Deleuze and the Calculus

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Abstract:
The paper investigates Deleuze’s philosophical interpretation of differential calculus, which draws upon the approaches of Maimon, Wronski, and Bordas-Demoulin. Deleuze argues that for each of these thinkers the differential is the Idea—respectively, Leibnizian, Kantian, or Platonic. He further argues that, within the differential, three principles are combined to form a sufficient reason: the principle of determinability, which corresponds to the undetermined \((dx, dy)\); the principle of reciprocal determination, which corresponds to the reciprocally determinable \((dx/dy)\); and the principle of complete determination, which corresponds to the effectively determined (the singular values of \(dx/dy\)). This Deleuzian conception of the calculus is discussed in relation to his Spinozian critique of the Leibnizian, Kantian, and Platonic Idea, his deployment of a virtual ontology, which has been strongly influenced by Bergson’s notion of the \(\text{\acute{e}lan vital}\), and recent developments in stochastic calculus. It is argued that, while these latter developments are mostly congruent with Deleuze’s interpretation of the calculus, Robert Rosen’s critique of mechanism raises some doubts about the adequacy and completeness of Deleuzes’s conception of the differential, especially in relation to Bergson’s \(\text{\acute{e}lan vital}\).

1. Introduction:

1.1. The Role of the Calculus in Deleuzean thought

Works such as \textit{Difference and Repetition} mark the point at which Deleuze finds his own philosophical ‘voice’, the moment where he moves away from detailed and dedicated studies of such thinkers as Hume, Kant, Bergson, Nietzsche, and Liebniz to establish his own powerful and unique vision. However, what often makes it difficult to share this vision is the refractive nature of the critical insights that Deleuze weaves together as he moves from one thinker to another. The focus of this paper is on the crucial role of the differential calculus in \textit{Difference and Repetition}; most especially the Chapter entitled \textit{Ideas and the Synthesis of Difference}. In this Chapter, under the influence of Salomon Maimon (1790), Deleuze develops a critique of Kant’s notion of the Transcendental Idea.

As Smith (2006:46) explains, Kant distinguishes between three types of concepts: empirical concepts (such as ‘the rose’, ‘the table’, or the unifying manifold of sensations); \textit{a priori} categories (seen to be applicable to all objects of possible experience); and Ideas (conceived as transcending experience). In Kant’s \textit{Critique of Pure Reason}, Ideas provide the criteria of understanding for distinguishing between the legitimate (immanent) uses of syntheses of consciousness as regulative focal points, and the illegitimate (transcendent) uses, which entail the non-regulative, false positing of objects (Smith, 2006: 45, 47). However, notions that were deemed to be antinomic or paralogical in the first \textit{Critique}—God, Immortal Soul, and Unlimited World—are effectively re-introduced in the third \textit{Critique}, together with the Ideas of the Sublime, Symbolisation, Genius, and Telos itself (Smith, 2006:50).

For Kant, Ideas exist in sensible nature but they have the capacity to carry our faculties beyond sensibility due to the intervention of reason. In regard to the Sublime, imagination is rendered impotent before infinity of Idea. In Symbolisation, judgements of existence and attribution such as
‘this white lily exists’, and ‘this lily is beautiful’ are rendered more cogent through poetic conjunction as evidenced in the phrase, ‘this white lily symbolises innocence’. However, for Kant the Ideas of God, Immortal Soul, and Unlimited World carry an even greater burden. He argues that the existence of freedom implies the cosmological Idea of suprasensible World, the gap between noumenal law and the phenomenal world implies the Idea of God, and infinite progress implies the Idea of an Immortal soul.

Deleuze acknowledges that for Kant, the transcendental form of a category is indistinguishable from its transcendental exercise. Nevertheless, this does not mean that the faculty of understanding addresses itself to objects outside the world; rather, it engages with what most concerns it and brings it into the world (Deleuze, 1994:143). While preserving Kant’s notion of the Idea as that which acts as a ground for every determinate accord between the faculties, Deleuze nevertheless insists that this generative capability, which enables the faculty of imagination to accord with understanding as indeterminate, must be reconceived as something immanent to reason insofar as it reflects a capacity to make judgements without a concept (i.e in advance of a concept being given). Kant’s concept of freedom, which implies being the cause of something in a way that is irreducible to mechanism, is thus entirely preserved (Smith, 2006:54). However, as will be demonstrated, what for Kant represents the conditioning, the totalising, and the unifying, becomes for Deleuze the genetic, the different, and the multiple.

As many commentators have observed, difference and multiplicity are core philosophical concepts for Deleuze. Moreover, the concept itself is conceived as a generative power. This generative notion comes across in his interpretation of Nietzsche’s Will to Power as a genetic element. Irreducible to a ‘want of representation’, it is expressed in the form of a desire to attain to new values. Similarly, Nietzsche’s ‘active forces’ can be distinguished from their ‘reactive’ counterparts both in their superior capacity to impose forms of activity on others, and in their transformative power with respect to the constraints of their own nature. Acting on their own accord, they go to the limit of what they can do. In Deleuze’s deconstruction of Plato’s metaphysics, the simulacrum is determined as that which differs in its essence from what it simulates. In his adoption of Henri Bergson’s distinction between duration and extensity, Deleuze defines differentiation as the process through which the internal multiplicity of the virtual is actualised in a succession of differences that differ in kind from one another as division occurs. In taking over the Foucaultian notion of the assemblage, Deleuze focuses on intensive multiplicities and movements of deterritorialization within the diagram, which are governed by rhizomatic and non-unifiable lines of flight. The intensive multiplicities of the rhizomatic are conceived as ‘ontologically prior’ to the extensive multiplicities of the arborescent, the hierarchical, and the totalizable. Finally, his deployment of Isaiah Berlin’s concept of critical freedom is evident in all those moments of becoming: becoming-animal, becoming-minoritarian, becoming-woman. To think, for Deleuze, is to attain the non-stratified by freeing life wherever it is imprisoned.

Smith foreshadows the fact that in Anti-Oedipus—Deleuze and Guattari’s alternative to The Critique of Practical Reason—Kant’s supersensible World will be displaced by Connection in the form of a virtual Chaosmos of part objects and flows; God will be displaced by Disjunction manifest in Schreber’s dismembered God, the ‘Body without Organs’; and the Immortal Soul will be displaced by Conjunction in the form of the Counter-Self of consumption/production, composed by a set of singularities. However, it is the deployment of the calculus to accomplish these various displacements, a deployment that is introduced in Difference and Repetition, which will be the focus of this paper.

Accordingly, section 1.2 of the paper sets the context by examining Kant’s overarching conception of what he calls the Principles of Sufficient Reason. The precise relationship holding between the political and what is truly generative in Deleuze’s interpretation of philosophy must also be kept in mind. In accordance with this generative perspective, Smith (2006: 54) argues that desire becomes...
the faculty, which by means of its representations is the cause of the actuality of the objects of those representations. Thus for Deleuze, rather than as something predicated on ‘lack’, desire must be conceived as a productive and positive force. Its workings are better described as a ‘factory’ rather than the Oedipal ‘theatre’. It has the potential to operate as a faculty in terms of its ability to attain to a higher form or will to the extent that it finds within itself the law of its own exercise, when it is determined by the representation of a pure form (i.e. the moral law which, in the form of the categorical imperative, takes on the form of a universal legislation, thus becoming the determining ground of freedom). The political import of this notion of desire is delineated in section 1.3 of the paper.

To understand the reasons for this negative judgement we must first consider the manner in which Kant attempted to overcome the inadequacies of Cartesian epistemology. This theme is introduced in the next section of the paper. We shall then examine how Deleuze takes up Maïmon’s advice, in drawing upon the insights afforded by an earlier tradition whose leading contributors include Hume, Spinoza and Liebniz. However, for reasons of brevity the focus of this paper will be on the way that Deleuze takes up Maïmon’s unique conception of the differential to combat Kant’s notion of the Transcendental Idea. Maïmon’s approach to this issue is examined in section 1.4, while Deleuze’s deployment of the calculus is then reviewed in section 1.5.

The second part of the paper begins in section 2.1 with a discussion of the commendation Prigogine and Stengers (1984) make in regard to Deleuze’s virtual ontology, which they consider to be a valuable philosophical basis for approaching the modern science of emerging complexity and far-from-equilibrium systems. In contrast, section 2.2 examines Rosen’s concerns about Newtonian calculus to determine whether his critique of mechanical simulation also applies to Deleuze’s generative notion of the concept. Concluding comments follow in section 3 of the paper.

1.2. Kant and the Principles of Sufficient Reason

According to Deleuze, the basis for Kant’s critique of Descartes is that the Cogito operates with only two logical values: undetermined existence (the ‘I am’) and determination (the ‘I think’), which determines the ‘I am’ as the existence of a thinking subject, a thing that thinks (Deleuze, 1994:85). However, nothing in Descartes explains how this undetermined is determined by the ‘I think’. In my consciousness of myself I am being itself, but in this being nothing is given for thought. Therefore, Deleuze contends that Kant found himself obliged to introduce a third value, the determinable as the form in which the undetermined is rendered determinable by the determination. Deleuze argues that this third value suffices to make logic a transcendental instance by establishing a transcendental though internal, rather than external, difference between the determination and what it determines, in such a way that a relation is constituted between thought and being. For Kant, needless to say, the general form in which the undetermined is determinable by the ‘I think’ is that of time.

Deleuze observes that while Descartes expelled time reducing the Cogito to an instant, in contrast Kant, through his introduction of the temporal schemata, applies the activity of thought to a passive, receptive subject—the self—which is thus obliged to ‘represent’ this activity to itself rather than to enact it: the I is now ‘fractured’ by this interiorization of time in its ‘pure and empty form’. Even the activity of synthesis, for Kant, is reduced to the prospect of receiving impressions and sensations via a passive contemplation.

Deleuze goes on to argue that for Kant, reason is the faculty of posing problems in general. However, in its natural state, it lacks the means for establishing truth or falsehood, or the capacity to determine grounds. The purpose of the Critique of Pure Reason is thus to provide reason with these means and capacities (Deleuze, 1994:168). Initially, problematic Ideas are both objective and undetermined. The undetermined object, existing in the Idea as an objective structure, allows us to represent other objects, which are thus endowed with a systematic unity. As the first moment of the Idea, the undetermined object must become indirectly determined or determinable by analogy with
those objects of experience on which it confers unity. The third moment in the development of the Idea entails the infinite and complete determination of the object with regard to the concepts of the understanding (Deleuze, 1994:169). In this development, Ideas repeat the three aspects of the Cogito: the I am as an indeterminate existence, time as the form under which this existence is determinable, and the I think as a determination.

Deleuze observes that for both Kant and Descartes, the harmony of the faculties is grounded in the identity of the Self in the ‘I think’ (Deleuze, 1994:133). At this point, Deleuze considers Kant’s crucial distinction between ‘common sense’ and ‘good sense’. He interprets the former as “the norm of identity from the point of view of the pure Self and the form of the unspecified object which corresponds to it”. However, the latter is defined as “the norm of distribution from the point of view of the empirical selves and the objects qualified as this or that kind of thing”. Where the former contributes ‘the form of the Same’, the latter determines “the respective contribution of the faculties in each case” (Deleuze, 1994:134).

1.3. The Political Motivation for Deleuze’s Critique of Kant

This section of the paper delineates the political impetus behind the critique that Deleuze mounts against Kant. Deleuze complains that for Kant, traditional notions of knowledge, morality, and even faith are never called into question. They are presumed to correspond to the natural interests of reason, with a unique form of common sense obtaining with respect to each interest. Although each of the faculties—imagination, understanding, and practical reason—collaborates harmoniously with its counterparts, Kant argues that, for each form of common sense, one of the faculties provides the model to which the other faculties are obliged to conform (Deleuze, 1994:136-7). For logical common sense, understanding acts as the legislative faculty over imagination and practical reason; reason itself is the legislative faculty for moral common sense, whereas imagination dominates in regard to aesthetic judgement (in passing, Deleuze speculates that phenomenology institutes a fourth form of common sense for which sensibility provides the sovereign frame).

However, in each case Deleuze observes that collaboration between the faculties is only achieved through a particular mode of representation: identity with regard to concepts (under the form of the Same in recognition), opposition with regard to the determination of concepts (via comparison between predicates and their opposites), analogy with regard to the judgement (through the relation between determinate concepts and their respective objects), and resemblance with regard to objects (as a requirement of perceptual continuity) (Deleuze, 1994:137-138). Thus, for Kant the Cogito, through its capacities of conception, judgement, recognition, imagination, and perception, operates as the unifying power and ultimate source for each form of common sense, reducing difference to a mere principle of comparison. In response to this Kantian reduction, Deleuze turns to the works of Salomon Maimon, a Jewish contemporary of Kant, who was not only familiar with the Kabbalah and the works of Maimonides, but also those of Hume, Spinoza and Liebniz. Deleuze was probably exposed to Malmon through Martial Gueroult, who wrote influential dissertations on the work of both Spinoza (1968, 1970) and Maïmon (1929). Deleuze finds what he requires for his philosophy of difference both in Maïmon’s generative conception of the Transcendental Idea and Spinoza’s conception of the common notions.

1.4. Maïmon on the Differential

The main focus of Maïmon’s critique of Kant is the on-going dualism holding between experience (the faculty of receptivity or sensibility) and cognition (the faculty of understanding). Kant argues that the content of cognition cannot be produced by the faculty of thought alone but must find its ultimate source in experience. This is why he feels compelled to introduce the concept of the “thing in itself”. Maïmon questions Kant’s resolution of this dualism in the Transcendental Deduction,
where it is discussed in terms of the \textit{quid facti} (that experience is governed by an \textit{a priori} process of structuring) and the \textit{quid juris} (that our use of the categories in the deduction is legitimate). For one thing, Ma'imon argues that the simple constituents of experience that Kant posits (bare intuitions and concepts) are never in themselves the objects of experience. For another, he complains that Kant is unable to explain how the different categories of understanding are able to discriminate between different intuitive content. For example, in his discussion of the contradictions in Kant's analysis of causality he points to the fact that Kant grounds causal order in the content of perceptions and their formal 'rule-governed' connection. However, Kant also assumes that, prior to the operation of the transcendental deduction, the content of intuitions is free from any temporal ordering. Accordingly, in this instance the application of the category of causality must be entirely arbitrary. And for Ma'imon, a similar arbitrariness extends to the other \textit{a priori} synthetic categories. Ma'imon contends that Kant errs in moving from recognition of our finitude to the acknowledgement of the necessity for an external element in cognition. Instead, the finitude of cognition should be viewed as a form of incompleteness. What seems to be given to us in experience, as a passive representation is incomplete in the sense that we remain unaware of its origin. This origin, he argues, is the productive capacity of the active mind. While an infinite mind would create the content of thought through the process of thinking, finite minds only become aware of this creative potential in the products of mathematical reasoning. In the case of empirical content, this creative process remains unconscious and can only be represented as such in space and time. For Ma'imon, space and time are concepts through which we represent to ourselves the differences between thoughts and what has not been completely conceptualised. Ma'imon rejects the Kantian notion that the representations of space and time are intuitions, instead viewing them as negative products of the imagination, insofar as it adds fictional properties to the objects of knowledge to compensate for the fact that these objects are incompletely determined.

He argues that the actual contents of experience are infinitesimals of perception that can be understood in a way that is analogous to the manner in which infinitesimals are applied in mathematics. For example, while the differences between points on a line are infinitely small, the relation between them can be provided with a determinate value in terms of the slope or differential. In the same way sensibility provides the differentials of perception, which are produced by the imagination from an infinite number of smaller perceptual elements, to a determined consciousness. The understanding then produces sensible objects from the relation between these different differentials. Thus, all experience and cognition is produced through a series of integrations from the infinitesimal elements of thought. Ma'imon also replaces Kant's somewhat peripheral 'Principle of Thoroughgoing Determinability', which states that of every pair of possible and opposite predicates, one of them must apply to every single thing, with a fundamental 'Law of Determinability', which serves to distinguish between real and arbitrary synthesis. The basis of this law is the principle that every general subject must be a subject for consciousness, not merely for itself, and the principle that every predicate must be a possible object of consciousness in connection with a subject and not merely in itself. A synthetic judgement accords with this law when its predicate is a real rather than a spurious determination of a subject. Ma'imon suggests that the predicate of 'straightness' in a straight line is an example of the former, whereas the predicate of 'greeness' in a green cup is an example of the latter. For Ma'imon, the synthetic judgements of mathematics exhibit a unique congruence with this standard of determinability. The antinomy between matter (as what is necessary for consciousness of form to arise) and form (as that which subsumes matter) is resolved by attaining a completeness in thought so that matter approaches form asymptotically.

Finally, in regard to Kant's notion of practical reason, Ma'imon produces the principle of practical reason from theoretical reason on the basis that the moral good is good because it is true. For him freedom resides in the free activity of the faculty of cognition, which is determined by its own
principles rather than by natural law. In the actualisation of this freedom agreeable feelings, in the abstract form of a striving after the infinite faculty of cognition, play an important role. Nevertheless, Maimon holds to the view that there is no determinate relation between moral law and particular actions.

1.5. Deleuze and the Calculus

Deleuze acknowledges the force of Maimon’s complaint that Kant’s dualism between concept and intuition is expressed in the latter’s reliance on an external relation between the determinable (Kantian space as a pure given) and determination (the concept insofar as it is thought, which must then be mediated through the schematism (Deleuze, 1994:173). As such, difference is rendered empirical, external and impure. In contrast, Maimon argues that both terms of the difference between concept and intuition must be conceived via the principle of reciprocal determination. A genetic interpretation of the reciprocal synthesis of differential relations makes this synthesis a threefold source of the production of real objects in the form of: (a) differences between real objects of knowledge; (b) space and time as conditions for the knowledge of differences; and, (c) concepts as conditions for the distinction between knowledges themselves. A particular object is the result of a particular rule of its production, and the relation between different objects results from the relation between their differentials. Deleuze brings out this genetic view through an examination of one of Maimon’s own examples—the concept of the straight line as the shortest path. He distinguishes the latter’s characterisation based on minimum conditions imposed over the line integral from a more conventional (and extrinsic) interpretation of the straight line as that which in all parts may be superimposed upon itself (Deleuze, 1994:174).

To further elaborate on his philosophical interpretation of the calculus, Deleuze turns to the work of Hoéné Wronski. Here, the focus is on Wronski’s somewhat enigmatic critique of Lagrange, who treats the differential \( \frac{dy}{dx} \) of \( x \) and \( y \) as the second term in a (Taylor’s) series expansion of the function \( y = f(x) \). In this form, Deleuze argues that the differential is viewed as a pure potentiality, which is then conditioned by a depotentialisation or reduction of relative powers (Deleuze, 1994:175). For Wronski, however, Deleuze suggests that the differential does not correspond to an engendered quantity, rather it constitutes an unconditioned rule for the production of knowledge of quantity, the construction of series, or the generation of discontinuities. Once again, the generative powers of the differential are highlighted (Deleuze, 1994:176).

While Deleuze emphasizes the difference between differentiation and integration—the latter can never be a simple inversion of the former—he also introduces a crucial (non-vocalized) distinction between differenation and differenciation:

Whereas differentiation determines the virtual content of the Idea as a problem, differenciation expresses the actualisation of this virtual and the constitution of solutions (by local integrations) (Deleuze, 1994:209).

Each term has two parts or aspects. While the dual aspects of differentiation correspond to “the varieties of relations and the singular points dependent upon the values of each variety”, those of differenciation correspond to “the qualities or diverse species which actualise the varieties” and “the number or the distinct parts actualising the singular points” (Deleuze, 1994:210). The two aspects of differentiation and differenciation then fit together within the complementary stages of progressive and complete determination,

On the one hand, complete determination carries out the differentiation of singularities, but it bears only upon their existence and their distribution. The nature of these singular points is specified only by the form of the neighbouring integral curves—in other words, by virtue of the actual or differenciated species and spaces. On the other hand, the essential aspects of sufficient treason—determinability, reciprocal determination, complete determination—find their systematic unity in
progressive determination. In effect, the reciprocity of determination does not signify a regression, nor a marking of time, but a veritable progression in which the reciprocal terms must be secured step by step, and the relations themselves established between them (Deleuze, 1994:210).

Deleuze’s review of philosophical interpretation of the calculus takes advantage of this distinction in two different ways. First, Deleuze draws on the insights of Bordas-Demoulin, arguing that the relation $dy/dx$ is not like a fraction established between specific quanta in intuition. While $dx$ is completely undetermined (undifferenciated) in relation to $x$, and $dy$ is completely undetermined in relation to $y$, in the particular and the general, they are perfectly determinable (differentiated) in relation to each other, in and by the universal. In this regard, Deleuze notes that Bordas was already close to the modern interpretation of the calculus in terms of the limit. However, this modern approach has come at a considerable cost,

We know in effect that the notion of limit has lost its phoronomic character and involves only static considerations; that variability has ceased to represent a progression through all the values of an interval; that the derivative and the integral have become ordinal rather quantitative concepts; and finally that the differential designates only a magnitude left undetermined so that it can be made smaller than a given number as required. The birth of structuralism at this point coincides with the death of any genetic or dynamic ambitions of the calculus (Deleuze, 1994:176).

Second, in speaking about the possibility of communication between heterogenous series, Deleuze introduces the concept of the ‘dark precursor’ or the ‘disparate’ (Deleuze, 1994:119). The precursor plays the part of the differenciator of the two series of differences placing them into relationship with one another. As such, it is the in-itself of difference, difference in the second degree, the self-different which relates different to different. In this manner it traces an invisible path, which is covered over by the phenomena that it induces within the system. As an immanent cause it conceals itself within its own effects, disguising itself within the series.

It would also be fair to say that many works interrogating the thought of Deleuze and Guattari are written by authors who have had little exposure to mathematics or to the more quantitative aspects of social theory. Accordingly, while political aspects of their thinking are examined this is less the case for what might more narrowly be called their reading of political economy. For example, despite Paul Patton’s work on translating Difference and Repetition, his otherwise helpful volume on Deleuze and the Political (2000) discusses differentiation and differenciation along with the ‘dark-precursor’ without explaining how these concepts are related to the critique of Kantian philosophy. Eric Alliez’s the signature of the World might seem to be an obvious exception to the rule. Unfortunately, this work deliberately focuses on the text What is Philosophy and does not engage, except indirectly, with other works such as Difference and Repetition, or Anti-Oedipus.

It is to be hoped that the above overview will redress this deficit. Nevertheless, the next section of the paper moves beyond a mere recapitulation to address possible concerns about the adequacy of this deployment of the calculus in constituting a philosophy of difference. Section 1.1 of the paper briefly described the influence of Nietzsche on Deleuze. In his treatment of Nietzsche’s work, Deleuze benefited from Pierre Klossowski’s well known study, Nietzsche and the Vicious Circle; especially in regard to Nietzsche’s concept of the eternal return (Deleuze, 1994: 66-7, 90, 95, 312). Needless to say, Deleuze conceives of the eternal return as the return of the different rather than the same, but this raises the question of how reproduction, as both a scientific and a philosophical concept, fits into the Deleuzean conception of the generative.

2. Roads to Complexity: Deleuze and beyond

This section of the paper briefly examines the implications for Deleuze’s Maimonian interpretation of the calculus of new developments in the calculus. While Prigogine and Stengers in their analysis
of complexity champion Deleuze’s notion of a virtual ontology, which is briefly discussed in section 2.1, the second sub-section of the paper reviews the arguments against the Newtonian calculus that have been mounted by Robert Rosen, a theoretical biologist.

2.1. Virtual Ontology and Chaos

In Order Out of Chaos, in a text that is specifically grounded in matters of scientific concern, Prigogine and Stengers (1984) suggest that time reversible dynamics (quantum mechanical, relativistic and Newtonian) can be reconciled with both time-irreversible thermodynamics, and biological processes of repair and reproduction through a deeper understanding of far-from-equilibrium processes and emergent complexity. The French edition of this work also addressed issues in the philosophy of science. In this context the authors complement Gilles Deleuze on his development of a virtual ontology, which, they suggest could serve as the philosophical frame for contemporary research into complexity theory.

In recent years, non-linear control theory and non-extensive statistical mechanics have developed new forms of calculus involving fractional (translation) and non-linear (dilation) derivatives, each associated with their own algebraic operators, geometries, and information metrics. And in physics, new interpretations of quantum mechanics have shown how Quantum mechanics (specifically, the Schrödinger equation) can be derived within the existing framework of Newtonian mechanics through the imposition of scale invariance and non-differentiability (Nottale, 1995). Nevertheless, the particular way in which Deleuze utilizes the calculus would seem to sufficiently general to accommodate these recent theoretical and empirical breakthroughs. However, an alternative body of literature emanating from theoretical biology points to considerations that may be more difficult to encompass with this Deleuzean interpretation of calculus.

2.2. Rosen’s Critique of the Newtonian Calculus

Robert Rosen (1985) argues that Aristotle’s distinctions between material, formal, efficient, and final cause have been reduced by Newtonian physics into the causality of a state-transition sequence. For the latter, causal entailment is governed solely by the exogenously determined initial state (the material cause in the form of the position and velocity of particles), the external force (the efficient cause), and the context or parameterization (the formal cause). Final cause has disappeared entirely. He submits Newton’s differential and integral calculus to a similar critique. Now, the initial conditions represent the material cause, the integral operator represents the efficient cause, while the formal cause represents the context or parameterization. Once again final cause is abandoned because transitive, in a world of inanimate particles, mechanistic forms of causality abound. However, Rosen warns that this ‘banishing’ of telos, purpose, or final cause from the natural sciences eliminates any prospect for a truly functional biology (Rosen, 1989: 20-21).

More formally, in Life Itself, Rosen (1991) establishes that mechanical simulation (predicated on the deployment of finite models) is unable to grasp the properties of self-entailment implied by metabolism, repair and replication processes, without falling into infinite regression; either outwards towards larger and more encompassing models, or inwards through fractionation into smaller and more sub-divided models. These critical observations would seem to apply with equal force to other forms of calculus, including Jackson’s (dilation) derivative and the fractional differential.

In contrast, it could be argued that Rene Thom’s philosophical and mathematical work on complexity, while sharing a similar motivation to that of Prigogine and Stengers, has remained the captive of a narrowly Kantian (in the dual sense of transcendental and universal) interpretation of catastrophe theory and non-linear dynamics.

3 See Juniper (2006a) for a discussion of the linkage between fractional calculus, Jackson’s calculus, and generalized diffusion processes.

4 Juniper (2006b) defends Rosen’s modelling of metabolism-repair and replication systems against attempts by advocates of ‘autopoiesis’ to subsume his analysis within a mechanistic, though infinitely recursive framework.

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As we have seen, for Deleuze and Guattari strictly philosophical concepts should never be derived from the reflexive relationship of a representer to the represented; rather, they are a manifestation of an expressive material aspect immanent to conditions of enunciation. In other words, they ‘represent’ a thing precisely insofar as they ‘express’ their own cause, by entering into internal relations (“foldings”) on the plane of immanence (Alliez, 2004: 12-3)\(^5\). In contrast, scientific concepts relate more narrowly to functions. It would seem that this crucial distinction between philosophical and scientific concepts would operate as a defence for Deleuze against Rosen’s critique of mechanical simulation. While Deleuze and Rosen share a common goal of grasping the nature of immanent causality, for Rosen, a teleological form of immanence is also at work both in processes of repair and reproduction. As we have seen, Deleuze’s conception of the ‘genetic’ should be interpreted in a Spinozian sense: philosophical concepts are ‘genetic’ insofar as they hold only to the extent that they express and reveal the inner movement of the thing and what the thing allows us to perceive: its energetic power (puissance). Deleuzean notions of “becoming-wolf”, “becoming-minoritarian”, or ‘becoming-woman’ do not require the biological concept of reproduction as a supplement for what is a politically motivated and generative style of thinking.

No doubt, Deleuze also eschews evolutionary approaches to reproduction, inheritance, the generation of variety and selection, out of a desire to avoid falling back onto what might be described as the ‘repetition of the same’. More than this, however, Deleuze follows Bergson in arguing that evolution should be reconceived as the actualization of the virtual. He further complains that environmentalism’s focus on the influence of external conditions reduces differences to passive effects that are abstractly combined with one another, and as such, are conceived to be incapable of acting as a self-controlling bloc (Deleuze, 1988b:98). In addition, he contends that finalism would be preferable to mechanism if it were the case that finality is open to a totality that is itself open, so that resemblance (of function) was subordinated to a divergence in movements of production (Deleuze, 1988b:105-6).

3. Conclusion

This paper has examined the way that Deleuze has used the calculus against Kant, with the intention of developing a rigorous Constructivist philosophy of difference. To this end, it focused on how Deleuze drew upon the interpretations of Maînon, Wronski, and Bordas-Demoulin. To counter misleading conceptions about the abstract scholasticism manifest in such an exercise, the paper chose to emphasize the political motivation behind Deleuze’s work. Concerns about the adequacy of this Constructivism were addressed in a manner that highlighted the distinction Deleuze draws between philosophy and science—biological or otherwise.

In his essays on Bergson, Deleuze conceives of the élan vital as a movement of differentiation that straddles both an apparent monism (for which all differences are treated as differences in kind with the present conceived as the most contracted degree of the past) and a dualism (for which all differences are treated as differences in kind). While Bergson decomposes composites to rediscover differences in kind between space and duration, matter and memory, or present and past, these dichotomies are neutralized if one of these takes all differences into itself. Duration, memory, and spirit are reconceived as forms of difference in kind in-and-for-itself (i.e. alteration in relation to itself, and space and matter as forms of difference in degree (i.e. outside itself and for us (Deleuze, 1988b:92-93). Duration as naturing nature is viewed as the most contracted degree of matter, whereas matter as natured nature is viewed as the most expanded degree of duration. Thus, all degrees coexist within single nature expressed in two forms of difference: differences in degree become the lowest nature of difference, and differences in kind become the highest nature of

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\(^5\) The plane of immanence is pre-philosophical insofar as it is presupposed by philosophy as a non-conceptual, intuitive understanding, not as an outside of philosophy but as philosophy’s internal, instituting condition (Deleuze and Guattari 1994, 41)
difference. For Deleuze and Bergson, there is a single nature, but this single nature only exists virtually, and as the virtual is actualized it differs in kind, giving rise to dichotomy and disassociation. Thus, dualism is accounted for on another plane. The obvious question, which this paper has answered in the affirmative, is whether the dualism between generation and reproduction can be overcome with the same ease.

References


