, the multistable figure offers a kind of placeholder.

NOTES

- 1 Hans-Jörg Rheinberger, *Toward a History of Epistemic Things: Synthesizing Proteins in the Test Tube* (Stanford: Stanford University Press, 1997), p. 34.
- 2 The turn toward the materiality of scientific objects and experimental practices within the history, philosophy, and sociology of science is associated with Hacking as well as the collaborations between Bruno Latour and Steve Woolgar, and Steven Shapin and Simon Schaffer. For Rheinberger's own history of the historicization of the philosophy of science, see his *On Historicising Epistemology: An Essay*, trans. by David Fernbach (Stanford: Stanford University Press, 2010).
- 3 Ian Hacking, *Representing and Intervening: Introductory Topics in the Philosophy of Natural Science* (Cambridge: Cambridge University Press, 1983), p. 150; Ian Hacking, 'Do Thought Experiments Have a Life of Their Own? Comments on James Brown, Nancy Nersessian and David Gooding', *PSA: Proceedings of the Biennial Meeting of the Philosophy of Science Association*, 2 (1992), pp. 302–08 (p. 307).
- 4 See Rheinberger's essay 'Schnittstellen' ('Intersections') for an extended discussion of 'der Wechselwirkung zwischen epistemischen Dingen und den technischen Bedingungen ihrer Manipulation in Experimentalsystemen' (Hans-Jörg Rheinberger, *Epistemologie des Konkreten: Studien zur Geschichte der modernen Biologie* (Frankfurt am Main: Suhrkamp Verlag, 2006), p. 314; in English as *Epistemology of the Concrete: Twentieth-Century Histories of Life* (Stanford: Stanford University Press, 2010), p. 218, where 'Wechselwirkung' is translated as 'reciprocal relation').
- 5 Rheinberger, *Toward*, p. 28.
- 6 *Ibid.*, p. 81.
- 7 Michel Foucault, *Security, Territory, Population: Lectures at the Collège de France, 1977–78*, trans. by Graham Burchell, ed. by Michel Senellart, English series ed. by Arnold I. Davidson (Basingstoke: Palgrave, 2007), pp. 79 and 276.
- 8 Foucault, *Security*, pp. 276–77.
- 9 See, esp., Giorgio Agamben, *The Kingdom and the Glory: For a Theological Genealogy of Economy and Government*, trans. by Lorenzo di Chiesa (with Matteo Mandarini) (Stanford: Stanford University Press, 2011).
- 10 Cf. Anton Schütz, 'Imperatives without Imperator', *Law and Critique*, 20.3 (2009), pp. 233–43: 'The history of executive power – the power whose secret is the disappearance of the question of its being behind its action – stands in the sign, "less". [...] The history of the West and its (once-)celebrated "take-off", is courtesy to the Christian God who has accepted to carry the cross once again, and to act, not according to the sovereign whim or privilege wielded by a master of the universe, but humbly in the sign of the *minus* of ministry, the limited means of government and governmental care' (p. 240).

- 11 Bruno Latour, *The Pasteurization of France* [and *Irreductions*], trans. by Alan Sheridan and John Law (Cambridge, MA: Harvard University Press, 1988), p. 152.
- 12 Agamben, *Kingdom*, pp. 17–18.
- 13 Foucault, *Security*, pp. 104 and 116.
- 14 Cf. Colin Starnes, ‘Augustinian Biblical Exegesis and the Origins of Modern Science’, in *Collectanea Augustiniana: Augustine: ‘Second Founder of the Faith’*, ed. by Joseph C. Schnaubelt and Frederick Van Fleteren (New York: Peter Lang, 1990), pp. 345–46.
- 15 Cf. Bruno Latour, ‘From the World of Science to the World of Research?’, *Science*, New Series, 280.5361 (1998), pp. 208–09.
- 16 ‘Luhmann’s systems theory effects a shift in thought from metaphysics to metabiology. However the expression “metaphysics” may have chanced to arise, one could attribute to it the meaning of a thinking that proceeds from the “for us” of physical appearances and asks what lies behind them. Then we can use the term “metabiological” for a thinking that starts from the “for itself” of organic life and goes behind it – the cybernetically described, basic phenomenon of the self-maintenance of self-relating systems in the face of hyper-complex environments’ (Jürgen Habermas, ‘Excursus on Luhmann’s Appropriation of the Philosophy of the Subject through Systems Theory’, in *The Philosophical Discourse of Modernity: Twelve Lectures*, trans. by Frederick Lawrence (Cambridge: Polity Press, 1987), pp. 368–85 (p. 372)).
- 17 Rheinberger, *Toward*, p. 181.
- 18 *Ibid.*, p. 182.
- 19 See Section III below.
- 20 Jacques Derrida, *Of Grammatology*, trans. by Gayatri Spivak, Corrected Edition (Baltimore: Johns Hopkins University Press, 1997), p. 9.
- 21 For the distinction between the philosophy of the concept and the philosophy of consciousness, see (for the original formulation) Jean Cavaillès, ‘On Logic and the Theory of Science’, trans. by Theodore J. Kisiel, in *Phenomenology and the Natural Sciences: Essays and Translations*, ed. by Joseph J. Kockelmans and Theodore J. Kisiel (Evanston: Northwestern University Press, 1970), pp. 353–409 (p. 409); Michel Foucault, ‘Life: experience and science’ (1984), in *The Essential Works of Michel Foucault, 1954–1984*, 3 vols, ed. by J. Faubion, trans. by Robert Hurley and others (Harmondsworth: Penguin, 1998), II, pp. 464–78; David Hyder, ‘Foucault, Cavaillès, and Husserl on the Historical Epistemology of the Sciences’, *Perspectives on Science* 10.4 (2003), pp. 107–29; Hans-Jörg Rheinberger, ‘Gaston Bachelard and the Notion of “Phenomenotechnique”’, *Perspectives on Science*, 13.3 (2005), pp. 313–28; Rheinberger, *On Historicizing Epistemology*; Pascale Gillot and Pierre Cassou-Noguès (eds), *Le Concept, le sujet et la science* (Paris: Vrin, 2009); and, for a slightly different configuration, Alain Badiou, ‘The Adventure of French Philosophy’, *New Left Review*, 35 (2005), pp. 67–77.
- 22 For biographical and historical overviews, see Heinz von Foerster, *Understanding Understanding: Essays on Cybernetics and Cognition* (New York: Springer,

- 2003), pp. v–ix, and N. Katherine Hayles, *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics* (Chicago: University of Chicago Press, 1999).
- 23 Georges Canguilhem, ‘The Concept of Life’, in *A Vitalist Rationalist: Selected Writings of Georges Canguilhem*, ed. by François Delaporte, trans. by Arthur Goldhammer (New York: Zone Books, 1994), pp. 303–19 (p. 304); in the original as ‘Le concept et la vie’, in *Études d’histoire et de philosophie des sciences* (Paris: Vrin, 2002), pp. 335–64 (p. 337). The formulation appears, in conditional form, during a gloss on Aristotle. But the position is Canguilhem’s. Earlier, in ‘Aspects of Vitalism’, he had noted: ‘This interpretation does not take anything away from a physics as determinist as it wants to be and can be – it does not take away from physics any of its objects. But it includes the physical interpretation within another, which is vaster and more comprehensive, since the meaning of physics is justified within it and the activity of the physicist fully secured’. See Georges Canguilhem, ‘Aspects of Vitalism’, in *Knowledge of Life*, ed. by Paola Marrati and Todd Meyers, trans. by Stefanos Geroulanos and Daniela Ginsburg (New York: Fordham University Press, 2008), pp. 59–74 (p. 71); in the original as ‘Aspects du Vitalisme’, in *La Connaissance de la vie* (Paris: Vrin, 2006), pp. 105–27 (p. 122).
- 24 Thomas Beddoes, *Contributions to Physical and Medical Knowledge, Principally from the West Country* (Bristol: Biggs & Cottle, 1799), p. 4; italics original. It seems to have been Beddoes, here, who won the race to invent ‘biology’, with Oken, Treviranus, and Lamarck following hot on his heels, and re-pioneering the term independently both of him and each other within half a decade.
- 25 Bachelard spoke of scientific instruments as ‘theories materialized’; ‘machines idealized’ is Rheinberger’s mirror formulation for theories themselves; for both, see Rheinberger, *Toward*, p. 20–21.
- 26 Jean-François Lyotard, *The Postmodern Condition: A Report on Knowledge*, trans. by G. Bennington and B. Massumi (Manchester: Manchester University Press, 1984), pp. 4 and 11.
- 27 Canguilhem, ‘The Concept of Life’, p. 316. Cf. François Jacob, *The Logic of Living Systems: A History of Heredity*, trans. by Betty Spillman (London: Allen Lane, 1974 [1970]), ‘The Programme’.
- 28 For clear accounts of second-order cybernetics’s de-ontologization of systems, see Jean Clam, ‘System’s Sole Constituent, the Operation: Clarifying a Central Concept of Luhmannian Theory’, *Acta Sociologica*, 43.1 (2000), pp. 63–79, and idem., *Was heißt, sich an Differenz statt an Identität orientieren? Zur De-ontologisierung in Philosophie und Sozialwissenschaft* (Konstanz: Universitätsverlag Konstanz, 2002).
- 29 Canguilhem, ‘The Concept of Life’, p. 318. For a discussion of Canguilhem’s distinctive theory of the (scientific) subject, see Alain Badiou, ‘Is There a Theory of the Subject in Georges Canguilhem?’, trans. by Graham Burchell, *Economy and Society*, 27.2–3 (1998), pp. 225–33. An impression of this theory is performatively suggested by Canguilhem’s essayistic style, which proceeds through accumulating conditional sentences. The chapters of, especially, *La Connaissance de*

la vie are composed, through a kind of philosophical pointillism, of propositions that, without forming a system of their own, highlight the possibility of error, a risk which Canguilhem will eventually propose as (perhaps) essential to life. Such conditional, ‘if’ thinking exhibits the fictionalizing faculty – a dissatisfaction with fact – which is where the ‘subject’ comes into being for Canguilhem.

- 30 Lily E. Kay has written on the cultural (Judeo-Christian) dimensions of the marriage of molecular biology and information theory, in *Who Wrote the Book of Life? A History of the Genetic Code* (Stanford: Stanford University Press, 2000).
- 31 Novalis, *Werke*, ed. by Gerhard Schulz (München: C. H. Beck, 1969), p. 376; in English as *Philosophical Writings*, trans. and ed. by Margaret Mahony Stoljar (New York: State University of New York Press, 1997), p. 50; translation modified.
- 32 Rheinberger’s own reference is not to radical constructivism (Spencer Brown, von Foerster, et al.), but to its post-metaphysical counterpart, the Derridean deconstruction of which he is the German translator. For a reading of their connection, see Niklas Luhmann, ‘Deconstruction as Second-order Observing’, *New Literary History*, 24.4, Papers from the Commonwealth Center for Literary and Cultural Change (1993), pp. 763–82. A critical treatment of Rheinberger’s theoretical path to his experimental systems approach would also need to refer, here, to his early engagements with Althusser’s epistemology and, specifically, the concept of ‘process without a subject’ through which Rheinberger reads Marx and Darwin together; see, esp., Hans-Jörg Rheinberger, ‘Entwicklung als “Prozeß ohne Subjekt”’, *Hegel-Jahrbuch*, 1976 (1977), pp. 268–76; and, cf., Hans-Jörg Rheinberger, ‘Die erkenntnistheoretischen Auffassungen Althusser’s’, *Das Argument*, 94 (1975), pp. 922–51; ‘Philosophie und spontane Philosophie der Wissenschaftler: zu Althusser’s Verhältnisbestimmung von Philosophie und Wissenschaften’, *Sozialistische Politik*, 8 (1976), pp. 95–102; and ‘Erkenntnisprozeß, Wissenschaft und Philosophie’, in *Althusser: Kontroversen über den ‘Klassenkampf in der Theorie’*, ed. by Hans Jörg Sandkühler (Köln: Pahl-Rugenstein, 1977), pp. 77–102.
- 33 The chapters of Rheinberger’s book alternate between the history of a particular experimental system in molecular biology and his epistemological construction of the model of experimental systems. The unusual composition maximises the possibilities of perceiving contiguities between the two modes of ‘life’.
- 34 Rheinberger, *Toward*, pp. 28–29.
- 35 Rheinberger quotes Derrida’s call, in *Of Grammatology*, for a systematic exploration of ‘the analogy between textual grafting and so-called vegetal grafting, or even, more and more commonly today, animal grafting’. It is ‘probably not by chance’, he comments, that the deconstructive trope of this special form of iteration ‘is derived from a biological background’ (*ibid.*, p. 184).
- 36 *Ibid.*, p. 82; cf. pp. 3, 224, and *passim*.
- 37 Canguilhem, ‘Aspects of Vitalism’, p. 61; ‘Aspects du Vitalisme’, p. 109.
- 38 Canguilhem’s tentative definition of the ‘biological object’ in its historical consistency; see Canguilhem, *A Vitalist Rationalist*, p. 205.
- 39 Niklas Luhmann, *Soziologische Aufklärung* 6; qtd. from G. Winthrop-Young,

- 'On a Species of Origin: Luhmann's Darwin', *Configurations*, 11.3 (2003), pp. 305–49 (p. 312).
- 40 Jacob, *Logic*, p. 296.
- 41 *Ibid.*, p. 297.
- 42 Related connections have been drawn by Jean Clam and William Rasch, both with reference to the paradoxical act of self-positing in the philosophy of Fichte. See Clam, 'System's Sole Constituent, the Operation', and William Rasch, 'Introduction: The Self-Positing Society', in Niklas Luhmann, *Theories of Distinction: Redefining the Descriptions of Modernity*, ed. and trans. by William Rasch (Stanford: Stanford University Press, 1996), pp. 1–30.
- 43 Béatrice Longuenesse, *Kant and the Capacity to Judge: Sensibility and Discursivity in the Transcendental Analytic of the 'Critique of Pure Reason'*, trans. by Charles T. Wolfe (Princeton and Oxford: Princeton University Press, 1998), p. 149; emphasis added.
- 44 Gilles Deleuze, *Difference and Repetition*, trans. by Paul Patton (London: Continuum, 2004 [1968]), p. 108.
- 45 See *ibid.* and cf. Peter Osborne's discussion of Kant's 'ontological doubling' of time, in 'On Comparability: Kant and the Possibility of Comparative Studies', *Boundary 2*, 32.2 (2005), pp. 3–22.
- 46 Immanuel Kant, *The Critique of Pure Reason: Unified Edition*, trans. by Werner S. Pluhar (Indianapolis: Hackett, 1996), §25, B 157–58n; *Kritik der reinen Vernunft. Zweite Auflage* (1787), ed. by Benno Erdmann, *Kant's gesammelte Schriften* (Berlin: Reimer, later Walter de Gruyter, 1900–), III (1911).
- 47 Deleuze, *Difference*, pp. 108 and 109.
- 48 Rheinberger, *Toward*, p. 180.
- 49 Jacob, *Logic*, p. 296.
- 50 Julian Roberts, *The Logic of Reflection: German Philosophy in the Twentieth Century* (New Haven: Yale University Press, 1992), pp. 42 and 44.
- 51 Deleuze, *Difference*, pp. 109 and 108.
- 52 Cf. the distinction drawn by Osamu Nishitani in his essay 'Anthropos and Humanitas: Two Western Concepts of "Human Being"', in *Translation, Biopolitics, Colonial Difference* ed. by Naoki Sakai and Jon Solomon (Hong Kong: Hong Kong University Press, 2007).
- 53 Habermas, 'Excursus', p. 273.
- 54 David Hume, *Dialogues Concerning Natural Religion*, ed. by J. M. Bell (London: Penguin Classics, 1990), p. 89.
- 55 Michel Foucault, 'Croître et multiplier' (1971) [Review of François Jacob, *La Logique du vivant: une histoire de l'hérédité* (Paris, Gallimard, 1970)], in *Dits et Écrits*, ed. by Daniel Defert and François Ewald, 4 vols (Paris: Gallimard, 1994), II: 1970–1975, texte n° 81, pp. 99–104 (p. 101). Cf. Jacob, *Logic*, p. 287: 'With organisms as simple as bacteria, the only criterion for natural selection is the rate of multiplication. [...] It is a law without reprieve and without mercy.'
- 56 'The old law prescribed: "*croissez et multipliez*", as if to imply that multiplication comes after growth [*croissance*] in order to prolong it' (Foucault, 'Croître et multiplier', pp. 103–04).

- 57 See, e.g., the analysis of the Panopticon: ‘The Panopticon [...] has a role of amplification; although it arranges power, although it is intended to make it more economic and more effective, it does so not for power itself, nor for the immediate salvation of a threatened society: its aim is to strengthen the social forces – to increase production, to develop the economy, spread education, raise the level of public morality; to increase and multiply [*faire croître et multiplier*]’ (Michel Foucault, *Discipline and Punish: The Birth of the Prison*, trans. by Alan Sheridan (London: Penguin, 1977), pp. 207–08; *Surveiller et punir: Naissance de la Prison* (Paris: Gallimard, 1975), p. 209).
- 58 See Michel Foucault, *The Will to Knowledge: The History of Sexuality 1*, trans. by Robert Hurley (London: Penguin, 1998 [1976]), p. 142.
- 59 G. W. F. Hegel, *Phenomenology of Spirit*, trans. by A. V. Miller (Oxford: Oxford University Press, 1977), p. 100; *Phänomenologie des Geistes*, ed. by Friedrich Wessels and Heinrich Clairmont (Hamburg: Meiner, 1988), p. 115.
- 60 See Alain Badiou, ‘Of Life as a Name of Being, or, Deleuze’s Vitalist Ontology’, trans. by Alberto Toscano, *Pli*, 10 (2000), pp. 191–99: ‘Deleuze [...] fixes the thought of being to its Nietzschean name, life’ (p. 193).
- 61 Georg Simmel, *Lebensanschauung: Vier metaphysische Kapitel* (Berlin: Duncker & Humblot, 1918), Teil I: ‘Die Transzendenz des Lebens’, online edition: <http://www.socio.ch/sim/lebensanschauung/leb_1.htm> [accessed January 2011].
- 62 See Luhmann: ‘Draw a distinction, otherwise nothing will happen at all. If you are not ready to distinguish, nothing at all is going to take place’ (Niklas Luhmann, ‘System as Difference’, *Organization*, 13.1 (2006), pp. 37–57 (p. 43)).
- 63 See Carl Schmitt, *The Nomos of the Earth in the International Law of the Jus Publicum Europaeum*, trans. by G. L. Ulmen, 2nd edn (New York: Telos Press, 2003), p. 342 and note.
- 64 ‘This spirit of Jesus, a spirit raised above morality [*Moralität*], is visible, directly attacking laws [*Gesetze*], in the Sermon on the Mount, which is an attempt, elaborated in numerous examples *to strip the laws of legality, of their legal form [den Gesetzen das Gesetzliche, die Form von Gesetzen zu benehmen]*’ (G. W. F. Hegel, ‘The Spirit of Christianity and Its Fate’, in *Early Theological Writings*, trans. by T. M. Knox (Philadelphia: University of Pennsylvania Press, 1975), p. 212; emphasis added; cf. *Werke*, 20 vols, ed. by Eva Moldenhauer and Karl Markus Michel (Frankfurt a.M.: Suhrkamp, 1969–71), I: *Frühe Schriften* (1971), p. 324).
- 65 Giorgio Agamben, *The Time That Remains: A Commentary on Paul’s Letter to the Romans*, trans. by Patricia Dailey (Stanford: Stanford University Press, 2005), pp. 64ff.
- 66 ‘Reconsidering the first command, draw a distinction’, Spencer Brown notes that, with it, ‘we have reached a place so primitive that active and passive, as well as a number of other more peripheral opposites, have long since condensed together’ (George Spencer Brown, *Laws of Form* (New York: Julian Press, 1972), p. 84).

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