

# Notes

## Introduction

1. See, for example, P. Rawes, 'Reflective Subjects in Kant and Architectural Design Education', *Journal of Aesthetic Education*, Volume 41, Number 1 (Spring, 2007), pp. 74–89.
2. Colin Rowe's and Robin Evans's architectural criticism examines the relationship between geometric ideas and geometric materialisations in architecture. See, for example, C. Rowe, 'The Mathematics of the Ideal Villa, Palladio and Le Corbusier Compared', in *The Architectural Review*, Volume 101, Number 603 (March, 1947), pp. 101–4 and Robin Evans, *The Projective Cast: Architecture and Its Three Geometries* (Cambridge, MA and London: MIT Press, 2000).
3. Michael Fried and Rosalind Krauss's art historical criticism about Frank Stella's paintings are examples of the divergent claims made for geometric figures in modernist art. For Fried, Stella's geometric forms represent an *a priori*, yet overtly Formalist, geometric expression. For Krauss, Stella's work represents evidence of empirical *a posteriori* Minimalist experiences. In each case, these critics reduce geometry to either an *a priori* idea or an *a posteriori* idea. See Michael Fried, 'Shape as Form', in *Art and Objecthood: Essays and Reviews* (Chicago and London: University of Chicago Press, 1998), pp. 77–99, and Rosalind Krauss, *Passages in Modern Sculpture* (Cambridge, MA and London: MIT Press, 1993).
4. Chapters 5 and 6 will show that Bergson and Husserl are among those who have criticised the first *Critique* for exemplifying the belief that *only* scientific or mathematical forms of geometry are adequate *a priori* geometric intuitions.

In histories of geometry, such as Heath's Introduction to the *Elements*, Euclid's writings are contextualised in relation to his Platonic and Pythagorean sources. Yet, Heath also states that Euclidian geometry is, principally, a revision of *scientific* geometric method, drawing from De Morgan's 1848 account of the *Elements*. Heath cites De Morgan:

There never has been, and till we see it we never shall believe that there can be, a system of geometry worthy of the name, which has any material departures (we do not speak of *corrections* or *extensions* or *developments*) from the plan laid down by Euclid. T. Heath, *Euclid: The Thirteen Books of the Elements*, Volume I. (London: Dover Publications, 1956), p. v

Heath expands upon this mathematical emphasis in geometric thinking, writing that much 'valuable work' has investigated the axiomatic method subsequently, but that 'once the first principles are disposed of, the body of doctrine contained in the recent text-books of elementary geometry does not, and from the nature of the case cannot, show any substantial differences from that set forth in the *Elements*' (Heath, 1956, p. v).

## 1 Drawing Figures

1. An abbreviated form of the titles of the *Critiques* (*CPR* and *CoJ*) is used hereafter in the references. *CPR* refers to I. Kant, *The Critique of Pure Reason*, edited and translated by P. Guyer and A. Wood (Cambridge: Cambridge University Press, 1997). *CoJ* refers to I. Kant, *Critique of Judgment*, translated by W. S. Pluhar (Indianapolis: Hackett Publishing Company, 1987).
2. Michael Dummett analyses the principle of mathematical form in the synthetic *a priori* in Kant's *Critique of Pure Reason* in, 'The Philosophy of Mathematics', in *Philosophy 2: Further through the Subject*, edited by A. Grayling (Oxford: Oxford University Press, 1998), pp. 126–9.
3. The essay, 'Concerning the Ultimate Ground of the Differentiation of Directions in Space' may be described as pre-Critical because it is written before 1770 and 1781. Gary Banham defines Kant's 'pre-critical' writings as those produced 'prior to 1770 or 1781', and texts which contain a 'conceptual' pre-Criticality, including the *Anthropology from a Pragmatic Point of View*, from 1798. Banham writes:
 

If a critique is taken to mean an investigation of the limits and status of claims made about an area from within the area in question hence as an immanent questioning, then the writings of Kant's which do not carry out such a style of investigation must be regarded as 'pre-critical'. G. Banham, *Kant's Practical Philosophy: From Critique to Doctrine*. (Basingstoke: Palgrave Macmillan, 2003), p. 8
4. In Chapter 3 the importance of 'parts' or 'scholia' will be examined in more detail in relation to Spinoza's geometric method.
5. Edward Casey provides an alternative reading of this debate. In this particular essay, he suggests that Kant's theory of spatial relations corresponds with Leibniz's, writing that
 

the crucial step here taken by Kant is that whereby positions, though declared indispensable for grasping the location of parts of objects and for the relations of objects ('things') to each other, are absorbed into regions – which are themselves absorbed into absolute space. Indispensable in one respect, positions are dispensable in other respects, that is, precisely when they cannot be reduced to the sheer relationality of Cartesian 'external place' or what Kant simply calls 'external relation'. E. Casey, *The Fate of Place: A Philosophical History*. (Berkeley, Los Angeles and London: University of California Press, 1998), p. 189
6. An abbreviated title of the essay is used hereafter in the references. *CDS* refers to I. Kant, *Theoretical Philosophy 1755–1770*, Cambridge edition I, edited and translated by D. Walford and R. Meerbote (Cambridge: Cambridge University Press, 1992).
7. Deleuze notes the importance of an internal intuition of space from which external space can be produced in a certain lineage of neo-Kantian thought; he writes:
 

If, in the forms of intuition, Kant recognised extrinsic differences not reducible to the order of concepts, these are no less 'internal' even though they cannot be regarded as 'intrinsic' by the understanding, and can be represented only in their external relation to space as a whole.... In

other words, following certain neo-Kantian interpretations, there is a step-by-step, internal, dynamic construction of space which must precede the 'representation' of the whole as a form of exteriority.

In the same passage, Deleuze also notes that such an interpretation places Kant much less at odds with Leibniz's writings on space. G. Deleuze, *Difference and Repetition*, translated by P. Patton (London: The Athlone Press, 1997), p. 26.

8. Banham examines the development of the different aesthetics in Kant's three *Critiques*: for example, assessing the scope of the imagination and synthesis in the first *Critique* and the 'productive imagination' in the third *Critique*. He summarises the three roles of the imagination in the first *Critique* as; 'an empirical rule of reproduction which operates through the presentation of images; a transcendental rule of synthesis whether determined as "figurative" (B-Deduction) or as constitutive of each level of synthesis (A-Deduction); a mediating function between sensibility and understanding via schematism'. Banham also observes that, the imagination's freedom is amplified by the new transcendental Aesthetic of Reflective Judgment in the third *Critique*, which brings reflective powers into the operations of the imagination, thereby generating a new set of 'formal and material purposiveness'. G. Banham, *Kant and the End of Aesthetics* (Basingstoke: Palgrave Macmillan, 2000), p. 58.
9. However, Kant is also careful to state that art can be generated in the agreement between the understanding and reason in the form of 'a unique concept', that is, 'the concept of nature as art' (*Cof*, pp. 392–3).
10. Geometry can be described as a science of magnitudes, insofar as it is the construction of bodies that are brought about through the division of bodies into parts. Therefore, a link between geometry and feeling may be revealed when both are related to corporeal and living bodies.
11. Daniel W. Smith has examined the relationship between the imagination and figure in Kant's Critical philosophy in the essay, 'Deleuze's Theory of Sensation: Overcoming the Kantian Duality', in *Deleuze: A Critical Reader*, edited by P. Patton (Oxford: Blackwell Publishers, 1996), pp. 29–56.
12. Banham's re-reading of the 'connections between the imagination, conceptuality and intuition' the Transcendental Aesthetic suggests, however, that the imagination is a productive form of 'transcendental psychology' even in the first *Critique*, for example, when he writes:
 

The transcendental synthesis of the imagination is here described as productive due to the fact that what is required for it to take place is that the nature of objectivity is itself produced by it. This is not a synthesis of objects, it is rather a synthesis that enables there to be any relation of 'objects' to each other such that we can speak of there being a world as it produced the very notion of what an 'objective' representation is. The notion that it takes place 'prior to apperception' should however, in our view be interpreted as... it is directed by the principles of unification that is derived from apperception. The tracing of this synthesis, as a synthesis that brings the unity of apperception to the manifold of intuition, is the subsequent primary work of the *Critique*. G. Banham, *Kant's Transcendental Imagination*. (Basingstoke: Palgrave Macmillan, 2006), pp. 143–4
13. Kant also examines the nature of relations, in mechanical and dynamic forms, in the 1786 essay, 'Metaphysical Foundations of Natural Science'. In

this text, geometry and its figures tend to be determinate. I. Kant, *Philosophy of Material Nature*, translated by J. W. Ellington (Indianapolis: Hackett Publishing Company, 1985).

14. Perhaps most strongly expressed in the idea that Euclid's *Elements* is an *exclusively* scientific, mathematical text; for example, T. Heath, *Euclid: The Thirteen Books of the Elements*, Volume I (London: Dover Publications, 1956), p. v.
15. An abbreviated form of the title of the *Anthropology* is used hereafter in references. *APP* refers to I. Kant, *Anthropology from a Pragmatic Point of View*, translated by V. L. Dowdell (London and Amsterdam: Southern Illinois University Press, 1978).
16. Howard Caygill explains that Kant's method is particularly metaphysics, developing a 'proper' relationship between the intelligible and sensible realities. He writes:

The only way to preserve metaphysics is to establish a procedure for determining the proper relation of the sensible and intelligible realms... Kant offers another analogy, but one which this time he fully develops. He offers the example of spatial orientation, and the nature of directionality. In order to orient ourselves spatially we must make a distinction between left and right; but how can this distinction be made? In Kant's words, is it transcendental or empirical, in Heidegger's is it ontic or ontological? We shall see in the next section that Heidegger's decision in *Being and Time* to assign this distinction to ontic determination does Kant an injustice, making the difference empirical: it isn't, but then neither is it transcendental....

Caygill continues: 'Spatial orientation rests on a difference which is in a sense outside of and yet underlying spatial orientation. Dropping the spatial metaphors, it assumes a procedure or activity of distinction...'. Caygill refers back to the *CPR* to ask if spatial orientation is an activity that is not yet defined by the faculties, and he suggests that it is a production of space that is, in some ways, prior to conceptual knowledge. In addition, he observes that it is a different kind of judgment; 'because this differentiating activity cannot be represented in intuition that Kant calls it a feeling, or an "affection" of the subject. This indicates that it does not form part of either the sensible or intelligible realms, but is yet essential for this proper calibration...'. H. Caygill, *Art of Judgment* (Oxford: Blackwell Publishers, 1989), p. 198.

17. Caygill has noted that Kant's commitment to the relationship between understanding and the intuitions is, ultimately, underwritten by an absolute division between intuition and God, the world and the soul, which means that critique is always determined by an external drive or difference. H. Caygill, *Walter Benjamin: The Colour of Experience* (London: Routledge, 1998), p. 2. Kant's Critical philosophy therefore enables geometry and aesthetics to be understood as aspects of the understanding and intuition. Yet it also allows an immanent sufficiency to be located in the subject.
18. Brian Massumi examines discontinuity and infinity in drawing and geometry in his essay, 'The Diagram as Technique of Existence'. He writes:

Let the clean blackboard be a sort of Diagram of the original vague potentiality, or at any rate of some early stage of its determination. This blackboard is a continuum of two dimensions, while that which it stands

for is a continuum of some indefinite multitude of dimensions. I draw a chalk line on the board [...]. For this white chalk mark is not a *line*, it is a plane figure in Euclid's sense, a *surface*, and the only line that is there is the line which forms the *limit* between the black and the white surface. This discontinuity can only be produced upon that black-board by the reaction between two continuous surfaces into which it is separated, the white surface and the black surface. (Massumi, 2001, p. 163)

19. *Phaedo*, 73b (cited in Proclus, 1992), p. 37. The following chapter will examine Proclus' attention to the relationship between the discursive nature of the mathematical diagram and memory; for example, in the first part of the Prologue, Proclus refers to the *Phaedo* and the *Meno* as examples of Plato's theory that recollection is the understanding or 'a part of the soul' that unfolds the ideas it already contains, Proclus, *A Commentary on the First Book of Euclid's Elements*, translated by G. R. Morrow (Princeton: Princeton University Press, 1992), p. 37.

## 2 Folding-Unfolding

1. In Chapter 4 we will see that Leibniz also emphasises the importance of 'intermediacy' in a series of figures, but in an analytic form.
2. All quotations from the *Commentary* are taken from Proclus, *A Commentary on the First Book of Euclid's Elements* (AD 410–485), translated by G. R. Morrow (Princeton: Princeton University Press, 1992). This translation is developed from Gottfried Friedlein's 1873 text, *Procli Diadochi in Primum Euclidis Elementorum Librum Commentarii ex Recognitione Godofredi Friedlein*, Leipzig, 1873, and is based upon the Greek text by Simon Grynaeus, Basel, 1533. The title is abbreviated to *CEE* in references hereafter.
3. The *Commentary's* Prologues and Definitions offers most insight to the metaphysical nature of the geometric method and its figures but it is also a step by step explication of Book 1 of the *Elements*.
4. Deleuze notes Proclus' definition of 'series' in relation to the Pythagorean divine notions of the one, many, limit and unlimit. G. Deleuze, *The Fold: Leibniz and the Baroque*, translated by T. Conley (London: The Athlone Press, 2001), pp. 23 and 146. Later in this chapter I elaborate on these principles, and in Chapter 4 I discuss the infinite and multiple in relation to Leibniz's geometric method and figures.
5. Éric Alliez analyses the fold and neo-Platonism in relation to the construction of the soul and time in Plotinus' philosophy. He distinguishes between three different kinds of folding:
  - a. *Greek folding (pli)* of the forces engaged in the relation to others that is constitutive of the relation to self....
  - b. the *Greco-Roman unfolding (dépli)* of the relation to self in power relations....
  - c. the *neoplatonic refolding (repli)* or the self within the whole that puts it outside itself....
 É. Alliez, *Captial Times: Tales from the Conquest of Time, Theory Out of Bounds*, Volume 6, translated by G. van den Abbeele. (Minneapolis and London: University of Minnesota Press, 1996), p. 73

6. Plato's theory of the Divided Line in the *Republic*, Book VI, 510–510e, is demarcated by the upper, transcendental realm of Being and the lower sensible realm of Becoming, emphasising the division between the faculties of reason and understanding from the faculty of imagination and sense opinion. See Plato, *Collected Dialogues of Plato, Including the Letters*, edited by E. Hamilton and H. Cairns (Princeton: Princeton University Press, 1989), pp. 745–6.
7. Dimitri Nikulin's study of geometry, matter, and the imagination in Plotinus, Proclus, and Descartes observes that 'The notion of the intermediary plays an important role in Platonic ontology as present in Proclus' commentary to the first book of Euclid's "Elements". In this approach, geometrical objects are considered intermediate between ideal objects (notions) and their physical images, being irreducible to any of them.' D. Nikulin, *Matter, Imagination and Geometry: Ontology, Natural Philosophy and Mathematics in Plotinus, Proclus and Descartes* (Burlington, VT: Ashgate Publishing, 2002), p. xiv.
8. Ian Mueller outlines three diagrams that show the different realms of metaphysical schema which inform the *Commentary*. They are: figure 1, the order derived from the Divided Line, Book IV, *Republic*; figure 2, the Neo-Platonic order, and figure 3, an alternative order of the soul mediating between the non-sensible and sensible realms (*CEE*, pp. xvii–iii).
9. Proclus, however, attributes creative power to the soul and reproductive power to the understanding. This discussion is also an interesting precursor of philosophical discussions concerned with notions of 'life-force', for example, Freud's examination of the 'to-and-fro' movement between pleasure and displeasure, or the forces of Eros and Thanatos, in the essay 'Beyond the Pleasure Principle' (1920). See S. Freud, *The Standard Edition of the Complete Psychological Works*, Volume 18, edited and translated by J. Strachey (London: Hogarth Press and the Institute of Psychoanalysis, 1955). Also see Baudrillard's discussion of the economics of force between Eros and Thanatos. J. Baudrillard, *Symbolic Exchange and Death*, translated by Iain Hamilton Grant (London: Sage Publications, 1993). In each case, concepts of life and death produce notions of production that are characterised by a twofold movement.
10. In the *Timaeus*, Plato describes the world's soul as a mixture of mathematical matter and cosmic powers, a 'strip' divided into parts to form the cosmos and the metaphysical principles of the Existent, the Same and the Different, in constant, autonomous movement. It is conceived as being immaterial and partless, and corporeal and divided (Plato, 1989, pp. 1165–7).
11. Also see Nikulin's examination of imagination in Proclus' *Commentary* (Nikulin, 2002, pp. 234–7).
12. The diagram is re-examined in Deleuze's study of Francis Bacon's paintings, when he writes:

The diagram is thus the operative set of asignifying and nonrepresentative lines and zones, line-strokes and color-patches. And the operation of the diagram, its function, says Bacon, is to be 'suggestive'. Or, more rigorously, to use language similar to Wittgenstein's, is to introduce 'possibilities of fact' . . . . Because they are destined to give us the Figure, it is all the more important for the traits and color-patches to break with

figuration. This is why they are not sufficient in themselves, but must be 'utilized'. They mark out possibilities of fact, but do not constitute a fact (the pictorial fact). In order to be converted into a fact, in order to evolve into a Figure, they must be reinjected into the visual whole; but it is precisely through the action of these marks that the visual whole will cease to be an optical organization; it will give the eye another power, as well as an object that will no longer be figurative. G. Deleuze, *Francis Bacon: The Logic of Sensation*, translated by D. W. Smith. (London and New York: Continuum, 2003), pp. 101–2

13. Nikulin writes:

Limit for Proclus is related to the unlimited as substance is related to pure potency, *dynamis*. He further distinguishes two potencies, the one of the productive principle, which has to be associated with the One [...], the other of pure receptivity, which has to be linked to matter. Since Proclus does not accept any potentiality in the intelligible, all matter should be excluded from here. But since the intelligible is constituted for him by both principles of limit and the unlimited, being has to exemplify a certain potency, which is the infinite potency of unceasing thinking and production; although this potency of being is not potentiality and in this way is different from the potentiality of coming to be. (Nikulin, 2002, p. 143)

14. Robin Durie's essay, 'The Strange Nature of the Instant', examines this discussion. See R. Durie (ed.), *Time and the Instant: Essays in the Physics and Philosophy of Time* (Manchester: Clinamen Press, 2000), pp. 1–24.

### 3 Passages

1. The term 'expression' is used repeatedly by Spinoza in the *Ethics* to describe the immanence of God in modes of substance; for example, in Part I, Definition 6, he writes: 'By God I mean an absolutely infinite being; that is, substance consisting of infinite attributes, each of which expresses eternal and infinite essence.' B. Spinoza, *Ethics, Treatise on the Emendation of the Intellect and Selected Letters*, edited by S. Feldman (Indianapolis and Cambridge, MA: Hackett Publishing Company, 1992), p. 31. This chapter is also informed by Deleuze's examination of the term which emphasises the importance of the internal movements of thought in Spinoza's and Leibniz's post-Cartesian philosophies see G. Deleuze, *Expressionism in Philosophy: Spinoza*, translated by M. Joughin (New York: Zone Books, 1992).

Martin Joughin's Preface succinctly summarises this argument when he writes:

Spinoza and Leibniz: two different expressions of 'expressionism in philosophy' characterized in this book as a system of *implicatio* and *explicatio*, enfolding and unfolding, implication and explication, implying and explaining, involving and evolving, enveloping and developing. Two systems of universal folding: Spinoza's unfolded from the bare 'simplicity' of an Infinity into which all things are ultimately folded up, as into a universal map that folds back into a single point; while Leibniz starts from the infinite points in that map, each of which enfolds within its

infinitely 'complex' identity all its relations with all other such points, the unfolding of all these infinite relations being the evolution of a Leibnizian Universe. (Deleuze, 1992, p. 5)

2. This chapter does not extend into an evaluation of whether Descartes' geometric writings also constitute a 'forgotten' geometry. However, see Chapter 6 for a discussion of Husserl's engagement with Descartes.
3. Later in this chapter I refer to Spinoza's criticism of Descartes' 'occultist' union between the mind and body. In addition, Chapter 5 notes Bergson's frustration with Descartes' scientific method that not only leads him to acknowledge Descartes' skill as a physicist but also to criticise his dependency upon the 'symbolic' limits of modern rational science.
4. Deleuze notes that Spinoza constructs the geometric method in relation to a 'way of being', which is reflected in his practical work of polishing optical lenses. Deleuze writes:
 

In Spinoza's thought, life is not an idea, a matter of theory. It is a way of being, one and the same eternal mode in all its attributes. And it is only from this perspective that the geometric method is fully comprehensible.... The geometric method ceases to be a method of intellectual exposition; it is not longer a means of professorial presentation but rather a method of *invention*.... G. Deleuze, *Spinoza: Practical Philosophy*, translated by R. Hurley. (San Francisco: City Lights Books, 1988), pp. 13–14
5. Also see Bergson's description of Spinoza's approach as having the impact of a 'dreadnought', in K. Ansell Pearson and J. Mullarkey (eds), *Henri Bergson: Key Writings* (London: Continuum, 2002), and cited in Chapter 5, note 9, below.
6. All citations from the *Ethics* are taken from B. Spinoza, *The Ethics, Treatise on the Emendation of the Intellect, Selected Letters* (1677), edited by S. Feldman and translated by S. Shirley (Indianapolis and Cambridge, MA: Hackett Publishing Company, 1992). The title is abbreviated to *E* in references hereafter. References give the following: Title, Part, Proposition or Definition, Corollary or Scholium, and page number; for example (*E*: I, Prop. 7, p. 34).
7. See, for example, Martin Joughin's discussion about enfolding/unfolding and *implicatio/explicatio* (Deleuze, 1992, pp. 5–7).
8. Seymour Feldman writes:
 

Spinoza's *Ethics* is perhaps the first purely philosophical treatise that presents its conclusions consistently and completely in an axiomatic manner. In this respect it is the paradigm of the hypothetical-deductive method suggested by Aristotle in his *Posterior Analytics* as the model for a scientific theory, which until Spinoza was only exemplified by Euclid's geometry. (*E*, p. 7)
9. Richard Arthur provides an excellent survey of the development of atomistic theories in which Spinoza and Leibniz participated. See R. Arthur (ed. and trans.), *The Labyrinth of the Continuum: Writings on the Continuum Problem, 1672–1686, G W Leibniz, The Yale Leibniz Series* (New Haven and London: Yale University Press, 2001).
10. Deleuze notes the confluence between the geometric *plan* and immanent *plane* in Spinoza's emphasis on the modal nature of 'life':
 

What is involved is no longer the affirmation of a single substance, but rather the laying out of a *common plane of immanence* on which all bodies, all minds, and all individuals are situated. This plane of immanence or



consistency is a plan, but not in the sense of a mental design, a project a program; it is a plan in the geometric sense: a section, an intersection, a diagram. Thus to be in the middle of Spinoza is to be on the modal plane, or rather to install oneself on this plane – which implies a mode of living, a way of life. (Deleuze, 1988, p. 199)

11. Spinoza can be said to be 'materialist' insofar as he anticipates the modern concern with biophysical definitions of matter. See, for example, Deleuze (1988) pp. 56–7, and Seymour Feldman's introduction to the *Ethics* (*E*, p. 12).
12. Spinoza continues this discussion into an extended examination of the motion of extended bodies and their constitution as divisible parts, motion, internal and external qualities and capacity to affect other bodies (*E*, pp. 72–6).
13. See Part II, Proposition 40, Scholium 1 (*E*, p. 89).
14. Spinoza's common notions may have some correspondence to Deleuze and Guattari's notion of the 'percept' when they write that the definition of art lies in its attempts to 'create the finite that restores the infinite: it lays out a plane of composition that, in turn, through the actions of aesthetic figures, bears monuments or composite sensations'. G. Deleuze and F. Guattari, *What is Philosophy?* translated by H. Tomlinson and G. Burchell (New York and Chichester: Columbia University Press, 1994), p. 197.
15. Deleuze writes:
 

But joyful passions lead us closer to this power [of action], that is, increase or help it; sad passions distance us from it, that is, diminish or hinder it. The primary question of the *Ethics* is thus: What must we do in order to be affected by a maximum of joyful passions? (Deleuze, 1992, p. 273)
16. Deleuze notes the historical 'pantheist' tradition in the relationship between the implication and explication (*implicatio/explicatio*) that produce a synthetic unity – '*complicatio*' – that is underscored by the neo-Platonic principles of 'multiplicity in the One, and of the One in the Many' and noting that the principles of implication and explication do not therefore constitute opposition but synthesis (Deleuze, 1992, p. 16).
17. Deleuze uses the concept of 'speeds' to register the multiple kinds of activity that are generated in the body by the emotions; for example, of the modes, he writes: 'For, concretely, a mode is a complex relation of speed and slowness, in the body but also in thought, and it is a capacity for affecting or being affected, pertaining to the body or to thought' (Deleuze, 1988, p. 124).
18. Deleuze writes that the *Ethics* is a twice-written book; the first book is the formal geometric method, the second 'subterranean' book is the 'broken chain of the scholia, a discontinuous volcanic line, a second version underneath the first, expressing all the angers of the heart and setting forth the practical theses of denunciation and liberation' (Deleuze, 1992, pp. 28–9).
19. Isabelle Stengers, for example, discusses whether it is possible to think of an ethics of science that might reflect feminist practice or radical politics and suggests rethinking the scope of the scientific method towards an ethical and critical practice that reflects Bergson's inquiry. See I. Stengers, *Power and Invention: Situating Science, Theory Out of Bounds*, Volume 10 (Minneapolis and London: University of Minnesota Press, 1997).

## 4 Plenums

1. See, for example, Leibniz's writings on the problem of bodies, motion and rest in, 'On Matter, Motion, Minima, and the Continuum', 1675 (Arthur, 2001, pp. 30–41). In his introduction, Arthur notes that Leibniz gave up 'the ontology of perfect solids and perfect fluids' during this period, and suggests that he develops a different ontology in which 'matter has varying degrees of resistance to division, [and] a given body can respond to the actions of the plenum by differing internal divisions, manifested as elasticity' (Arthur, 2001, p. lxxv).

Arthur's commentary on the problem of the Continuum informs discussions about geometric methods, in particular, in his analysis of Leibniz's conceptual development of substance, infinite divisibility, and the 'unassignables' or 'indiscernibles'. Arthur also shows how Leibniz's ontology of the Monad is developed in conjunction with the intensive debates about physical and mathematical sciences in the seventeenth century, whilst recognizing the inherent labyrinthine nature of his writings in which internal disagreements, correspondence with other writers and progressive changes of opinion and contradiction, come together to form a discontinuous, yet continuous philosophy. Arthur notes, for example, that Leibniz's philosophy of infinity is intimately related to the operations of Geometry, such as, his essay, '*De usu geometriae*' (1676), in which Leibniz considers geometry to be the basis for discussions about the 'Continuum', when he writes: 'Only Geometry... can provide a thread of the Labyrinth of the Composition of the Continuum, of maximum and minimum, and the unassignable and the infinite, and no one will arrive at a truly solid metaphysics who has not passed through that labyrinth' (cited in Arthur, 2001, p. xxiii).

2. In his 'Treatise on Calculus' (1675–1676), Leibniz defines calculus as 'every curvilinear figure is nothing but a polygon with an infinite number of sides, of an infinitely small magnitude'. Arthur explains, 'according to this conception any curve can now be represented as an infinite "sum" of such differentials.... Similarly, the area can be represented as an infinite sum of the products of each ordinate and a differential... ' (Arthur, 2001, p. liv).
3. This is reflected in the different metaphysical 'levels' in which the two texts begin; the *Ethics* begins with a definition of the infinite, yet indivisible, substance or God, whereas the *Monadology* begins with an explication of the infinite divisibility (i.e., magnitude) of the Monad.
4. As a result, the relationship between quality and quantity becomes the central condition of production, not as an opposition of forces but as a variation in degrees of intensity in the Monad. Deleuze examines these relations in Leibniz's, Kant's and Maimon's theories of qualitative difference (Deleuze, 1997, pp. 170–6).
5. Leibniz's correspondence with Samuel Clarke between 1705–16 contains an expanded discussion about Kant's Newtonian understandings of space and time versus Leibniz's theories of geometry, space and time. See, H. G. Alexander, *The Leibniz-Clarke Correspondence* (Manchester: Manchester University Press, 1956). This debate is too large to be addressed here, but it is worth noting that Deleuze suggests that the differences between Kant's and Leibniz's positions are mediated through Salomon Maimon's 'reformulation'

of the *Critique of Pure Reason* by means of a Leibnizian form of qualitative 'difference'. Deleuze outlines how Maïmon overcomes the external difference that constitutes 'the Kantian duality between concept and intuition' by 'showing how inadequate the point of view of conditioning is for a transcendental philosophy: [so that] determinability must be itself conceived as point towards a principle of reciprocal determination' (Deleuze, 1997, p. 173).

6. The Monad's internal infinity, difference and magnitude also suggests a strong precedent to the Jena Romantics concept of 'fragment', whose magnitude is an excessive unity that challenges the notions of finite extension and agency. See, for example, P. Lacoue-Labarthe and J-L. Nancy, *The Literary Absolute: The Theory of Literature in German Romanticism*, translated by P. Barnard and C. Lester (Albany, NY.: SUNY, 1988).
7. All citations from the *Monadology* are taken from the edition, G. W. Leibniz, *Discourse on Metaphysics, Correspondence with Arnauld, Monadology*, translated by G. R. Montgomery (La Salle, Ill.: Open Court Publishing Company, 1973). The title is abbreviated to *M* in references hereafter, followed by the section number and page number.
8. Arthur writes that the problem of the atom and the void is 'a tangled thread' throughout Leibniz's writings, which develops from his theories of atoms as 'unextended "indivisibles" to; "the insensibly small, very hard particles" such as the "bullae" and the "terrellas" [which are] akin to the "chemical" atoms of Sennert [and represent] "units of formation" or "action" in his writings before 1676' (Arthur, 2001, pp. xliii–xliv). After 1676, however, Arthur writes that Leibniz embraces 'atomism', positing the 'necessity' of an 'indestructible core'. But with respect to the *Monadology* we find that it goes a step further, reflecting Leibniz's subsequent rejection of atomism for substance, which he calls the 'substantial atom', 'the combination of soul and body', or the 'corporeal substance' in which there is the indivisible soul (Arthur, 2001, p. xlvi).
9. Also see below for Leibniz's definition of the immensum from 'On the Origin of Things from Forms' (1676), and cited in Arthur (2001), p. 121.
10. Keith Ansell Pearson writes that Bergson's critique of knowledge is a 'philosophy of life', which recalls Spinoza's philosophy of a 'practical way of living'. K. Ansell Pearson, *Philosophy and the Adventures of the Virtual: Bergson and the Time of Life* (New York and London: Routledge, 2002), p. 17. Ansell Pearson also notes that both Spinoza and Bergson are linked by a commitment to a univocal and transcendental immanence (Ansell Pearson, 2002, p. 103).
11. However, there are also significant differences between Leibniz's and Bergson's concepts of perception and memory: first, Leibniz provides a particularly strong concept of intensity, whereas Bergson considers perception and its intensity in relation to a much more explicitly defined spatiotemporal order. In this respect, Bergson brings Leibniz's project into a more fully formed topological geometric project. Second, Bergson analyses memory and the actions of the individual in relation to an embodied and transcendental 'intuition'. Bergson's thinking therefore displays a more psychological mode of interpretation than Leibniz's logic, despite the sufficiency of the Monad that is derived from perception and appetite.

12. Robin Durie, for example, highlights the extent to which a 'potential' theory of infinity as magnitude is problematic, since it does not admit the corporeality of being (*entelechia*). He cites Aristotle's discussion about the reality of a 'potential' magnitude and the Entelechy in the *Physics*:  
 'To be' means to be potentially [*dynamei*] or to be actually [*entelechia*]; and the infinite is either in addition or in division. It has been stated that magnitude [*megethos*] is not in actual operation infinite [i.e., there is a limit to the actual size things can be]; but it *is* infinite in division – it is not hard to refute indivisible lines – so that it remains for the infinite to be potentially [*dynamei*]. We must not take 'potentially' here in the same way as that in which, if it is possible for this to be a statue, it actually will be a statue, and suppose that there is an infinite which will be in actual operation. (Aristotle's *Physics III*, 206a, 14ff, cited in Durie, 2000, p. 13)
13. The seventeenth-century notion of substance provides a distinct shift in the concepts of infinity and magnitude from those that existed in the ancients' philosophy. Durie states that, according to Zeno, a magnitude of an infinite aggregate is impossible, or insufficient, since it is only potentially given (Durie, 2000, p. 13). For Leibniz, however, the notion of aggregate or impossibility is not just demonstrated as a logical idea, but is established as the definition of an intensive and thinking substance that is sufficient.
14. See, for example, *The Fold* in which the 'amplitude' of the soul (its intension and inflection) is similar to Bergson's memory in which the 'living present' or act is 'essentially variable in both extension and intensity' (Deleuze, 2001, p. 70).
15. Deleuze writes: 'This procedure of the infinitely small, which maintains the distinction between essences (to the extent that one plays the role of inessential to the other), is quite different to contradiction. We should therefore give it a special name, that of "vice-diction"' (Deleuze, 1997, p. 46).
16. Arthur suggests that 'metaphor of the net presages that of the folds of matter' (Arthur, 2001, p. 402).
17. The relationship between space and matter is also evident in the use of the term 'plenum' in architecture, which refers to an interstitial space or void between the floor and the ceiling; and plenums are also chambers for the circulation of air in combustion engines. Also note Deleuze's opening sentence about the operation of folding in relation to the baroque architectural form of interconnected chambers, floors and layers in *The Fold*; 'the Baroque differentiates its folds in two ways, by moving along two infinities, as if infinity were composed of two stages or floors: the pleats of matter, and the folds of the soul' (Deleuze, 2001, p. 3).
18. Arthur writes that  
 Leibniz was committed to a plenistic physics from the beginning, largely under the influence of Hobbes. But this was the dominant view of his contemporaries, shared by the Cartesians and even atomists like Huygens. It was not displaced in continental Europe until the spread of Newtonianism in the latter part of the eighteenth century. (Arthur, 2001, p. 460)
19. Arkady Plotnitsky explores a rather polarised geometrico-topological route from Leibniz, Riemann to Deleuze, and does not include Bergson in this

lineage. A. Plotnitsky, 'Algebras, Geometries and Topologies of the Fold: Deleuze, Derrida and Quasi-Mathematical Thinking (with Leibniz and Mallarmé)', in *Between Deleuze and Derrida*, edited by Paul Patton and John Protevi (London and New York: Continuum, 2003), pp. 98–119.

## 5 Envelopes

1. By contrast see, for example, art historical studies of Duchamp's concept of the 'ready-made', his interest in geometry and 'l'infinite', in *The Writings of Marcel Duchamp, Marchand du Sel* edited by M. Sanouillet and E. Peterson (Cambridge, MA and New York: Da Capo Press, 1973). See also L. Dalrymple Henderson, *Duchamp in Context: Science and Technology in the Large Glass and Related Works* (Princeton: Princeton University Press, 1998).
2. Developments in mathematics and geometry in the nineteenth century focus on the break away from Euclidian geometry, and become increasingly concerned with the mathematical possibility of a spatial 'fourth dimension' and non-Euclidian principles of space-time. In each case, these geometries sought to disrupt the apparently teleological determination of Euclidian geometry towards ideal truths. Thus, non-Euclidian geometry challenges the axiomatic *a priori* conception of mathematics, in particular, focusing on the possibility of alternative solutions to the 'truth' of Euclid's fifth postulate: 'That, if a straight line falling on two straight lines make the interior angles on the same side less than two right angles, the straight lines, if produced indefinitely, meet on that side on which are the angles less than two right angles' (Heath, 1956, p. 155). Gauss's, Lobachevsky's and Bolyai's theories of lines that will necessarily meet – the lines on a sphere – in the 1820s and 1830s lead on to Beltrami's 'pseudosphere' in the 1860s which provided an accessible diagram of curved space. Other non-Euclidian geometries took the issue of congruence as evidence that Euclid's geometry did not fully describe spatial relations (e.g., the non-congruence of the left and right hand). See, for example, L. Dalrymple Henderson, *The Fourth dimension and Non-Euclidian Geometry in Modern Art* (Princeton: Princeton University Press, 1983).

Most complex of these was Riemann's theory of topological manifolds (explained in his lecture 'On the Hypothesis that Lie at the Foundations of Geometry' of 1854 and published in 1867), which distinguished between bounded and infinite space, and congruence, diverging significantly from Euclidian principles of transformation to produce geometric figures that are 'locally' and 'globally' differentiated.

Lawrence Sklar, for example, explains that a 'topological structure' is evident in the intrinsic difference between two surfaces, such as a plane and a cylinder, determined at a local *and* a global level. At a global level 'the two surfaces differ, even neglecting their embedding in three-space, in the global properties of *connectivity* determinable by a geometer confirmed to the surface and ignorant of the embedding'. At a local level they differ if we are given 'free mobility throughout the surface'; for example,

if we start from a point on a plane and travel along any geodesic (straight line) through that point without ever reversing direction, then we will never return to our initial point. On a cylinder, however, through each

point there is a geodesic (the circle around the cylinder through that point) such that if we travel along that geodesic, never reversing direction, we will sooner or later return to our starting point. This shows that *the intrinsic identity* of a [figure, such as a] cylinder and a plane *is a local matter*. L. Sklar, *Space, Time and Spacetime*. (Berkeley, Los Angeles and London: University of California Press, 1977), pp. 41–2 (my emphasis)

3. See, for example, Ansell Pearson's examination of the multiplicity in Bergson's notion of the 'virtual' (Ansell Pearson, 2002).
4. In his essay 'Laughter: An Essay on the Meaning of the Comic' (1900), Bergson suggests that the imagination abstracts from the particular perception: '[the] artistic imagination [...] simply reveals what we have hidden from ourselves in our perceptual power of condensation which is at the same time an abstraction from the individual to the general'. Cited in J. Mullarkey, *Bergson and Philosophy* (Edinburgh: Edinburgh University Press, 1999), p. 59.
5. All quotations are taken from H. Bergson, *Matter and Memory*, translated by N. M. Paul and W. Scott Palmer (New York: Zone Books, 1991). The title is abbreviated to *MM* in references hereafter.
6. Mullarkey defines the image as a universal designation of 'the objects of every type of perception' (Mullarkey, 1999, p. 32).
7. For an interesting 'psychical' interpretation of topology and the body see Bernard Burgoyne's discussion in his essay 'Autism and Topology', in which he examines the 'weak' topological structures of the autistic child. In note 32 to the essay he writes:
 

Equally topological structure can be obtained by considerations of boundary or frontier. There exists a range of topological notions, all of which can be demonstrated to be equivalent *in having this power to generate the structure of a space*: where there are limitations of the equivalence they raise questions about the foundations of topology and the foundations of mathematics. The equivalent notions include the concepts of neighbourhood, interior, closure, closed set, net, limit, filter and ideal. B. Burgoyne (ed.), *Drawing the Soul: Schemas and Models in Psychoanalysis*. (London: Rebus Press, 2000), p. 215 (my emphasis)
8. Mullarkey, for example, discusses Bergson's development of heterogeneous notions of space in *Matter and Memory*, in distinction to the 'homogenous' notion of space in the earlier essay 'Time and Free Will' (1888) (Mullarkey, 1999, p. 13).
9. See, for example, Bergson's impressive analysis of Spinoza's geometric method in the *Ethics*, in the essay 'Philosophical Intuition', in *The Creative Mind* (1933), which Bergson suggests has 'behind' it the 'subtle' 'lightness' of intuition that elides the conceptual weight of his method. He writes:

Nevertheless I know of nothing more instructive than the contrast between the form and the a matter of a book like the *Ethics*: on the one hand those tremendous things called Substance, Attribute and Mode, and the formidable array of theorems with the close network of definitions, corollaries and scholia, and that complication of machinery, that power to crush which causes the beginner, in the presence of the *Ethics*, to be struck with admiration and terror as though he were before a battleship of the Dreadnought class; on the other hand, something subtle,

very light and almost airy, which flees at one's approach, but which one cannot look at even from afar, without becoming incapable of attaching oneself to any part whatever of the remainder, even to what is considered essential, even to the distinction between Substance and Attribute, even to the duality of thought and Extension. What we have behind the heavy mass of concepts of Cartesian and Aristotelian parentage is that intuition which was Spinoza's, an intuition which no formula, no matter how simple, can be simple enough to express. (Ansell Pearson and Mullarkey, 2002, pp. 236–7)

10. All quotations are taken from 'Introduction to Metaphysics' (1903) (reprinted in Ansell Pearson and Mullarkey, 2002). The title is abbreviated to IM in references hereafter.
11. On intuition and geometry, Mullarkey writes: 'Bergson believes there is no "simple and geometrical definition of intuition"'. He cites the *Creative Mind* in which Bergson writes that a changing reality requires 'views of it that are multiple, complementary and not at all equivalent'. Mullarkey continues: 'Intuition entails whatever is required by a subject in a particular context to adjust to the full alterity of that situation as it extends beyond the confines of [the subject's] perspective' (Mullarkey, 1999, p. 159).
12. All quotations are taken from H. Bergson, *Creative Evolution*, translated by A. Mitchell (London: Macmillan and Company, 1964). In references, the title is abbreviated to *CE* hereafter.

## 6 Horizons

1. David Carr distinguishes the *Crisis* from Husserl's earlier major 'introductions to phenomenology', the *Ideas* (1913), the *Cartesian Meditations* (1931) and *Formal and Transcendental Logic* (1929), in particular, drawing attention to the 'unmistakable and passionate expression, though in the most general terms, to his position on the turbulent events of the time.' E. Husserl, *Crisis of European Sciences and Transcendental Phenomenology: An Introduction to Phenomenological Thought* (1954), translated by David Carr from the posthumous German edition by Walter Biemel (Evanston: Northwestern University Press, 1970), p. xvi.
2. Husserl's *Crisis of European Sciences and Transcendental Phenomenology* is abbreviated to *CES* in references hereafter.
3. Of course, there are other significant phenomenological intersubjective horizons with Husserl's work; including, Husserl's difficult relations with his former student, Heidegger's phenomenology, Merleau-Ponty's theory of 'life-world' and Derrida's analysis of 'historicity' in *Husserl's Origin of Geometry: An Introduction* (1962) translated by J. P. Leavey (Lincoln and London: University of Nebraska Press, 1989). Also see Carr's introduction to the *Crisis* (*CES*, pp. xxv–xxvii, and note 20, p. xxx).
4. David Carr rejects the association between Husserl's teleological *Geist* and Hegel's phenomenology, stating that although each examines the production of reason in a European context, Husserl's earlier phenomenological writings show that he does not follow the causal progression of historical events that Hegel promotes. However, Carr does recognise that the *Origin* has most

affinity with these arguments because of its 'inquiry into the essence of history as such rather than one concerned with facts directly' (*CES*, pp. xxxiii–xxviii). Also see Paul Ricoeur's discussion of Husserl's concept of sense and historical analysis in the *Crisis* in, 'Husserl and the Sense of History', in P. Ricoeur, *Husserl: An Analysis of His Phenomenology*, translated by E. G. Ballard and L. E. Embree (Evanston: Northwestern University Press, 1967), pp. 161–7.

5. Citing Gurwitsch, Carr observes that many commentators have described Husserl's project as a 'history of philosophy' and 'a philosophy of history'. A. Gurwitsch, 'The Last Work of Edmund Husserl', in *Studies in Phenomenology and Psychology* (Evanston: Northwestern University Press, 1966), p. 401. Cited by Carr (*CES*, p. xxxiii).
6. Deleuze, however, suggests that Husserl's concept of the idea follows Riemann's topological idea of the 'multiplicity', thereby offering a more positive connection between Husserl's theory of the idea and modern geometric science, in contrast to Husserl's anxiety that modern geometry ignores the potential for univocal transcendental ideas. Deleuze writes:

Everything is a multiplicity in so far as it incarnates an Idea. Even the many is a multiplicity; even the one is a multiplicity. That the one is a multiplicity (as Bergson and Husserl showed) is enough to reject back-to-back adjectival propositions of the one-many and many-one type. Everywhere the differences between multiplicities and the differences within the multiplicities replace schematic and crude oppositions. Instead of the enormous opposition between the one and the many, there is only the variety of multiplicity – in other words, difference. (Deleuze, 1994, p. 182)

Here Deleuze appears to refer to Husserl's *Ideas*, and *Cartesian Meditations* (but does not state this explicitly) to show that Riemann, Husserl and Bergson are linked in their concern with infinite univocal ideas. So, if we agree that Bergson and Husserl also construct multiplicities or ideas through their discussions of sense and perception, this potential may also be extended to include Husserl's investment in the geometric idea in the *Crisis* and the *Origin*.

7. This potential is also reflected in Deleuze's and Guattari's observation that Kant's Critical philosophy and Husserl's *Cartesian Meditations* and *Ideas* are connected, writing:

A transcendental logic (it can also be called dialectical) embraces the earth and all that it bears, and this serves as the primordial ground for formal logic and the derivative regional sciences. It is necessary therefore to discover at the very heart of the immanence of the lived to a subject, that subject's acts of transcendence capable of constituting new functions of variables or conceptual references: in this sense the subject is no longer solipsist and empirical but transcendental. We have seen that Kant began to accomplish this task by showing how philosophical concepts are necessarily related to lived experience through a priori propositions or judgment as functions of a whole possible experience. But it is Husserl who sees it through to the end by discovering, in non-numerical multiplicities or immanent perceptivo-affective fusional sets, the triple root of acts of transcendence (thought) through which the subject constitutes first of all a sensory world filled with objects, then an



intersubjective world occupied by the other, and finally a common ideal world that will be occupied by scientific, mathematical or philosophical concepts. (Deleuze and Guattari, 1994, p. 142)

8. See Ricoeur for a discussion of Kant's *Critique of Reason* as an implicit phenomenology. Ricoeur re-reads Kant through Husserl's phenomenological method and ends his chapter on Kant and Husserl, writing: 'Husserl *did* phenomenology, but Kant *limited* and *founded* it' (Ricoeur, 1967, p. 201).
9. Interestingly, Ricoeur does not consider intersubjectivity in relation to the reflective subject, but writes that Kant comes 'closest' to a proper 'theory of intersubjectivity' in the *Anthropology* (Ricoeur, 1967, p. 196).
10. Danielle Lories argues that Husserl's *Ideas* Volume I (§11) presents an 'aesthetic attitude' which corresponds with Kant's theory of aesthetic disinterestedness and reflective judgment in the *Critique of Judgment*. She proposes re-reading the *Critique of Judgment* in light of Husserl, 'as a phenomenology of the aesthetic attitude', with particular reference to Kant's theory of reflection:
 

It is, I think, in this description of the reflection specific to aesthetic judgment that the main interest of a phenomenology of the aesthetic attitude that can be found in Husserl resides. By describing the double movement that unifies the aesthetic feeling and gives the object its aesthetic colour or tone, Husserl discards the interpretations of the Kantian form that consider it to be empty (which it never was!). D. Lories, 'Remarks on Aesthetic Intentionality: Husserl or Kant', *International Journal of Philosophical Studies*, Volume 14, Number 1. (March, 2006), p. 45
11. Derrida writes that Husserl cannot promote a 'poetic language' because its significations are not transcendental 'objects' and are therefore outside the realm of shared linguistic translatability. Derrida's observation suggests that Husserl considers the poetic act of aesthetic thinking to be a weak transcendental project because it does not deliver clear univocal knowledge (Derrida, 1989, p. 82).
12. Derrida notes that Husserl radicalises Kant's transcendental intuition in his theory of the horizon:

Would not, then, his original merit be to have described, in a properly *transcendental* step (in a sense of that work which Kantianism cannot exhaust), the conditions of possibility for history which were at the same time *concrete*? Concrete, because, they are experienced [*vécues*] under the form of *horizon*. The notion of horizon is decisive here: 'horizon-consciousness,' 'horizon-certainty,' 'horizon-knowledge,' such are the key concepts of the *Origin*. Horizon is given to a *lived* evidence, to a *concrete* knowledge which, Husserl says, is never 'learned'..., which no empirical moment can then hand over, since it always presupposes the horizon. Therefore, we are clearly dealing with a primordial knowledge concerning the totality of possible historical experiences. Horizon is the always-already-there of a future which keeps the indetermination of its infinite openness intact (even though this future was *announced* to consciousness). As the structural determination of every material indeterminacy, a horizon is always virtually present in every experience; for it is at once the unity and the incompleteness for that

experience – the anticipated unity in every incompleteness. The notion of horizon converts critical philosophy's state of abstract possibility into the concrete infinite potentiality secretly presupposed therein. The notion of horizon makes the a priori and the teleological coincide'. (Derrida, 1989, p. 117)

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