

## **Science and Philosophy: Two Sides of the Absolute**

GREGORY DALE ADAMSON

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The fundamental obstacle to the evolution of Western thought is the problem of continuity. Following that, the greatest hurdle is the refusal to confront or even acknowledge its existence. As Bergson for one has pointed out, the problem of continuity underlies that of metaphysics and, accordingly, philosophy as a whole - for the simple reason that we are immanent to it. Although Bergson is not alone in discovering continuity's implication in, for example, the duration of thought itself (the most notable other being Nietzsche), no one else has been more maligned for doing so. In this sense, not only is Bergson's conception of continuity of value to any future metaphysics, the general reaction to it indicates both a resistance within thought to the possibility of change as well as precisely where, in contemporary philosophy, that change must take place.

The primary transformation that philosophy must undertake if it is to embrace continuity as it is lived or encountered, is to abandon both its pretension to emulate and, as it is currently practiced, its actual subordination to, science. The simple reason for this, is that if philosophy is inseparable from life's continuity, as continuity itself demands it must be, then philosophy must not so much embrace uncertainty but adapt itself in order to encounter and express thought's immanence to life and change. Moreover, as Bergson has demonstrated, our only access to that which takes place in the absolute continuity of lived time is the immediacy of our affective awareness. Our affections, it could be said, exist solely in the infinitive. In this sense, it is to affectivity that we must look in order to grasp the changing composition of the present and our relations with it.

Alternatively, however, Bergson is careful not to place science and what must still be termed a "philosophy of the future" in conflict. It is through the developments of science, for example, that the outlines of

metaphysics are said to be drawn. On the other hand, the epistemological foundations of science, as much as the ontological grounds of the object of any scientific point of view, draw a clearly definable line between that which science is capable of describing and that which philosophy has the potential to express. This distinction is drawn by the difference between the discrete and the continuous. Science is, unavoidably, constrained within and by, the ontological limitations of the discrete, for the simple reason that it is the necessary condition of both information and objectivity. The objective can only be determined when, as Bergson puts it, we take a “snapshot” of duration.

The aporetic relation between the primary data of any objective science and the continuity of process emerged with the Eleatic paradoxes. As Zeno pointed out, movement is absent from a world where all processes are either conceived or apprehended as a series of instants. Since the discrete underlies both the apprehension and comprehension of objectivity, the reconciliation of the discrete and the continuous has been an insurmountable barrier to metaphysics as well as philosophy’s desire to attain the objectivity of science. Aristotle managed to brush Zeno’s aporia under the carpet, by naming it the potential infinite, only for it to reappear with the discovery of the calculus. Leibniz and Newton’s attempts to resolve the problem simply caused the potential infinite to return under the guises of the infinitesimal and the fluxion. Only with Cantor’s set theoretical definition of the continuum did it seem as if, albeit briefly, the problem had once and for all been solved. Employing arithmetic alone Cantor was able to demonstrate the actuality, rather than potentiality, of the mathematical continuum.

Upon discovering his work, Bertrand Russell wasted no time in declaring Cantor’s definition a complete success. With characteristic confidence he announces in *The Principles of Mathematics*:

The chief reason for the elaborate and paradoxical theories of space and time and their continuity, which have been constructed by philosophers, has been the supposed contradictions in a continuum composed of elements. The thesis of the present chapter is, that Cantor’s continuum is free from contradictions. (Russell 1964: 347)

Accepting that continuity could be logically defined as a discrete series, Russell believed he had established not only an ontological basis to science but the scientific status of philosophy. Despite Russell’s

confidence, the validity of Cantor's "thesis" was to prove short-lived and a new set of paradoxes would soon emerge which revived the form of the age-old aporia and the "scientific" or analytical approach to philosophical problems would remain.

Historically, it now appears somewhat 'untimely' that during the period in which Cantor had supposedly surmounted the contradictions exposed by Zeno, and in which Russell believed philosophy could at last achieve the status of a science, and that they, amongst others, had therefore expelled 'intuition' from the subject-matter of philosophy, Bergson was arguing that any attempt to define continuity numerically was an inherently false problem; that science and philosophy were irreconcilably distinct and that continuity could only be apprehended in the same duration as our affective awareness. From Russell's point of view, and the tradition that was to follow him, Bergson's statements were untimely only in the senses of anachronistic and redundant. When he later came to comment on Bergson's thought, following the translation of his primary works into English, Russell was to paint him in precisely this manner, ultimately concluding that it was Bergson himself who was the false problem. His "Philosophy of Bergson" lecture, delivered to the Cambridge "Heretics" in 1912, ridiculed Bergson's use of what Russell deemed "traditional errors" in number theory to portray the limitations of the intellect. This lecture is literally the moment of Bergson's disappearance from the Anglo-American philosophical scene and, as his biographer Alan Wood recounts, the occasion of Russell's ascendance:

Bergson's mystical philosophy of evolution was then enjoying a tremendous vogue, which Russell set out to demolish; there was an eager audience to hear him, and everyone had a sense of a great occasion. The lecture can be found reprinted in Russell's *History of Western Philosophy*; to enjoy its savor, the reader must imagine it delivered in Russell's dry, precise and ironic voice, and punctuated by the laughter and applause which greeted his sallies. It was an event of some importance in Russell's life, helping to re-establish him as one of the leading figures in Cambridge; and especially because it was his first big success as a public speaker. (Wood 1957: 89).

Russell's displacement of Bergsonism from the centre of British philosophy is more than symbolic. Ever since this period, "analytical"

philosophy has come to almost exclusively dominate the subject of philosophy as taught in the English speaking academies. Accordingly, the name "Bergson" continues to evoke a titter which echoes all the way back to the halls of Cambridge. The very object of Bergson's intuition continues to be regarded as "unphilosophical" and, as the above quotation attests, invariably prefaced as "mystical." For these reasons, although Russell's paper is a rather inaccurate interpretation of Bergson, it probably remains the clearest testament to his standing in contemporary (analytical) philosophy.

The most obvious result of Bergson's dismissal, which equally corresponds to the most conspicuous characteristic of the analytical tradition, was the erasure of affectivity from the realm of "thought." Although the foundations of Russell's mathematical Platonism were undermined by numerous aporias, the most notable being his own discovery of the paradox of the 'set of all sets', which showed that Cantor's continuum was not "free from all contradictions", and although Gödel, Post and Turing were later to introduce inconsistencies into the very heart of the formalist programme which extended to the foundations of logic and conceptions of mechanical intelligence in general, the problem of thought's continuity remained on the outside. This is all the more striking given that the problems which emerged from within, for example, the logical definition of the continuum, only served to vindicate Bergson's protestations. In spite of the appearance of irreparable gaps in the foundations of logic, gaps which rather than pointing to undecidability and other such vacuous cul de sacs, open directly onto the realms of change and expression, philosophy has refused to alter its methodology. It is as if the entire discourse of analytical philosophy has been nothing other than the expression of a fear to leave behind the realms of logic, mathematics and science, which amount, from within philosophy, to the last vestiges of theology.

On the other hand, Bergson suggests that only science, or analysis in general, can provide both the outlines of a metaphysics and the means of undoing the constraints of transcendental theology. With the former, duration can be seen to reappear at the limits of scientific thought: entropy, for example, indicates an arrow of time simultaneous with the continuity of process; general relativity suggests that space-time is a substantial continuum while quantum mechanics approaches the movement of change as immanent to the substantial continuity of time. Science, however, is limited in its ability to comprehend the continuity of change or its

metaphysical implications, for the scientific method (that which makes a method “scientific”) is predicated on the division of time. It is only this division which allows measurements and units to be established and which facilitates representation in general. Alternatively, the nature of change and production can be properly revealed only through the immediate apprehension of continuity. In this sense, it is at the limit of science that the potential for a philosophical account of process emerges.

The discrete delimits not only the object of science but equally any mode of thought of which it is the foundation. In this regard, Bergson employs the term “intellect” to categorise modes of thought predicated on the division of time. He employs the Eleatic paradoxes to demonstrate that any mode of thought which does not take its own duration into account will inevitably confront continuity as an obstacle. All intellectual processes are certain to encounter the pure infinitive of affective continuity as their asymptotic limit, for it is the experience of movement which eludes representation. It is this exact limit which unhinges Cantor’s set theory, reappearing under the guises of the untamable infinite and an indefinable whole. In the end, although Bergson was invariably ridiculed for equating continuity with the duration of existence, it now seems somewhat perversely ironic that the developments in logic that Russell, for example, used against him only serve to validate his concerns.

With Cantor’s set theoretical definition of the continuum, however, a unique opportunity arises whereby continuity can be seen to form the limit of logic, epistemology and metaphysics. Not only do the paradoxes within the set theoretical definition of the continuum present the continuity of experience as a limit, they reveal that the “whole” is as equally indivisible. Furthermore, the “diagonal method” that Cantor employed in order to delimit the continuum reappears not only with the discovery of undecidability within logic itself but also with the definition of the “intellectual process.” Gödel and Turing, amongst others, discovered by manipulating Cantor’s logic an almost definitive account of the “intellectual” process: Gödel’s “general recursive functions” and Turing’s computational “machine” evidence the existence of a common element in all algorithmic, mechanical or effectively computable procedures. What finally emerges from the failure of the Platonic quest to firmly place mathematics and logic on solid foundations, is a precise definition of what Bergson termed the intellect. Moreover, Zeno’s paradoxes, which Russell considered to be solved and reason enough to reject Bergson’s “intuitive” continuum, once again return as a limit separating discrete computation

from the continuity of thought. From the Bergsonian perspective, it is process which is effectively “uncomputable.”

Emil Post, now regarded as having anticipated both Gödel and Turing’s respective discoveries of formal incompleteness and undecidability, tried to incorporate Bergson’s theory of memory into the foundations of a “creative” logic. Post argued that “incompleteness” and “undecidability,” rather than simply presenting aporias, were the traces of the continuity of the process of thought. Incompleteness, according to Post, represented the “intuitive” basis by which mathematical concepts came into being. Post, however, was only able to observe the creative at the limits of logic, whereas from Bergson’s perspective we need to reconsider what it is we mean by “thought” if we are to apprehend our immanence to time. The nature of our affective duration reveals the continuous unfolding of difference as much as its multiplicity. It is only by approaching thought in the infinitive and re-evaluating the role of affectivity in the production of ideas in general that we will be able to gain an intuition of process and evolution, as much as a metaphysical basis to expression. In the end, we can safely say that it was not the haze of mysticism which clouded Bergson’s judgement but that philosophy for the greater part of a century has been suffering from a severe want of sensibility.

In *Matter and Memory* Bergson analyses the function of the intellect by isolating its fundamental constituents. He begins this analysis by determining the intellect’s primary data, arguing that if we take perception to its theoretical limit all that we are left with is a faculty for isolating images. Perception, in this sense, constitutes nothing but a “frame” through which we distinguish objects from one another. Accordingly, there is no reason to doubt the “reality” of what we perceive, for the images perceived exist in extension. Nor need it be said that perception “adds” anything to what we apprehend, the perceptual frame simply subtracts that which is of no interest (Bergson 1991: 36). Bergson adds that because what is perceived actually exists in extension, then we can equally term an image “matter.” The simple ingredients of what is then referred to as “pure perception,” are the perceptive frame as the equivalent of a camera lens and the images this frame isolates in extension. If this framework is extended to the limit of possible perception, the world is reducible to an aggregate of “images.” Bergson refers to the totality of this aggregate as “matter” (Bergson 1991: 9).

Remaining with this construction of matter as the sum of possible images, Bergson then adds that what we conceive of as “space” arises

with the form of the perceptual frame and the relations between images. Space, in this sense, signifies material “structure” while “time” corresponds to the relations of succession between images (Bergson 1991: 187). The structure of objective spatio-temporal relations can then be isolated as the ideal object of the intellect. Although the primary data of the intellect are given in actuality, they are by nature “timeless.” The very idea of an objective image can only arise if we consider process “stopped for an instant.” When we determine objective data we do so in the manner of a camera, taking a “snapshot” of process. The findings of *Matter and Memory* are summarised in the following passage from *Creative Evolution*:

What is the most general property of the material world? It is extended: it presents to us objects external to other objects, and, in these objects, parts external to parts. No doubt, it is useful to us, in view of our ulterior manipulation, to regard each object as divisible into parts arbitrarily cut up, each part being again divisible as we like, and so on *ad infinitum*. But it is above all necessary, for our present manipulation, to regard the real object in hand, or the real elements into which we have resolved it, as *provisionally final*, and to treat them as so many *units*. To this possibility of decomposing matter as much as we please, and in any way we please, we allude to when we speak of the *continuity* of material extension; but this continuity, as we see it, is nothing else but our ability, an ability that matter allows to us to choose the mode of discontinuity we shall find in it. ... *Of the discontinuous alone does the intellect form a clear idea.* (Bergson 1983: 154)

“Atomism” is, for Bergson, the underlying ontological presupposition of all intellectual methods. Again, as the above quotation alludes, this atomism is actual. All material structures, for example, are to a certain degree composed of varying scales of atomic units; a piece of wood is a single entity composed of organic cells, the cells in turn are composed of organic molecules, the molecules specific atoms, the atoms sub-atomic particles and so on. While, conceived in abstraction from actual material entities, infinite division equates with spatial continuity.

Bergson’s principal criticism of the intellectual conception of time is that it prescribes spatial continuity to duration. In *Creative Evolution* the “cinematograph” is introduced both as an example and a metaphor of this

fundamental “spatialisation of time.” The aim is to show that the intellect’s apprehension of movement and change constitutes a series of “static poses” and that this limitation is equally manifest in its products. For this reason, the cinematograph also serves as a metaphor for the calculus. In both of these examples, time is rendered an “independent variable,” singular movements are apprehended as variations of “movement in general” while continuity is reduced to the purely spatial succession of points or images (Bergson 1983: 336). This conception of continuity presupposes “pure perception:” the assumed subject is a purely abstract frame while both subject and object are conceived as coexisting in the same instant.

The paradoxes of Zeno serve to demonstrate the intellect’s inability to conceive motion other than as a series of discrete states and the impossibility of representing the absolute duration or *mobility* of movement. In one sense, Bergson concurs with Zeno’s contention that at each point on its trajectory, for example, an arrow must be at rest and that this inevitably leads to the conclusion that motion does not exist. In contrast to Zeno, however, Bergson holds that the paradoxes apply not to movement *per se* but solely to its representation. In fact, movement is found to be absent from Zeno’s paradoxes altogether: all that any of the paradoxes present us with is the representation of motion as a series of discrete states and the trajectory of each movement but not movement in itself. From this point of view, the paradoxes concern the data by which we analyse movement, not its duration. They also continue to bemuse philosophers by confusing the continuity of motion with the *trajectory* of the object:

It is to [the] confusion between motion and the space traversed that the paradoxes of the Eleatics are due; for the interval which separates two points is infinitely divisible, and if motion consisted of parts like those of the interval itself, the interval would never be crossed. (Bergson 1919: 112-3)

In “The Philosophy of Bergson,” Russell criticises Bergson’s interpretation of Zeno by simply turning it against him. Russell argues that the paradoxes are an attempt to demonstrate that there is no continuous state of change. He then suggests that Zeno tacitly assumes Bergson’s theory of change: if there is to be change then there must be a continuous state of change internal to the thing. But, according to Zeno, if at each

point of transition the thing, at that point, is the same as itself, then there can be no continuous state. Russell upholds Zeno's position by extending the argument to conclude that change is a *continuous series of states* and, accordingly, that there are no *continuous states*. Furthermore, Russell extends Zeno's findings to his own set theoretical resolution of the paradoxes in order to demonstrate that Bergson's distinction between mobility and the thing that moves is a mere sophism. According to Russell, "movement" is irreducible to the "thing" which moves, it corresponds to the infinite set of relations between variable positions that the thing assumes along its trajectory.

Russell's critique of Bergson rests primarily on his belief that number as an abstract class logically precedes the actual numbering of things. In the case of Zeno, Russell contends that as Cantor was able to define the continuum as the class of real numbers solely according to logic and arithmetic, so too must the mathematical continuum be prior to our "intuitions" of continuity. As a means of eluding the paradoxical conclusions of Zeno, which presuppose the enumeration of steps or divisions, Russell makes a distinction between what he terms "extensional" and "intensional" wholes:

... we must distinguish between wholes which are defined extensionally, i.e. by enumerating their terms, from such as are defined intensionally, i.e. as the class of terms having some given relation to some given term, or, more simply, as a class of terms ... Now an extensional whole – at least so far as human powers extend – is necessarily finite: we cannot enumerate more than a finite number of parts belonging to a whole, and if the number of parts be infinite, this must be known otherwise than by enumeration. But this is precisely what a class-concept effects: a whole whose parts are the terms of a class is completely defined when the class-concept is specified ... And to say, of such a class, that it is infinite, is to say that, though it has terms, the number of these terms is not any finite number – a proposition which, again, may be established without the impossible process of enumerating *all* finite members. And this is precisely the case of the real numbers between 0 and 1 ... (Russell 1964: 349-50)

The solution that Russell then proposes for Zeno's paradoxes has since become standard. His first step was to reject completely the idea of an

“intuitive” whole, corresponding to a period of motion, from the conception of mathematical continuity. Once this is done, the flight of the arrow, for example, can be defined as a mathematical series by giving the target the value of the limit of an *actually infinite* series of positions. So if the arrow traverses a distance from zero to one mile, “one mile” represents the limit of its journey and this limit is the equivalent of the infinite expression of the mathematical series of distances it traverses. Since this set can be defined “intensionally,” the actual enumeration of the infinite series need not be carried out, as the limit defines the infinite series as a class. Accordingly, in reply to Bergson’s view that the mathematical conception of change “implies the absurd proposition that movement is made of immobilities” Russell writes:

... the apparent absurdity of this view is merely due to the verbal form in which he has stated it, and vanishes as soon as we realize that motion implies relations. A friendship, for example, is made out of people who are friends, but not out of friendships; a genealogy is made out of men, but not out of genealogies. So a motion is made out of what is moving but not of motions. It expresses the fact that a thing may be in different places at different times, and that the places may still be different however near together the times may be. Bergson’s argument against the mathematical view of motion, therefore, reduces itself, in the last analysis, to a mere play upon words. (Russell 1912: 333)

The immediate implication of Russell’s critique is that the affective apprehension of movement, as well as friendship and history, is ultimately illusory. From this perspective, it seems to be rather ironic that it is Russell who is charging Bergson with being a dupe of language, for where is the illusion of continuity supposed to reside? The simple fact of any “discrete series” is that no living being will ever “experience” it. Bergson’s simple claim is that, in terms of movement, a numerical series will never replace the continuity of its apprehension. This holds equally true for denotative language in general, the word “friendship” will never describe the singular relation between two friends nor the evolution of the category “friendship.” In this respect, the concept of a class is in itself inherently Platonic. Friendship denotes all friendships irrespective of their intrinsic differences, as much as movement denotes “movement in general.” With

characteristic lucidity, Giorgio Agamben sums up what Bergson describes as the “numerical” basis to signification:

The antinomy of the individual and the universal has its origin in language. The word “tree” designates all trees indifferently, insofar as it posits the proper universal significance in place of singular ineffable trees ... In other words, it transforms singularities into members of a class, whose meaning is defined by a common property (the condition of belonging E). The fortune of set theory in modern logic is born of the fact that the definition of the set is simply the definition of linguistic meaning. The comprehension of singular distinct objects  $m$  in a whole  $M$  is nothing but the name. Hence the inextricable paradoxes of classes which no “bestly theory of types” can pretend to resolve. (Agamben 1993: 9)

From the Bergsonian perspective, it is the abstract frame underlying the idea of pure perception that forms the basis of the conceptions of number and denotation. “One,” in this sense, can be seen to correspond to the abstract form of an object in general, while the difference between “number” and the “numbered” refers to the distinction between the perceptual frame in itself and the objects it categorises. With the numbering of an aggregate a common quality is predicated to each element, rendering numbering to be at once an act of “classification.” As with number, a denotative term abstracts a common quality from an heterogeneity, at once transforming an aggregate into a class. This class or “genus” is the object denoted (Bergson 1919: 163). In this sense, the same universality and conceptual eternity presupposed in number is manifest in the symbolic denotation of objective categories. Accordingly, all of the qualities of number continue to govern our use of language. The concepts “pen” and “friendship” for example, appear to exist for all time and prior to the appearance of the actual entities. These factors are the conditions of descriptive language and the means by which we establish “objective” agreement.

The disjunction dividing the infinite and the infinitive can be seen to follow the exact distinction between the intensional and the intensive. In *Time and Free Will*, Bergson points out, for example, that denotative language elides the singular nature of our immediate intensive relations. The intensive in general can be clearly shown to exceed denotation and, in extension from this, to provide the ground of sense or the “immediate data

of consciousness.” Moreover, given that the synthetic unity or frame of reflective consciousness is governed by abstract or nominal categories, the intensive cannot be presented to reflective consciousness without changing in kind. Following from this, although Bergson is critical of denotation, he does not claim that it constitutes the whole of language. His point is that what we think cannot be reduced to language alone. The meaning of “duration,” for example, cannot be reduced to the subject of a proposition or conceived as the element of a class: duration refers simply to that in experience which can only be experienced.

This “intuitive” apprehension of language is completely overlooked by Russell and if his criticism that duration and all it entails is nothing but a “fiction” is broadened, his argument can be seen to carry some quite drastic implications. Not only does his position entail that pretty much all of philosophy prior to the emergence of logical analysis is the dupe of “ordinary” language, in line with Russell’s Platonism it suggests that the whole of literature, art, music, mythology, and expression are just pretty illusions if not decorations on, or hindrances to, logic. In many ways, with the abandonment of any serious appreciation of the history of philosophy, the emergence of specialised philosophical languages and notation and the alienation of philosophy from the rest of the humanities, these implications have since been manifest in the practice of Anglo-American philosophy.

In *Mysticism and Logic* Russell complements his critique of Bergson’s interpretation of Zeno by this time turning Bergson’s metaphor of the cinematic apparatus against him. The cinema, rather than exposing a limit to intellectual methods as Bergson describes it, presents Russell with a perfect metaphor to complement his “logical atomism.” Russell interprets cinematic continuity in terms of Cantor’s set theory and his own solution to Zeno’s paradoxes, redefining “matter” as an infinite series of “images” or “sense data:”

When I first read Bergson’s statement that the mathematician conceives the world after the analogy of the cinematograph, I had never seen a cinematograph, and my first visit to one was determined by the desire to verify Bergson’s statement, which I found to be completely true, at least so far as I am concerned. When, in a picture palace, we see a man rolling down a hill, or running away from the police ... we know that there is not really only one man moving, but a succession of photographs, each with a different momentary man. The illusion of persistence arises only

through the approach to continuity in the series of momentary men. Now what I wish to suggest is that in this respect the cinema is a better metaphysician than common sense, physics, or philosophy. The real man too, I believe, however the police may swear to his identity, is really a series of momentary men, each different one from the other, and bound together, not by numerical identity, but by continuity and certain intrinsic causal laws. And what applies to men applies equally to tables and chairs, the sun, moon, and stars. Each of these is to be regarded, not as one single persistent entity, but as a series of entities succeeding each other in time, each lasting for a very brief period, though probably not for a mere mathematical instant. In saying this I am only urging the same kind of division in time as we are accustomed to acknowledge in the case of space. A body which fills a cubic foot will be admitted to consist of many smaller bodies, each occupying only a tiny volume; similarly a thing which persists for an hour is to be regarded as composed of many things of less duration. A true theory of matter requires a division of things into time-corpuscles as well as space corpuscles. (Russell 1953: 123-4)

One would doubt if there could be a more “purely intellectual” account of either process or viewing a film as this. It is an extraordinary phenomena that, especially at this time, someone could give an account of the experience of cinema which is almost completely devoid of experience. With the evolution of cinema as a mode of expression, however, together with the discovery within physics of processes which exceed the mere unfolding of “intrinsic causal laws,” it is now fast becoming a given that there is something more than simply a sum of images and causes in the duration of process. That which exceeds reduction to a purely static series resides in the infinitive of movement contained in the unfolding of the whole, a movement which is never quite atomistic and within which time itself is enfolded.

In *Mysticism and Logic*, however, Russell’s stated aim is to provide a logical basis for scientific thought and to promote philosophy itself as a scientific discipline. In this light, the continuous can be seen to problematise both his ontology and theory of knowledge. These limitations to Russell’s work are doubly revealing given that his conceptions of matter and information, outlined in *Mysticism and Logic*, can be seen to be heavily indebted to Bergson. This would-be contentious claim is

corroborated by the fact Russell devoted a large amount of his time to reading the entirety of Bergson's published work, most texts at least two times, in preparation for writing "The Philosophy of Bergson" (Slater ed. 1992: 319). Bergson's influence is readily observable in the above quotation, where Russell takes his conception of matter to its infinite limit. Furthermore, Russell's definition of the "ultimate constituents of matter," as "sense-data," also bares many resemblances to Bergson's conception of the image.

Russell's principal concern was to transcend the atomistic assumption that matter is composed of indestructible elements. He did not dispute that the primary data of perception are "atomistic" in their isolation and distribution but that these are percepts of enduring objects. Russell proposed this view in order to correlate his "logical atomism" with the then emerging discoveries in quantum physics. The classical assumption that atoms are solid particles of matter was being replaced in physics with the idea that quantum entities are more like series of spatio-temporal "events." According to Russell's cinematic metaphor, the idea of material objects is to be replaced by sense-data as sets of events. The influence of Bergson can be most readily perceived when Russell comes to define the perception of external sense-data. When we perceive a distant object such as the sun, Russell argues:

The sun itself and the eyes and nerves and brain must be regarded as assemblages of momentary particulars. (Russell 1953: 131)

This is precisely what Bergson describes, in *Matter and Memory*, when he insists that perception must be regarded as arising from relations between "images." The material relations between the "afferent nerves," the "brain" and the image perceived, are equally, for Bergson, the primary constituents of pure perception (Bergson 1991: 19). However, in this case Bergson considers such an image of perception to arise only when experience is taken to its logical limit. The resulting image of perception as a static relational event between discrete material entities is precisely what "pure perception" refers to. Bergson introduces this device as a means of isolating that which is incapable of being reduced to either an image or a definable relation between images. That which eludes "pure perception," in this respect, is the continuous variation of the "whole" and equally the affects expressing it, which are incapable of being isolated in time.

Russell, on the other hand, considered the object of philosophy to begin with solely with “particulars”: a particular being the arrangement of a multiplicity of entities, events or images. In order to describe the acquisition of knowledge, Russell introduces a variation of Spinoza’s parallelism, conceiving the mind as simply the awareness of the spatial and temporal patterning of particulars. From this perspective, a given state of the brain is said to correspond to a certain series of particulars which in turn give rise to a particular state of mind (Russell 1953: 188). Knowledge is then said to arise through the apprehension of similar structures from multiple points of view or the repetition of events. The objective of thought being then to establish the universals governing continuity. Edwin Curley, in a study of Spinoza’s metaphysics, has noted the proximity of Russell’s “logical atomism” to Spinozism. Reading Spinoza from this point of view, he writes:

We have an idea of extension. That idea will involve certain affirmations about extended things, for there are certain respects in which all bodies agree ... The affirmations involved in our idea of extension attribute these common properties to extended things and so describe the nature of extension. Such affirmations are general propositions of the form: everything which has the attribute of extension has also common property X ... these propositions, included by Spinoza among the “common notions,” are for him the fundamental laws of nature, and that the facts they describe constitute the nature of the attribute of extension. (Curley 1969: 56-57)

Although this is probably a more accurate reading of Russell than of Spinoza, it highlights the fact that for Russell the objects of thought exist *sub specie aeternitatis*. The main problem with Curley’s reading, and with Russell’s logical atomism, is that it blatantly contradicts Spinoza’s assertion that substance is continuous and indivisible. Moreover, Spinoza’s critique of the divisibility of substance is equally applicable to duration. In the *Ethics*, for example, Spinoza states that any argument supporting the notion that substance is capable of division will end up repeating Zeno’s paradoxes. These paradoxes follow:

... not from the fact that an infinite quantity is supposed, but that they suppose an infinite quantity to be measurable and composed of

finite parts; wherefore from the absurdities which thence follow they cannot conclude anything else than that an infinite quantity is not measurable nor composed of finite parts ... And so the arrow which they intended for us they now direct against themselves. (*Ethics* I, Prop. XV, note)

Russell was convinced that the continuum was a set of “finite” parts and employed his solution to Zeno’s paradoxes as proof of this. To vindicate Spinoza and Bergson’s critiques of atomism, Russell himself soon found difficulties in the class concept which compromised the assumption that number classes could be said to precede the numbered and the set theoretical definition of the continuum. However, it is not often advertised that Cantor also encountered problems in the definition of the continuum prior to Russell’s discovery of the paradox of the “set of all sets.” This might have something to do with Cantor being something of a devout Spinozist. He believed, for one, that his definition of the continuum described extension as an actually infinite *transfinitum* which he then equated with Spinoza’s *natura naturata* (Dauben 1979: 145). That is, he considered the modes of extension or products of nature to be “actually infinite.” The “*transfinitum*” refers to, in this sense, the limit of representation. As Deleuze notes in *Expressionism in Philosophy*, in Spinozism *natura naturata* must be considered an *actual infinity* in order to maintain its distinction from *natura naturans*:

The ultimate extensive parts [of *natura naturata*] are in fact the actual infinitely small parts of an infinity that is itself actual. Positing an actual infinity in Nature is no less important for Spinoza than for Leibniz: there is no contradiction between the idea of absolutely simple ultimate parts and the principle of infinite division, as long as this division is *actually infinite*. (Deleuze 1992: 205)

The actually infinite divisibility of extension must be maintained in order to avoid falling into the Aristotelian equation between potential infinite and time. This is precisely what Cantor attempts to do with his set theory, in defining the absolute as that which lies beyond the limit of possible representation. In line with this, he describes the paradoxes that emerged with the set theoretical definition of the continuum as the ineradicability of absolute continuity.

In the analysis of number in *Time and Free Will*, Bergson reveals infinite division to be at the foundation of number itself, for it can be regarded either as an indivisible unity or as a multiplicity of divisions. “One,” for example, can be regarded as a whole or as an infinite sum of fractions. For this reason, Bergson defines number as the “synthesis of the one and the many” (Bergson 1919: 75). The difference between the one and the many is paralleled with the distinction between the “subjective” and the “objective” (Bergson 1919: 83). Bergson defines the unity of the one as the subjective synthesis of the many. For this reason, the synthetic unity of the one *presupposes* a preexisting multiplicity. In this regard, Bergson writes, the “actual and not merely virtual perception of subdivisions in what is undivided is just what we call objectivity” (Bergson 1919: 84). In objectivity the numbered appears as a “plurality” and each element of a plurality is itself infinitely divisible. At its limit, number presupposes an actual infinity of divisions. As Deleuze writes in *Bergsonism*: “the objective is that which has no virtuality” (Deleuze 1991: 41). The numerical “potential” of number is always *actual* to it. In this sense, the infinite divisibility of the numbered is the objective correlate of number.

Furthermore, Bergson considers the isolation of a “set” or a “totality” to be always an abstraction from a larger “whole.” Even the concept of matter as a totality is predicated on the idea of a “frame” within which that whole is conceived. For this reason, matter must be regarded as “actually infinite” not only in order to avoid false problems but also for the term “matter” to have any significance. Although this actual infinity is a “fiction,” the presupposition that all is given, Bergson writes, is “immanent to the method” of analysis (Bergson 1983: 345). In the sense that the real number continuum is a basic assumption in the use of the calculus, we must assume that there is a limit to division when we analyse objective processes. Accordingly, as Bergson writes in *Creative Evolution*, the mathematical continuum is as much a discrete series as the intellect is a discrete state mechanism:

... the intellect represents *becoming* as a series of *states*, each of which is homogenous with itself and consequently does not change. Is our attention called to the internal change of one of these states? At once we decompose it into another series of states which, reunited, will be supposed to make up this internal modification. Each of these new states must be invariable, or else their internal

change, if we are forced to notice it, must be resolved again into a fresh series of invariable states, and so on to infinity. Here again, thinking consists in reconstituting, and, naturally, it is with *given* elements, and consequently with *stable* elements, that we reconstitute. (Bergson 1983: 163)

The mathematical continuum is predicated on the assumption that process can be “stopped for an instant.” This is the condition of determining data and it is equally the basis of Russell’s conception of “sense-data.” Moreover, the ultimately retrospective nature of the discrete inevitably transforms the continuity or “being made” of process into the already complete. At this point we can intuit Bergson’s inversion of Zeno’s paradoxes. Objectively, we conceive movement in terms of spatial translation, however, in this case the subject is considered to be “outside the movement” (Bergson 1983: 310). The continuity of movement in itself expressed through its immediate affective apprehension by nature eludes the grasp of thought and containment within the temporal frame of representation.

It is the same continuity, which eludes representation, that in the end undoes the very idea of a “totality.” All totalities and “closed sets” are open to the continuity through which they evolve. Accordingly, atomism does not go as far as the intellect would have it. “Pure perception” is assumed in the determination of objective data and in the frame through which discrete images are isolated as “units” but the continuity of duration renders all units “provisional,” “partial expressions” of a whole which changes. From Bergson’s perspective, it is duration which “hinders everything from being given all at once,” implying that *natura naturata* itself can no longer be considered a consistent totality (Bergson 1992: 93). This leads to the declaration, in *Creative Evolution*, that “the real whole might well be, we conceive, an indivisible continuity” (Bergson 1983: 31). In the first of the *Cinema* books, Deleuze articulates the implications of bringing duration into the concept of the set. His reading of Bergson describes perfectly the fact that the impossibility of determining either a set of all sets or a highest ordinal implicates the whole within every set. The paradox of the set of all sets introduces an inconsistency into all “sets” from the one to the highest cardinal. As Deleuze writes:

We know the insoluble contradictions we fall into when we treat the set of all sets as a whole. It is not because the notion of the whole is

devoid of sense; but it is not a set and it does not have parts. It is rather that which prevents each set, however big it is, from closing in on itself, and that which forces it to extend itself into a larger set. The whole is therefore like a thread which traverses sets and gives each one the possibility, which is necessarily realized, of communicating with another, to infinity. (Deleuze 1986: 16-17)

As Deleuze alludes, Bergson's fundamental critique of the intellect is that it can only deal with partial entities or with "closed" systems. Although Cantor's set theory was received as bringing consistency into mathematics, it has only served to direct the arrow back at itself, ultimately vindicating Bergson's critique of Zeno and the intellect. The parallels between Bergson and Cantor do not, however, end there: both, in response to the "inconsistency" of the absolute, proposed two distinct conceptions of multiplicity. Cantor, for example, writes:

If we start from the notion of a definite multiplicity [*Vielheit*] (a system, a totality) of things, it is necessary, as I discovered, to distinguish two kinds of multiplicities (by this I always mean *definite* multiplicities). For a multiplicity can be such that the assumption that *all* of its elements "are together" leads to a contradiction, so that it is impossible to conceive of the multiplicity as a unity, as "one finished thing." Such multiplicities I call *absolutely infinite* or *inconsistent multiplicities*. (Cantor 1899: 114)

It is interesting to note that ten years prior to this, in the text that Russell condemned for its shoddy mathematics, Bergson had not only intuited the incommensurability between mathematical continuity and duration but had also conceived of two distinct multiplicities. In contrast to the closed sets that compose matter, Bergson proposes that duration is a *qualitative* multiplicity:

In short, we must admit two kinds of multiplicity, two possible senses of the word "distinguish," two conceptions, the qualitative and the other quantitative, of the difference between *same* and *other*. Sometimes this multiplicity, this distinctness, this heterogeneity contains number only potentially, as Aristotle would have said. Consciousness, then, makes a qualitative discrimination

without any further thought of counting the qualities or even of distinguishing them as *several*. (Bergson 1919: 121)

Duration as a qualitative multiplicity is expressed through the apprehension and expression of affective difference. Affectivity's multiple nature gives a sense of difference which is neither spatial nor temporal but wholly substantial: it is expressed through a multiplicity which must be said to interpenetrate and whose only unity, as Deleuze points out, is its multiplicity (Deleuze 1991: 85). The unfolding of affective difference takes place solely within the absolute infinitive of its pure duration. In this sense, it is only through affectivity that the production of difference can be apprehended: difference being that which can neither be made the element of a set or a set of elements. Moreover, vindicating Bergson's concept of the "movement-image" and Deleuze's "set theoretical" description of it, movement itself must be inscribed within the "image." It is precisely the duration in which change both unfolds and is apprehended that remains irreducible to a set of material relations or "particulars.'

With the division that emerges in set theory between sets and continuity as well as Bergson's incommensurable quantitative and qualitative multiplicities, the ontological ground of the distinction between the objects of science and metaphysics can be discerned. As Bergson writes in *The Creative Mind*:

Thus we have on the one hand science and mechanical art, which have to do with pure intellect; on the other hand, metaphysics, which calls upon intuition. (Bergson 1992: 79)

Metaphysics begins, Bergson argues, at the limits of science. From Newtonian dynamics to fractal geometry and chaos theory, matter is regarded as atomistic and change is conceived outside the subject. Although quantum mechanics, for example, has suggested an indivisible continuity, the wave-function, coexisting the discrete atomic model, the continuous serves merely to bring "unpredictability" into the "discrete" realm of atomic positions. It is the external subject who renders continuity radically ulterior and all attempts to bring time into science, from Einstein to Prigogine, manage only to edge closer to the infinitive of experience. The metaphysics of time and change, however, must begin from experience in order to determine that which can only be experienced.

Moreover, it is only within time that the duration of thought itself can be apprehended as well as expressed.

The infinitive can be seen to appear not only at the limits of the mathematical conception of the continuum but equally within the limits of logic itself and the logical definition of the thought process that emerged from Cantor's work. After problems arose in what David Hilbert coined "Cantor's Paradise," one of the primary goals of what became known as formalist mathematics was the axiomatisation of the set theoretical definition of the continuum. Russell and Whitehead's mammoth *Principia Mathematica* is one example of an attempt to get the logic straight and reduce mathematics to a fundamental collection of axioms. However, soon after the formalist programme began Kurt Gödel came up with his "incompleteness theorems." Gödel comprehensively demonstrated that there were apparently "true" statements in any formal system, such as set theory, which could not be proven so from within the system itself. Hilbert and Russell's plan to ground Cantorian set theory in formal logic was proven to be interminably incomplete. Gödel produced his demonstration by manipulating Cantor's diagonal method, which demonstrated the existence of a real number not containable in the set of natural numbers, to show that in order to prove the consistency of one axiom another would need to be added and so on. Platonism once again stumbled on the third man argument; in order to prove an axiom another would have to be produced but the same "incompleteness" would remain, requiring another axiom, and so on, *ad infinitum*. Gödel in the end declared that neither the synthetic nor the intuitive could be banished from either mathematics or logic, ratifying Bergson's claim that the limitations of intellectual processes are "immanent to the method" of the intellect itself, and are incapable of being objectified.

Another problem that Hilbert raised was what is known as the *Entscheidungsproblem*. This inquired as to whether or not there existed a mechanical process applicable to any mathematical statement that could answer if that statement were provable or not. The problem came down to asking if there was a definite method for solving mathematical problems (Hodges 1988: 4). If the answer was affirmative then a general algorithm for answering all mathematical problems could be said to exist but if it could be proven that some problem had no algorithmic solution, then the *Entscheidungsproblem* would itself be unsolvable. In a paper titled, "On Computable Numbers, With an Application to the *Entscheidungsproblem*" Alan Turing approached this question by first defining in a precise sense

the intuitive ideas of algorithmic or mechanical processes. He began by considering the calculation of computable real numbers, those numbers whose infinite decimal expansion is calculable by finite means (Turing 1936: 116). Turing reduced the process by which the abstract subject computed the problem to an unlimited pad or “tape” upon which the calculation proceeded, a finite number of symbols, a set of instructions and a discrete series of computational steps. He was then able to show that whatever a human could compute could be carried out by a “machine” configured in the same manner. The class of computable numbers is then shown to be “denumerable” in the Cantorian sense, that is, equivalent to the class of natural numbers. Turing then applied Cantor’s diagonal method to demonstrate the existence of real numbers which cannot be computed by any machine, that is, which are “uncomputable.”

Turing produced conclusive evidence that Hilbert’s problem was false, in as much as there was no general algorithm for proving mathematical problems. But in the process he produced what is now the founding document of discussions about “Artificial Intelligence.” His argument extended to the conclusion that “it is possible to invent a single machine which can be used to compute any computable sequence” (Turing 1936: 127). From one point of view, Turing argued that any mechanical process could be coded by a “Turing Machine.” From another, his findings suggested that all intellectual processes are inherently algorithmic or mechanistic. In both cases “mechanical process” is defined simply in terms of the iteration of discrete states. The resulting conception of “mechanical intelligence” is practically isomorphic to Bergson’s description of the intellect as a mechanism in *Creative Evolution*. Bergson’s “pure intellect” is the *abstract* process of computation which represents processes as discrete series of given elements or symbols. Accordingly, the “Turing machine” can be regarded as the precise definition of Bergson’s “pure intellect” as a faculty. Further to this, in the same year that Turing published “On Computable Numbers,” papers were published by Gödel, Alonzo Church, Stephen Kleene and Emil Post, which all offered independent demonstrations of the existence of an abstract “algorithmic process.” However, not one of these examples is considered as “proof.” As Turing himself notes:

The expression “there is a general process for determining ...” has been used throughout this section as equivalent to “there is a machine which will determine ...” This usage can be justified if and

only if we can justify our definition of “computable”. ... All arguments which can be given are bound to be, fundamentally, appeals to intuition, and for this reason rather unsatisfactory mathematically. (Turing 1936: 134-5)

Accordingly, terms such as “effectively computable,” “recursive function” or “Turing machine computable” are considered along the lines of “empirical hypotheses” (Galton 1996: 138). In line with Gödel’s findings, “computation” cannot be defined in itself, it can only be modeled. However, the independent and simultaneous expression of equivalent processes through different formal means, is generally regarded as evidence that these hypotheses are correct. The various results can be collectively regarded, in Spinozist terms, as the expression of a “common notion” of an “immanent” idea. We literally cannot define the ground of the intellect in intellectual terms, which is why Bergson identifies all “purely intellectual” processes as expressive of a general “tendency” of thought immanent to the formal products of the intellect:

All the operations of our intellect tend to geometry, as to the goal where they find their perfect fulfillment. But, as geometry is necessarily prior to them (since these operations have not as their end to construct space and cannot do otherwise than take it as given), it is evident that it is a latent geometry, immanent in our idea of space, which is the mainspring of our intellect and the cause of its working. (Bergson 1983: 210-11)

Bergson is careful to distinguish this “latent geometry” from the Kantian intuitions; geometry is employed here simply as a trope for the identity principle which is at the basis of mechanical repetition. Again, it is this relation which underlies both the intellect as a mechanism of thought and its abstract and formal products. The fundamental characteristics of the Bergsonian intellect are, first, its reliance on the abstraction of discrete states from continuous processes and, second, the contraction of a continuous relation throughout the discrete series. For this reason, Bergson argues that intellectual, and by extension mechanical, processes are inherently deterministic. In a paper titled “Computing Machinery and Intelligence” Turing defines “intelligence” in precisely these terms:

... digital computers ... may be classified among the “discrete state machines.” These are the machines which move by sudden jumps or clicks from one quite different state to another. These sudden states are sufficiently different for the possibility of confusion between them to be ignored. *Strictly speaking there are no such machines. Everything really moves continuously.* But there are many kinds of machines which can profitably be thought of as being discrete state machines ... It will seem that given the initial state of the machine and the input signals it is always possible to predict all future states. This is reminiscent of Laplace’s view that from the complete state of the universe at one moment in time, as described by the positions and velocities of all particles, it should be possible to predict all future states. The prediction which we are considering is, however, rather nearer to practicability than that considered by Laplace. The system of the “universe as a whole” is such that quite small errors in the initial conditions can have an overwhelming effect at a later time. The displacement of a single electron by a billionth of a centimeter at one moment might make the difference between a man being killed by an avalanche a year later, or escaping. *It is an essential property of the mechanical systems which we have called “discrete state machines” that this phenomenon does not occur.* Even when we consider the actual physical machines instead of the idealised machines, reasonable accurate knowledge of the state at one moment yields reasonable accurate knowledge any number of steps later. (Turing 1950: 11-12, my emphasis)

In the above, Turing clearly recognises the disjunction between the continuity of both thought and dynamical processes and the intellect as a “discrete state mechanism.” As with Bergson’s conception of the intellect as a mechanism, the definition of “machine intelligence” is predicated on the *negation* of continuity and the *abstraction* of a symbolically defined system from the “universe as a whole.” As Bergson writes in *Creative Evolution*:

The mechanistic explanations ... hold good for the systems that our thought artificially detaches from the whole. But of the whole itself and of the systems which, within this whole, seem to take after it, we cannot admit *a priori* that they are mechanically explicable, for then time would be useless, and even unreal. The essence of mechanical explanation, in fact, is to regard the future and the past

as calculable functions of the present, and thus to claim that *all is given*. (Bergson 1983: 37)

As Turing points out, the combined effects of negation and abstraction remove uncertainty from the continuity of process. Bergson equally considers the Laplacian ideal of infinite information to be “immanent to the method” of the intellect as a mechanism of thought. Since the determination of a “discrete state” is predicated on process being “stopped for an instant,” that which eludes the grasp of the intellect as a mechanism, and the mechanistic models of processes, is the duration of process itself. Mechanism is the limit of the intellect’s involvement with process, meaning that we can only objectively conceive and logically or mathematically deduce from what has gone before what might happen again. In keeping with this, Bergson argues that “matter” as an “aggregate of images” is derived from “the suppression of all efficient duration, the likening of the universe to a thing *given*, which a super-human intelligence would embrace at once in a moment or eternity” (Bergson 1983: 346). This “super-human” perspective is that given with objectivity and is embodied in the “mechanical” subject who performs mathematical equations or who simply “computes.” As Brian Rotman has argued, this “super-human” perspective is the disembodied “ghost” in Turing’s machine (Rotman 1993).

The proximity of the Turing machine to the pure intellect is an affirmation of Bergson’s *positive* categorisation of the intellect as a “faculty.” The discovery of a general form of intellectual thought only vindicates Bergson’s fundamental claim that:

The intellect is not made to think *evolution*, in the proper sense of the word – that is to say, the continuity of a change that is pure mobility. (Bergson 1983: 163)

As with Turing, Bergson contends that if we are to conceive the world as “given,” or think of movement objectively as a series of discrete states, then the continuity of thought and process is elided. However, Bergson argues that the “indeterminacy” which undermines mechanism is simply a trope for that which the intellect *cannot think*. “Indeterminacy” and “disorder” are terms which include the determinate and order and merely indicate that which lies beyond the frame of the intellect (Bergson 1983: 222).

In contrast to this, Bergson employs the term “intuition” to describe that which takes place in the continuity of thought and that which is at the origin of “intellectual” ideas. Turing also conceived of an “intuitive” basis to thought. In a paper based on his doctoral thesis, titled ‘Systems of Logic Based on Ordinals’, he argues that in “post Gödel” times it is impossible to find “a formal logic which wholly eliminates the necessity of using intuition,” adding that:

Mathematical reasoning may be regarded rather schematically as the exercise of two faculties, which we may call *intuition* and *ingenuity*. The activity of the intuition consists in making spontaneous judgements which are not the result of conscious trains of reasoning. (Turing 1939: 210)

Turing’s idea of an originary intuition incommensurate with its symbolic representation, receives further attention in the history of logic and mechanical intelligence through the work of Emil Post. It is now accepted that Post anticipated the findings of Gödel and Turing by at least a decade (Davis 1965: 338). Not only did he produce incompleteness and undecidability results comparable to Gödel’s, he formulated a conception of “finite combinatory processes” equivalent to Turing’s “computable numbers” which, most importantly, was also expressed from the point of view of a “worker” carrying out the computation. What is different about Post’s work, however, and that which probably contributed to much of it being rejected for publication in his lifetime, is his conclusion that “*mathematical thinking is, and must remain, essentially creative*” (Post 1944: 316). Most of his analysis involved demonstrating that the *Principia Mathematica* was first a consistent deductive system and then, by application of the diagonal process, that it was by nature incomplete. He then showed that for any deductive system it was possible to produce another that was stronger, containing the former but producing more consistent statements (Post 1965: 416-17). Post regarded the “creative” process of thought to be that which inheres in logical incompleteness and undecidability. Surprisingly, for a paper in logic, Post declares that his conclusion is more “in line with Bergson’s ‘Creative Evolution’” than Russell’s *Principia* (Post 1965: 417).

The worker of Post’s “finite combinatory processes” is for the most an analogue of Turing’s “computer,” in that it follows a systematic and discrete method. However, as an appendix to the above paper, Post

includes extracts from his notebooks and diary giving a rough, intuitive account of the “creative process” itself. In contradistinction to Turing’s computer, which in being able to calculate infinite series has only a “logical” existence, Post situates his worker in time. He argues that the process of computation is mostly unconscious, taking place in what he terms a “psychic ether” which he compares to Bergson’s “theory of memory” (Post 1965: 432). From here, he argues that finite combinatory processes manipulate the spatialised symbolisation of this unconscious creative process. It is the fact that creative thought is *continuous* which leads to a disjunction between mathematical processes and mathematical objects. Post then describes the movement between the continuity of process and discrete computation in explicitly Bergsonian terms; listing the stages in which ideas emerge as follows:

- (a) Activity in time which is creative. This is the source of the process.
- (b) By reflection this activity itself is frozen into spatial properties.
- (c) The spatial relations are symbolized by spatial symbols.
- (d) These symbols have no further symbolizable properties internally as it were and so end the descent. (This is essentially Bergsonian). (Post 1965: 420-21)

From Post’s perspective, the “computer” does not only perform algorithmic tasks, as in the case of the Turing Machine, it produces or “creates” algorithms. As with both Turing and Bergson, who claim that “everything really moves continuously,” Post argues that the thought process is *continuous*. However, it is the continuity of thought which is lost in reflection, since the “intellect” transforms temporal continuity into a series of “spatial properties.” As with Brouwer’s “intuitionism,” Post points out that it is the intuition of temporal order which has been neglected in symbolic logic and which gives rise to fallacies such as the greatest ordinal or the set of all sets. “Incompleteness” and “undecidability” are, for Post, expressions of the creativity or openness of mathematics and logic, which by nature elude reduction to axiomatisation for they subsist in the duration of thought.

In a broad sense, although a finite combinatory process, or Turing machine, can express a problem simply as the iteration of concrete operations irrespective of time or speed, the origin of each distinct “machine” or algorithm originates in the intuition of a sense of temporal unfolding. It could be said that although the “creative” in mathematics is

literally the construction of algorithms, the creative “process” is not itself algorithmic. Epistemologically, it is the subsistence of the intuitive ordering in time that cannot be completely formalised and which guarantees that formalisation can never be completed. Post’s account of this sense of a purely ordinal progression which precedes and is irreducible to its representation as a discrete series derives from Bergson’s *Time and Free Will*. Here Bergson compares the qualitative ordering of time to musical variation, where differences blend into one another and the whole continuously transforms with each variation. As an example of this, he describes the subconscious cognition of the strokes of a clock where on the fourth stroke we become aware of the “time.” Bergson then compares the relation of this subconscious perception to its apprehension in reflection:

If, then, I question myself carefully on what has just taken place, I perceive that the first four sounds had struck my ear and even affected my consciousness, but that the sensations produced by each one of them, instead of being set side by side, had melted into one another in such a way as to give the whole a peculiar quality, to make a kind of musical phrase out of it (Bergson 1919: 127).

The “fourth” chime is apprehended as a qualitatively singular “note,” in this sense, not because of its difference from the previous sounds but from their being enfolded within those that succeed. It is this purely qualitative and continuous sense of succession which expresses the immediate ground of our sense of duration and is that which allows us to differentiate “times.” Moreover, this qualitative sense is irreducible to the simple numerical series given in reflection, as the fourth note, for example, expresses a singular intensity bound up in the duration in which it occurs.

In an essay entitled “Intellectual Effort,” Bergson outlines a model of the creative process of thought which, in part, can be regarded as the inverse of the above. In this case, the process of thought derives from an initial intensity which is actualised in its products as it is unfolded. Concerning the feeling we have of “intellectual effort,” Bergson asks “does not the consciousness of a certain . . . movement of ideas count for something?” (Bergson 1920: 186-7). He suggests that rather than bring to consciousness a given idea or static concept which is unchanged in expression, in the movement of thought a “dynamic schema” or “directive idea” is actualised which changes with and is implicated in each of its

elements. Although this virtual “schema” is given prior to its expression in the form of an “image,” it does not have a definite extension or direction. Image, in this case, can be said to any “actual” element, a word in language, image in cinema, tone in music, ingredient in cuisine. In the first instance, the schema corresponds, Bergson writes, to an “expectation of images” (Bergson 1920: 227). The initial sense of the idea is given in an intellectual tone, an affective disposition or feeling and is the counterpart of what Bergson terms, in “An Introduction to Metaphysics,” the “fluid concepts” inherent in intuition (Bergson 1992: 168). Since the initial idea or schema is transformed in the process of composition, for the images which are actualised modify the idea as it is expressed, the relations between images constitute the “unforeseen” in composition (Bergson 1920: 213). Although the idea precedes its actualisation, we have no idea what form it will take. The schema, in this sense, is virtual rather than “possible,” for its actualisation is contingent on the elements through which it is expressed. It is only after it is actualised that the idea appears to precede its expression.

Intellectual “effort” results from the resistance encountered from given modes of thought. This is due to the intellect being structured and limited by determinate concepts, the later forming the basis of habit and pragmatism. As the intellect, however, is the domain of language or signs in general, only it can provide the elements which will give form to the movement of thought. In line with this, Bergson describes the process of actualisation as “something intermediate ... between the efficient cause and the final cause” (Bergson 1920: 230). The process of actualisation is “formative” rather than formal, while the “schemata” of thought condition its actualisation relations between elements remain indeterminate. Moreover, the relation between actual and virtual is neither dialectical nor recursive: indetermination is implicated within the process of actualisation and cannot be considered in isolation from the idea which expresses it. Accordingly, the transformation of thought can be conceived neither as a progression nor as a series of radical breaks rather it follows a “succession without mutual externality” (Bergson 1919: 108). That conscious states are continuous and “mutually interpenetrating” means that there can be no difference between before and after in which to conceive of a “progression.” In other words, we cannot say where one thought ends and another begins.

Bergson equally considers the virtual and actual, the dynamic schema and its materialisation, to “differ in kind.” The formative idea is not only

irreducible to the material form in which it is expressed, it can be manifest in a potential multiplicity of modes. As Bergson writes in *The Creative Mind*, thought may be always expressed in “pre-existing elements:”

... but it can almost arbitrarily choose the first elements of the group provided that the others are complementary to them; the same thought is translated just as well as diverse sentences composed of entirely different words, provided these words have the same connection between them. (Bergson 1992: 121)

The feeling or intensity at the origin of thought is drawn from the duration or milieu in which it takes place. From this perspective, it could be said that not only mathematical concepts betray movements, even they are impregnated with a certain sense of time: giving credence to the idea that chaos theory and postmodernity have something in common with the sensibilities of the 1960s. The formation of any mode of thought or being takes place within a sense of movement which is manifest and transformed as it is actualised. Furthermore, the distinction between actual form and virtual idea provides the foundation for conceiving of homologous movements. Since thought is expressed in terms of a virtual “disposition” which can be actualised in any image whatever, music and literature, the plastic arts and cinema, even philosophy and science, can, in this sense, express the same intensive origins. Bergson also describes this transcendence of movement as the basis of sense in language:

The truth is that above the word and above the sentence there is something much more simple than a sentence or even a word: the meaning, which is less a thing thought than a movement of thought, less a movement than a direction. (Bergson 1992: 121)

As the sense of a melody is that which can only be heard, the “meaning” of language is that given in language which can only be thought. It is the expression and apprehension of sense which is irreducible to signification, while the domain of sense subsists in the absolute duration of substance. This “substantial duration,” as Bergson terms it, consists of a virtual multiplicity of movements or “tendencies” which enfold time or memory into the absolute continuity of life. This pure multiplicity is nowhere to be found in the Library of Babel, it is expressed solely in the enduring

sensibilities of the living for there is nowhere else for the infinitive of thought to be found.

Thought's infinitive emerges at every point where the "pure intellect" discovers its limit and ground. This limit is not, however, simply the undecidable, the chaotic, the clinamen, the indiscernible, the unnameable, or any of the other myriad metaphors given to the "beyond" which, as Gödel revealed, the intellect constructs from within. (Maybe it is worth noting, although at the risk of appearing overly dramatic, that those thinkers who unmasked the undecidable but were equally denied an avenue for expression, Cantor, Turing, Post and Gödel, each took their own life). As Bergson insists, the discovery of the intellect together with its limitations offers nothing other than the potential for an alternative. As the limit of thought is time, it is time itself which must be enfolded within thought. That which is expressed in the infinitive of existence is the continuity of affect, and as this continuum is synchronous with the infinitive of composition, it is with the nature of affectivity that the process of thought must be intuited.

It is within the continuity of duration that the real "thinks itself" rather than passively "self-organises". By broadening the scope of what it means to think, then, possibly philosophy might gain a broader understanding of what it means to endure. Furthermore, it is only from the intellectual point of view that "intuition" has been devalued, for the affections are truly "common notions." Until we properly distinguish between science and metaphysics, the intuitive, as the other mode of thought, will continue to be excluded from the "citadel" of knowledge, for it is not only the presupposition of scientific thought that nothing can escape representation but the fear of science, mathematics and logic which propels the subordination of intuitive modes of thinking to the realm of the "feminine" and the disinherited. Given that all of the limitations Bergson placed on the intellect are still intact after a century of logical analysis, maybe it is time to finally laugh, as Michel Serres has said, at those who thought their soft logic was hard.

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