**Anthony W. Auerbach**

# Structural Constellations

## Excursus on the drawings of Josef Albers c. 1950–1960



With a catalogue of unpublished drawings in the collection of the Josef and Anni Albers Foundation, Connecticut.

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**How to read *Structural Constellations***

Ostensibly a monograph on the drawings of Josef Albers, the reader will find under the heading 'excursus' a series of investigations—into the concept of constellation in the writings of Walter Benjamin and Theodor W. Adorno, the semiotics of star maps, the rhetorics of geometry and the structure of representation—in which Josef Albers's *Structural Constellations* are not discussed directly for almost 200 pages. Although it departs from its subject matter, this group of essays may be regarded as tending towards an interpretation of *Structural Constellations*, as Benjamin would say, 'returning in a roundabout way to its original object.'

The main themes of the dissertation are addressed to specific objects: texts by Benjamin and Adorno, star maps in the tradition which stretches between Ptolemy's *Almagest* and Argelander's *Bonner Durchmustering*, geometry lessons, the gossip about Cubism, works and manifestos by Alberti, Dürer,van Doesburg, Lissitsky and Albers. The aim is to broaden the terms of reference and develop more precise interpretative tools for an assessment of Albers's *Structural Constellations*, to place these works in a more accurate historical context and provide the basis for a reassessment of some of the products and rhetorics of twentieth century modernism.

The reader should not expect the dissertation to reach a climax with Albers's *Structural Constellations*. Albers emerges, even as he dissppears in the elucidation of his works, as a late modernist and practitioner of negative dialectics. His works emerge as a configuration of these dialectics and offer a reflection on the topics and ideas explored in the dissertation.

The historical and theoretical discussion of the metaphorical and graphic praxis of constellation and what I have called the 'epistemological wish-images' mediated by geometry is counterbalanced by a companion volume cataloguing some 1,500 drawings by Josef Albers.

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**Structural Constellations:**
**Excursus on the drawings of Josef Albers c. 1950–1960**

**I On Constellation and Interpretation:**
**An exchange between Walter Benjamin and Theodor W. Adorno**
My opening chapter traces the modalities of the term *Konstellation* as it changed hands between the two writers, from its evocation in Benjamin's study of German *Trauerspiel* (1925) through its adoption by Adorno in his programme 'Die Aktualität der Philosophie' (1931) to its role in the epistemology of the *Passagen-Werk* (1935–40) and Adorno's and Benjamin's controversies of the same period. I also consider the legacy of this unfinished discussion in Adorno's late work.

**II On Constellation and Drawing: the semiotics of star maps**
In this chapter I propose a semiotic analysis of star maps. I examine the graphic expression of the negotiation between knowledge and signification in the post-Ptolemaic tradition of celestial cartography by means of a selection of historical examples. I advance a semiotic theory in order to form an assessment of both innovative and conservative features of celestial cartography. This study includes a treatment of previously neglected nineteenth-century maps.

**II On Structure and Representation: epistemological wish-images**
That geometry could be both the guarantee and the abyss of representation calls for an historical as much as a structural explanation. In this chapter I consider drawing as the site of the entanglement of art and geometry. By means of a set of historical episodes, I consider what role geometry, mediated by drawing, has played in art and beyond that, what ideological claims, mediated by geometry, have been made by or for art. I discuss the changing role of drawing in geometry, ancient and modern; and role of geometry in a series of art-historical episodes: Alberti, Dürer, Monge, Farish, Necker, van Doesburg, Lissitzky, Albers.

Method is a digression. Representation as digression—such is the methodological nature of the treatise. The absence of an uninterrupted purposeful structure is its primary characteristic. Tirelessly the process of thinking makes new beginnings, returning in a roundabout way to its original object.

Walter Benjamin, *The Origin of German Tragic Drama*

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VOLUME ONE



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# I On Constellation and Interpretation: An exchange between Walter Benjamin and Theodor W. Adorno

> Universal history has no theoretical armature. Its method is additive; it musters a mass of data to fill the homogeneous, empty time. Materialistic historiography, on the other hand, is based on a constructive principle. Thinking involves not only the flow of thoughts, but their arrest [*Stillstellung*] as well. Where thinking suddenly stops in a configuration [*Konstellation*] pregnant with tensions, it gives that configuration a shock, by which it crystallises into a monad. A historical materialist approaches a subject only where he encounters it as a monad. In this structure he recognises the sign of a Messianic cessation [*Stillstellung*] of happening, or, put differently, a revolutionary chance in the fight for the oppressed past. He takes cognisance of it in order to blast a specific era out of the homogeneous course of history—blasting a specific life out of the era, or a specific work out of the lifework.[1]

This startling passage from Walter Benjamin's 'Theses on the Philosophy of History', the last piece he wrote (1940), can be regarded as a memorandum for the work he never achieved. With the invocation of cessation, Benjamin formulates not his methodology but its criterion: that by which the work is translated into a task; a criterion, moreover, which makes clear what he felt was at stake. The burden of methodology falls on *Konstellation*, making it more than a mere metaphor. Indeed, the very object of historiography, here named 'monad', is precipitated from the constellation and not otherwise.

In a different formulation, from a draft found among Benjamin's materials for the Arcades Project in the folder labelled 'On the Theory of Knowledge, Theory of Progress', monad is substituted by the term 'dialectical image', a notion apparently elaborated during conversations between Benjamin and Theodor W. Adorno in 1929.[2]

> The immobilisation of thought is as much a part of thinking as its movement. When thought comes to a standstill in a constellation [*Konstellation*] saturated with tensions, there appears the dialectical image. It is the caesura [*Zäsur*] in the movement of thought. Its place is certainly not arbitrary. In a word, one must seek out where the tension between dialectical opposites is the greatest. The object thus constructed in the materialist presentation of history is therefore the dialectical image. This is identical with the historical object; it is the justification of its being blasted from the continuum of history.[3]

1 Walter Benjamin, 'Theses on the Philosophy of History', in *Illuminations*, ed. by Hannah Arendt, trans. by Harry Zohn (New York: Schocken Books, 1968), p. 262–263. See **Appendix A**: original texts of translations from the German cited in Part I.

2 See Rolf Tiedemann, 'Dialectics at a Standstill', trans. by Gary Smith and André Lefevere in *On Walter Benjamin: critical essays and recollections*, ed. by Gary Smith (Cambridge MA and London: MIT Press, 1988), pp. 132–33 and Susan Buck-Morss, *The Origin of Negative Dialectics* (New York: Macmillan Free Press, 1977), p. 22.

3 Modified translation, cf. Walter Benjamin, *Arcades Project*, ed. by Rolf Tiedemann, trans. by Howard Eiland and Kevin McLaughlin (Cambridge, MA and London: Belknap Press/Harvard University Press, 1999) p. 494.

The present essay interrogates the idea of constellation as it emerges from Benjamin's and Adorno's works and the correspondence between them. It aims to show how terms such as monad and dialectical image, whose meaning is no more easily given than that of constellation, came to be arranged about it, and how they might reflect upon one another.

Such an investigation, which takes aim at methodology, can hardly avoid reflexivity. In adapting to its topic, it puts it to the test, posing the question of the feasibility of a demonstration. However, in so far as I adopt a philological approach and I am willing to tell a story, I also (to borrow a phrase from Benjamin) brush my topic against the grain. In this case, philology is the scruple which checks any rush towards an easy ending to the story.

Given the role constellation plays in a polemic against positivistic descriptions (against the non-theory of 'universal history'), understanding the term the way Benjamin and Adorno use it, it is likely to elude positive definition. My attempt to trace the modalities of the term historically can be expected to elucidate various implications of the proposition (or rather, the varying set of propositions and hints), including its vagaries and inconsistencies. If that falls short of a positive, inductive or normalising definition, it will have to show whether the concept of constellation itself suggests a different epistemological model and how this could be valid. However, I do not privilege the idea with a mysterious or mystical status, as if it were a magic formula. Nor do I take the notion of constellation as self-evident, even though it has been widely accepted as such.

The casual use of the word constellation, that is, outside a specifically theoretical context (in personal letters, for example) by Benjamin and Adorno attests to its currency as a metaphor in common language. The common usage of constellation, its seeming naturalness, masks a fund of sedimented meanings. In the literature on Benjamin and Adorno, the associative potential of constellation has prompted, and the common usage appeared to authorise, various elaborations on the metaphor and uncritical glosses, but the topic has seldom been treated specifically.[4]

The term constellation enjoyed a brief vogue in psychology, where, broadly speaking, it was meant to suggest a way of understanding an individual's state taken in relation to a pattern of influences rather than as a result of a concatenation of causes, and how these influences might be grouped associatively, either in the mind of the individual or in theory. However, probably because of its wealth of possible associations (and perhaps because it found easy acceptance in common language) it was discarded by a discipline that modelled

4 For example, Buck-Morss (*The Origin of Negative Dialectics,* pp. 90–110) and Simon Jarvis (*Adorno: a critical introduction*, Cambridge: Polity Press, 1998, p.175–179) do take it up as a headline theme. Shierry Weber Nicholsen (*Exact Imagination, Late Work, on Adorno's aesthetics*, Cambridge, MA and London: MIT Press, 1997) and Fredric Jameson (*Late Marxism, Adorno or the persistence of the dialectic*, London and New York: Verso, 1990) discuss it in the general context of literary *Darstellung* or presentational form. Buck-Morss however allows an unreflected common image of constellation to distort a valuable analysis: 'The role of the subject, to draw connections between the phenomenal elements, was not unlike that of the astrologer who perceived figures in the heavens.' (p. 92). This evokes a picture that Jameson also seems to have in mind: '*Darstellung* will consist in tracing the constellation, in somehow drawing the lines between the empirical concepts thus "configured" together' (p. 54). This image—connecting or joining points with lines—does not seem to figure in Benjamin's or Adorno's repertoire, although it is suggested by a way of drawing constellations on star maps which became prevalent in the twentieth century. I treat the graphic forms of constellation in detail in Part II.

its theory on the positive sciences and required its technical terms to yield to clear definition. Doubtless the connection of constellation with astrology was too close at a time when psychology was anxious to prove its scientific credentials.

Benjamin and Adorno were aware of the more than academic interest that astrology and the like attracted in intellectual circles in the period between the two World Wars. The trend towards affirmation of the irrational which found its academic expression in the reception of writers such as Kierkegaard, Heidegger, Jung and Klages[5] had its counterpart in the popular reception of spiritualism, magic, the occult and pseudo-religious doctrines such as theosophy and anthroposophy. These movements by no means excluded the intellectual classes and indeed gained adherents among prominent modernists as well as those for whom such beliefs expressed an unequivocal reaction to modernity. Benjamin and Adorno regarded these trends with a sense of alarm which combined philosophical, sociological and political concerns. Their correspondence documents the need they felt to differentiate and defend their project from the epistemological traps set, for example, by Jung or by Surrealism.

The danger appeared more acute the closer Benjamin's and Adorno's own critique of rationality brought them to dealing with the categories espoused by their opponents and the more obviously these categories were seen to be appropriated by political forces. Benjamin and Adorno saw the intellectual and popular sympathy for the archaic, myth and magic as one with the rise of Fascism and National Socialism. However, the theoretical showdown they seem to anticipate in the letters never really happened. Perhaps it seemed futile as the full horror of the Nazi era unfolded. Adorno's book on Kierkegaard (written 1929–30, revised 1932) was published on the day the Reichstag was burned and Hitler, assuming dictatorial powers, suspended the freedom of the press. According to Hullot-Kentor, the first draft of *Kierkegaard* contained a major section 'Excursus on Constellation' which was cut in Adorno's revision of the text for its publication. The short section entitled '"Constellation"' which remains in chapter five of the book[6] deals with a concept of constellation from which Adorno protects himself by placing it in inverted commas. He accuses Kierkegaard of collapsing the 'starry heavens' into the 'blind self', surrendering the subject to abstract universal concepts as to astrological fate; of offering constellations as mythical and ineluctable determinants.[7] *The Dialectic of Enlightenment* written by Adorno with Max Horkheimer during the war suggests a diagnosis of the phenomena of Fascism as integral to the body of bourgeois culture, but does not engage in specific polemics against the writers they might have accused of lending intellectual support to Nazism in the 1920s and 30s. In any case, in this book, the authors

5 To name only those who figured most prominently for Benjamin and Adorno: Søren Kierkegaard (1813–1855), Ludwig Klages (1872–1956), Carl Gustav Jung (1875–1961), Martin Heidegger (1889–1976).

6 Theodor W. Adorno, *Kierkegaard: Construction of the Aesthetic*, ed. and trans. by Robert Hullot-Kentor (Minneapolis: University of Minnesota Press, 1989), pp. 91–92.

7 Adorno's attack on Heidegger and German Existentialism in *Jargon der Eigentlichkeit: zur deutschen Ideologie* (*The Jargon of Authenticity,* 1964), in a way takes up unfinished business of Benjamin's from as early as 1930 (see *The Correspondence of Walter Benjamin 1910–1940*, ed. by Gershom Scholem and Theodor W. Adorno, trans. by Manfred R. and Evelyn M. Jacobson (Chicago and London: University of Chicago Press, 1994), pp. 359–360, 365).

already set their sights beyond the European situation. Adorno's 'Theses against Occultism', written in 1947 for his 'reflections from damaged life', express a vehement hostility to all forms of occultism as the 'rationally exploited reaction to rationalised society'[8] and echo the critique Benjamin had offered much earlier in a book review. In an article occasioned by the publication of *The Occult Sciences in the Light of Our Age* (1932) Benjamin argued that spiritualism and the like were not so much the antithesis of European humanism but the products of its dissolution—products which, furthermore, usurped and debilitated what humanist education had previously defended. Benjamin saw the damage done to knowledge by occultism reflected in the techniques of capitalism, 'both of which,' he wrote, 'profited from the collapse of general education':

> [Advertising] has mastered the art of transforming the commodity into an arcanum, [occultism] is able to sell the arcanum as a commodity.[9]

Adorno's theses point out the parallel with Fascism (whereas Benjamin had left it up to the reader to make the connection) but, in the context of *Minima Moralia*, they are adapted to the aftermath of the World War in which the totalitarian aspects of capitalism as he found it in the United States were no less apparent than those of the Communist Bloc, as they faced one another under the threat of total destruction. In an era which saw to the systematic eradication of genuine subjectivity, 'The real absurdity,' he wrote, 'is reproduced in the astrological hocus-pocus, which adduces the impenetrable connections of alienated elements—nothing more alien than the stars—as knowledge about the subject.'[10] Adorno later returned to this topic at length in his sociological analysis of the *Los Angeles Times* astrology column as a case study in the ideological critique of the authoritarian personality and the culture industry. 'The Stars Down to Earth' offers a précis or microcosm of the dialectic of enlightenment. In the astrologist's anxiety to present his practice as a science and thus lay claim to the 'ultimate, absolute truth' which ideology attributes to science, 'Auguste Comte's postulate that positivism should become a kind of religion is fulfilled ironically [...] extreme empiricism, teaching absolute obedience of the mind to given data, "facts", has no principle such as the idea of reason, by which to distinguish the possible from the impossible and thus the development of enlightenment overreaches itself and produces a mentality often no longer able to resist mythological temptations.'[11]

A dialectical approach is sensitive to what happens when astrology assumes the authority of science and can locate its irrationality precisely in the spurious correlation of external

8 Theodor W. Adorno, *Minima Moralia: reflections from damaged life*, trans. by E. F. N. Jephcott (London: NLB, 1974), p. 239.
9 Walter Benjamin, 'Light from Obscurantists', in *Selected Writings Volume II 1927–1934*, ed. by Michael W. Jennings, Howard Eiland and Gary Smith, trans. by Rodney Livingstone et al (Cambridge, MA and London: Belknap Press/Harvard University Press, 1999), p. 656.
10 *Minima Moralia*, p. 241.
11 Theodor W. Adorno, 'The Stars Down to Earth' in *The Stars Down to Earth and other essays on the irrational in culture*, ed. by Stephen Crook, (London: Routledge & Kegan Paul, 1994), pp. 116–117.

data (the positions of the stars are not in dispute) with the psychological needs of its clients (no less real and possibly more urgently in need of interpretation). The travesty of reason, that is, mere correlation as the masquerade of reason—not the stars—betrays the individual to alienated reality as if to ineluctable fate. A dialectical approach is also capable of acknowledging that astrology presents models of rationality and of interpretation that continue to operate in the modern humanities and continue to provoke the ambivalence that exercised the philosophy (or self-justifications) of astrology in relation on the one hand to science and on the other hand to religion. For example: the existence of psychology (or, for that matter, astronomy) as a separate discipline from astrology is the result of a process of emancipation (and, as Adorno would point out, the division of labour). In its time, astrology had the answers to the questions we would now ask of psychology and provided authoritative counsel on the basis of the disposition of the stars and planets at a given moment (of an individual's birth, for instance). Modern psychology appeals to the rationality of astrology; in other words, it models itself on astrology's explanatory, interpretative power, its ability to reconcile the universal and the historical, but, whereas astrology had its ruses to excuse its failure to live up to its own promise or to avoid accusations of heresy, the ambivalence of psychology towards determinism is not so easily resolved. Because, determinism remains the tendency of the theory even though the individual—the subject of psychology—was constructed by the Enlightenment as the subject of its struggle *against* determinism. In this way psychology shares with astrology the paradox that the more deterministic the theory and hence the more authoritative the interpretation, then the more futile-seeming it renders the possibility of change. Consequently, a method such as psychoanalysis has a model of enlightenment built into it in so far as the therapeutic process is intended to dispel for the individual the powers that the theory itself constructs mythologically. Philosophy faces a similar challenge as long as it has not given up its aim not just to interpret the world but to change it.

Taking constellation seriously raises the question of why Benjamin and Adorno should have adopted a term apparently so compromised.

■

The ambiguity with which constellation first makes its appearance in Benjamin's theory is quickly absorbed and, I would argue, carried throughout its elaboration by Benjamin and Adorno, jointly and severally. Benjamin writes in the introduction to his study on German tragic drama, 'Ideas are to objects as constellations [*Sternbilder*] are to stars.'[12]

*Sternbild*, literally: star-picture, offers (fleetingly) a clear analogy. The German term refers to the conventional star signs, the traditionally accepted groups of bright stars which are recognised in the night sky and provided with figurative associations. The English term with

12 Walter Benjamin, *The Origin of German Tragic Drama*, trans. by John Osborne (London and New York: NLB, 1977), p. 34. Further page references in brackets in the text.

the same specific meaning as *Sternbild*, although a more technical usage, is asterism. Even we who no longer make use of the stars as a calendar or chronometer, or for navigation, have learned at least a few of the most prominent constellations and though we may not know how to point them out in the night sky, we are all familiar with the signs of the Zodiac whose configurations measure the annual path of the sun among the fixed stars. The star map populated with 'men and monsters' in their antique embodiments or modern attenuated forms is an abiding fixture of visual culture.

*Konstellation*, which Benjamin introduces a few lines later, like the English constellation, can be synonymous with *Sternbild*, but also carries a different burden, namely, the astrological sense of constellation, meaning the total configuration of the heavens at a given moment for a given subject. The horoscope requires a matrix in which the instantaneous positions of the 'wandering' stars can be plotted. The system of asterisms plays an important role in articulating a cosmological structure as a screen upon which its axes can be projected and calibrated, and transient phenomena recorded.

Both terms reach into long traditions whose epistemological implications would reveal considerable complexity under close scrutiny, although, in Benjamin's present context (especially, perhaps, that of a book on seventeenth-century allegorical drama) their weight as figures of speech is assured. The interdependency of the two senses of *Konstellation* (that the horoscope makes no sense except in a field of signs)—sealed by the double meaning of the word—hints at complementary historical aspects. The configuration of fixed stars is static and implies duration, but the life of the sign is a historical matter and is by no means fixed. The horoscope is dynamic, but implies the arrest of time in an instant which interrupts history and, according to the tradition, forms a configuration capable of interpretation, if not actually of determining power.

The 'Epistemo-critical Prologue' to the *Trauerspiel* study aims to establish the history of literature (as it were, Benjamin's particular branch of archaeology) as a philosophical project. Benjamin maintains that as long as the task which the philosopher shares with the artist is the 'task of representation' (32), then philosophy's truth cannot divorced from its methodology, its forms of representation. Benjamin's notion of representation distances philosophy from the natural sciences on the one hand, which amass the objects of knowledge under conceptual systems and on the other hand from abstract universal systems such as mathematics.

> The more clearly mathematics demonstrate that the total elimination of the problem of representation—which is boasted by every proper didactic system—is the sign of genuine knowledge, the more conclusively does it reveal its renunciation of that area of truth towards which language is directed. (27)

The idea of the 'truth towards which language is directed' and to which philosophy and art share a commitment was sketched in his 1916 essay 'On Language as such and the

Language of Man' to which Benjamin seems to allude in the dedication of the *Trauerspiel* book ('Conceived 1916 Written 1925').[13] It reappears in the *Trauerspiel* prologue in the orientation of Benjamin's notion of representation towards mimesis, a renewal of an originary act of naming in which 'Ideas are displayed, without intention' (37).

The notion of *intentionlessness* is suggested in 'On Language as such and the Language of Man' in so far as this mystical (and certainly difficult) theory asserts that, at least in the paradisical state, the word is no '*mere* sign',[14] whose relationship with its object is accidental or conventional. Naming, in which man (Adam) echoes in knowledge what God's creative word called into being, is the translation of the mute language of things into that of man. The idea of the language of things was important for Benjamin because it underlined the distinction he wanted to make between what is communicated *in* language—immediately, without intention—and what is communicated *through* language—conventionally. In this unpublished essay, Benjamin reminded himself, 'For an understanding of artistic forms,' which was his chief ambition, rather than language theory as such, 'it is of value to attempt to grasp them all as languages and to seek their connection with natural languages.'[15] Benjamin's effort to carry out this aim is one of the distinguishing features of his output throughout his career and perhaps what links his early, theologically oriented work with what he later produced under a different, apparently incompatible, theoretical star.

Intentionlessness acquired a particular weight in Benjamin's and, later, Adorno's theory as it gathered connotations which contrasted it not only with conventional (arbitrary) signification, allegory or symbolism, but also with a sense of the inadequacy of the concepts of knowledge, with Husserl's 'intentional objects' (in which Adorno saw the ghost of idealism) and with commodification—as it became aligned with 'non-identity', with Freudian notions of the unconscious (the interpretation of 'slips') and the Proustian *mémoire involontaire*.

'Truth is the death of intention,' writes Benjamin (36). If philosophy is to be the representation of truth, then it is truth which sets the standard for the method that distinguishes philosophical representation from any particular science which would lay out its possessions (knowledge) according to its own conceptual systems and categories. 'If representation is to stake its claim as the real methodology of the philosophical treatise, then it must be the representation of ideas' (29). Ideas, because the 'self-representation' of truth 'does not derive from a coherence established in the consciousness, but from an essence' (30). Hence, Benjamin invokes the Platonic theory of ideas as a kind of *Ur*-philosophy, albeit in a far from conventional way. He attributes a 'representational impulse' (31) to truth and (despite Plato) points the theory of ideas back towards phenomena by citing the *Symposium* where truth is identified with beauty and associated with desire. He thus emphasises the aesthetic over the ideal, devising a myth in which only Eros, the lover of truth, 'can bear witness to the fact that

13 As suggested by George Steiner in his introduction to the English edition. Two other essays of 1916 were important for the book: '*Trauerspiel* and Tragedy' and 'The Role of Language in *Trauerspiel* and Tragedy'.
14 Walter Benjamin, 'On Language as Such and on the Language of Man', in *One-Way Street and Other Writings*, trans. by Edmund Jephcott and Kingsley Shorter (London: NLB, 1979) p. 117.
15 'On Language', p. 122.

truth is not a process of exposure which destroys the secret, but a revelation which does justice to it' (31). In other words, the representation of ideas is not the disclosure of something which lies behind or beyond empirical reality, but the revelation in which phenomena are gathered and redeemed.

The representation of ideas may also be said to justify, if not to redeem, the concepts of organised knowledge, whose very splitting function (analysing things into constituent elements) enables 'phenomena to participate in the existence of ideas.' The same function fits the concepts for their mediating role in representation. Indeed, the redemption of phenomena and the representation of ideas are one and the same. Concepts, moreover, locate the subject in the process. They give the conceptualising subject a job to do. 'For,' Benjamin says, 'ideas are not represented in themselves, but solely and exclusively in an arrangement of concrete elements in the concept: as the configuration of these elements' (34).

The configuration is the actuality of the idea, mediated by the subject, while the idea is the 'objective virtual arrangement, [the] objective interpretation' (34) of phenomena. In contrast to Plato's ideas, the transcendental forms of whose eternal truth empirical phenomena were only the shadowy reflections, Benjamin's ideas construct 'the absolute from out of the empirical fragments themselves,' as Buck-Morss puts it.[16] This raises the question of *how* ideas relate to phenomena; and this is where Benjamin introduces the analogy with constellation that I cited already.

In his methodological reflections Benjamin tends to entwine the theoretical with the technical, that is: the style of literary presentation. Although there is, of course, a polemical point to it, this is one of the characteristics which can make Benjamin's writing difficult. In the opening paragraph of the *Trauerspiel* prologue, Benjamin praised the esoteric essay or treatise as the proper form for his philosophical ambitions. He made an analogy between the treatise and a mosaic in order to compare the digressive character of the former, its 'continual pausing for breath', starting over and 'returning in a roundabout way to its original object' (28) with the structure of the mosaic whose brilliance depends as much on the quality of the individual fragments of which it is made as on the overall design. Moreover, Benjamin holds, 'The value of fragments of thought is all the greater the less their direct relationship to the underlying idea (29). The mediaeval origins Benjamin claims for the treatise-mosaic suffice to underline its didactic theological orientation and its distance from the systematic, or systematising approach which absorbed later philosophy. Benjamin thus combines an image and a literary exemplar in setting the agenda for his own effort. The invocation of 'arrangement', the 'configuration' of concrete elements in the concept, reprises the theme in abstract philosophical terms. *Sternbild* introduces a model of signifying practice. The constellation analogy brings with it suitably primordial connotations and motivates a rhetorical-poetic pattern of references connected with classical astronomy which links the 'salvation of phenomena' (the assumed task of celestial mechanics from Ptolemy to Copernicus—perhaps

16 *The Origin of Negative Dialectics*, p. 92.

only ironically related to Benjamin's meaning) with an analogy he makes referring to the 'harmony of the spheres' and the 'orbits of the stars' (37). The constellation metaphor is, as it were, an advance on the treatise, the mosaic and the elements gleaned from the work of the concept in so far as it appears to remove the substratum: the text which holds the caesura, the cement which binds the brilliant fragments of a mosaic, or the system which relates concepts. But Benjamin does not attempt to theorise constellation and so leaves his metaphor for the relationship between ideas and objects as obscure as it is vivid. The image suggested by *Sternbild* and reinforced by the assertion, 'Ideas are timeless constellations' (34) is, in its way, precise, but is hardly explanatory. The seeming unequivocality it gets from the constellations' long cultural pedigree (in so far as the constellations are a sign of civilisation, their history is co-extensive with culture) and Benjamin's own association of them with the Platonic ideas could be deceptive. At the point where Benjamin introduces it, the constellation metaphor does little more than assert the possibility of a relationship between the discrete particulars of empirical reality and a linguistic act that releases their significance.

For Benjamin, the essence of constellation is discontinuity. It is not the joining of fragments—although fragmentariness might be a quality of its components and a feature of the literary style of representation. The components of a Benjaminian constellation-idea, that is, the remains of historical objects mediated by concepts, are not reconciled or repaired: they are redeemed. They are assumed into the unity of truth rather than subsumed by the coherence of a system. The image of constellation is allowed, as it were, to colour the explanation Benjamin then offers of the 'structure or truth' (36) and of the linguistic character of ideas in terms of the Adamic theory of language he had first outlined in 1916.

Pursuing his theme of discontinuity, it follows, for Benjamin, that 'ideas subscribe to the law which states: all essences exist in complete and immaculate independence, not only from phenomena, but, especially, from each other'[17] and 'The harmonious relationship between such essences is what constitutes truth' (37). How this doctrine follows in Benjamin's 'and so' is somewhat obscured by the convoluted negotiations he enacts between theology (which grounded his language theory) and philosophy (which supplies the present terms of reference). Nonetheless, the cosmology of ideas that Benjamin introduces here anticipates the invocation—or rather, appropriation—of monadology he makes a little later in the *Trauerspiel* prologue. To be sure, Benjamin's use of the term connected with the name of Leibniz is no less idiosyncratic than the theory of ideas he introduced in Plato's name. Benjamin underlines the theme of discontinuity with the remark that 'it is not surprising that the philosopher of the *Monadology* was also the founder of infinitesimal calculus' (48)—the method which interprets continuous variables as a series of discrete, infinitesimal differences. The notion of monadological structure (with Leibniz in mind) has something to say about the world of ideas and the unity of truth, but, in fact, no more than Benjamin has

17 This is the astronomical analogy: 'Just as the harmony of the spheres depends on the orbits of the stars which do not come into contact with each other, so the existence of the *mundus intelligibilis* depends on the unbridgeable distance between pure essences.'

already said without Leibniz's aid. However, the assertion, 'The idea is a monad,' (48) seems, at least at first glance, hard to reconcile with the idea characterised as a timeless constellation.

How can the idea be at the same time a constellation (a configuration or arrangement of discrete things) and a simple, original and indivisible substance (as monad would imply)? Benjamin seems to rely on the paradoxical nature of the monad as it was elaborated by Leibniz, but he does not make a point of it. For us to attempt to reconcile Benjamin's use of the term with the *Monadology* would soon run into difficulties. While Benjamin accepts aspects of Leibniz's speculation, he does not necessarily subscribe to Leibniz's motives. Benjamin's metaphysics is likely to illuminate the obscurer passages of Leibniz sooner than the other way round. For example, perhaps, where Leibniz says:

> There must be in the simple substance a plurality of affections and relations, although it has no parts.
>
> The passing state, which involves and represents a multitude in unity [...] is nothing else than what is called *perception*. [...] Here it is that the Cartesians especially failed, having taken no account of perceptions of which we are not conscious.[18]

Nonetheless, Leibniz provides the notion of the monad as a 'perpetual living mirror of the universe,'[19] 'its present [...] big with its future,'[20] and as the 'origin' of 'perception':

> And as the same city looked at from different sides appears entirely different, and is as if multiplied *perspectively*; so it happens that, as a result if the infinite multitude of simple substances, there are as it were so many different universes, which are nevertheless only the perspectives of a single one, according to the different *points of view* of each monad.[21]

Benjamin states baldly: 'The idea is a monad—that means briefly: every idea contains an image of the world' (48). Thus monad seems to suggest a meaning which was latent in the word if not the image Benjamin evoked earlier. Even as it appears to depart from *Sternbild*, the monad converges with *Konstellation*. That is, with the astrological sense of constellation, meaning the total configuration of the heavens at a given moment for a given subject. In this constellation the cosmos converges in the individual and belongs to it. The objective universe is concentrated in the subject. This is the tradition that postulates the correlation between macrocosm (the universe) and microcosm (man).

The double meaning of constellation as it is played out in Benjamin's theory of ideas does not seem to have detained most scholars of Benjamin's work, for whom constellation, in its vagueness, has sufficed to justify a paratactical style of literary presentation, and for whom

18 Gottfried Willhelm von Leibniz, 'The Monadology', in *Selections*, ed. by Philip P. Wiener (New York: Charles Scribner's Sons, 1951), §§ 13–14.
19 'The Monadology', § 56.
20 'The Monadology', § 22.
21 'The Monadology', § 57.

monad, as synecdoche by another name, has justified reading the whole from a part or fragment. Admittedly, Benjamin has provided a multitude of other, probably more interesting, topics for scholarly investigation and controversy.

Because the *Trauerspiel* book deals with explicitly allegorical works and sets itself the task of redemption as the goal of philosophical interpretation, it has been suggested that Benjamin attempted thereby to '"redeem" allegory theoretically'[22] with implication that Benjamin, the critic and philosopher, writes as an allegorist. One could argue that Benjamin's theory of representation suggests, as it were, allegory in a state of redemption. This would be one way of emphasising the distance which separates the kind of representation Benjamin has in mind from the allegorical forms which dominate the seventeenth-century texts he is reading. Benjamin offers a dialectical interpretation of literature and, implicitly, a revaluation of allegory against the prevailing classical or romantic views. In so far as Benjamin argues that the outdated and neglected form of the Baroque play of lamentation might regain contemporary significance, he might have been trying to restore its academic reputation (as well as establish his own—an attempt which failed completely), but to call Benjamin's approach allegorical, or his aim the redemption or revival of allegorical techniques,[23] is to deny it the ambitions Benjamin is at pains to establish in the prologue. Certainly, these are ambitions which, in so far as they concern the theory of representation, find reflection in Benjamin's in-depth discussion of allegory, from which he derives important and influential insights, for example, on the dialectic of nature and history and the theory of melancholy. Nonetheless, the idea-constellation-monad may be said to function in Benjamin's text almost as an emblem for a double resistance. On the one hand, it resists the total fungibility of the sign which could leave one in thrall to objects as a character in an allegorical drama is to the stage properties that foretell his death (the trivial objects which haunt the protagonist like Fates). On the other hand it resists the presumption of a hidden and inexpressible reality beyond the object (as supposedly embodied by the mystical or theological symbol). Benjamin's book is testament to the fragility of the project.

■

Adorno's inaugural lecture as an academic philosopher (Frankfurt, 1931) represents a public affirmation of his engagement with Benjamin's thought in the preceding years. In the speech which amounts to his philosophical manifesto, Adorno does not mention his mentor by name. The debt to Benjamin was to have been acknowledged in the printed version, but it was not published in Benjamin's or Adorno's lifetime. However, what Adorno owed to Benjamin could hardly be acknowledged in a dedication or a footnote. Instead, it was repaid (with interest, one may say) throughout Adorno's text, and indeed throughout his career.

22 Susan Buck-Morss, *The Dialectics of Seeing* (Cambridge, MA and London: MIT Press, 1989), p. 18.
23 *The Dialectics of Seeing*, p. 170.

'The Actuality of Philosophy' aligns the epistemological models and theory of representation that Benjamin had placed at the outset of the *Trauerspiel* study with a historical materialist agenda. Adorno's readiness to engage in philosophical polemics and his facility in articulating in philosophical language concepts that in Benjamin remain locked in an almost hermetic literary style do not simply translate Benjamin's ideas, but absorb and extend them.

The speech asserts the particularity with which every era must come to terms with the inadequacies of philosophy. The actuality of philosophy is not to be regarded as the latest item in an inventory or progress, but rather the result of a process of decay through which philosophy's big questions—the meaning of being, the concept of reality, the adequacy of *autonome ratio*, in short, it's 'pretensions to totality'[24]—are exposed as symbolic functions whose 'archaic dignity' (120) merely masks their vacuity. Adorno warns, on the one hand of the helplessness of ontology (though it would claim for philosophy jurisdiction over being), and, on the other hand, of the prospect of philosophy being displaced entirely by the natural sciences and their formal apparatus (though logical positivism would claim the archaic prerogative of regulating the sciences). Like Benjamin, Adorno denies that the objects of knowledge, whether they are delivered by the empirical sciences or simply 'ready at hand', are identical with truth.

> Plainly put: the idea of science is research; that of philosophy is interpretation. In this remains the great, perhaps the everlasting paradox: philosophy persistently and with the claim of truth, must proceed interpretively without ever possessing a sure key to interpretation; nothing more is given to it than fleeting, disappearing traces within the riddle figures of that which exists and their astonishing entwinings. (126)

Without the constraints imposed by a literary-historical thesis, Adorno is free to develop the implications of Benjamin's epistemology and the idea of interpretation for the programme of an 'authentically materialist knowledge' (127). The 'text' which philosophy is given to interpret is 'incomplete, contradictory and fragmentary,' for 'while our images of perceived reality may very well be *Gestalten*, the world in which we live is constituted differently than out of mere images of perception' (126).

On the 'riddle figures of that which exists and their astonishing entwinings' Adorno adds, 'The history of philosophy is nothing other than the history of such entwinings' (126) thus pointing to how he conceived his own philosophical *métier* in the form of immanent critique, that is, critique from out of the historical 'material' of philosophy itself as much as from any other conceptual construction of reality (empirical, social, economic, ideological, mythical and so on). Philosophy, Adorno says, 'must always begin anew and therefore cannot do without the least thread which earlier times have spun, and through which the lineature

24 Theodor W. Adorno, 'The Actuality of Philosophy', in *Telos*, 31 (1977), p. 120. Further page references in brackets in the text.

is perhaps completed which could transform the ciphers into a text' (126).

Interpretation should not, Adorno says, be confused with the problem of meaning. Nor should philosophy 'portray reality as "meaningful" and thereby justify it' (126). Instead, the point of interpretation is to do justice to reality by illuminating 'intentionless' truth. Following Benjamin, though with a sceptical gesture towards the Platonic ideas (which in their customary form he attributes to a by-product of Kantian dualism), Adorno denies that interpretation is supposed to reveal a second, secret world behind appearances. For him, interpretation is a kind of riddle-solving where the illumination of the answer negates and consumes the question itself. This illumination is sudden and momentary, 'like lightning'.

> Just as riddle-solving is constituted, in that the singular and dispersed elements of the question are brought into various groupings long enough for them to close together in a figure out of which the solution springs forth, while the question disappears—so philosophy has to bring its elements, which it receives from the sciences, into changing constellations [*Konstellationen*]. (127)

Circumspection is provided by his adding a paraphrase: 'or, to say it with less astrological and scientifically more correct expression, into changing trial combinations' although his tone appears just as circumspect about scientific correctness.

Clearly, the 'changing constellations' represent a departure from the 'timeless' ones of Benjamin's earlier text (and might be just as hard to reconcile with Benjamin's monads). Adorno's use of constellation seems to combine elements of both the aspects I discussed in connection the *Trauerspiel* prologue, along with borrowings from a more commonplace sense of the word such as had furnished psychology with a useful metaphor (if not a technical term).

The image of the flashing, instantaneous illumination that Adorno emphasises (without really explaining) could be understood as pointing towards the astrological constellation, the momentary (indeed, momentous) formation of a set of transient relationships between celestial phenomena. Yet Adorno's constellation also has the air of a formal procedure, which brings about a *Gestalt*, and hence points back towards *Sternbild*. The procedure—and this is where Adorno makes explicit what was veiled in Benjamin's *Trauerspiel* version—is one of *construction*: 'the task of philosophy is [...] to interpret unintentional reality [...] by the power of constructing figures or images, out of the isolated elements of reality' (127). Adorno places the Benjaminian ideas, which in the *Trauerspiel* book still invoked the authority of philosophical tradition, in opposition to that tradition:

> the function which the traditional philosophical inquiry expected from meta-historical, symbolically meaningful ideas is accomplished by inner-historically constituted non-symbolic ones. [...] the historical images would be [...] themselves ideas, the configuration of which constituted unintentional truth. (128)

What was undecided in Benjamin—*Sternbild* or *Konstellation*—emerges in Adorno as a double contradiction when the tendency of *Konstellation* towards determinism (which he had criticised in his *Kierkegaard*) and the tendency of *Sternbild* towards 'mere' semiotics are brought face to face with praxis. This contradiction was a difficulty for Adorno, which in 'The Actuality of Philosophy' he appears to cover by his invocation, almost as a talisman that would work to co-opt the power of the contradiction, of the *dialectic*. Adorno claims that 'The interpretation of given reality and its abolition are connected to each other, not, of course, in the sense that reality is negated in the concept', for it is only the riddle that is abolished in the constellation of elements mediated conceptually, 'but that out of the construction of a configuration [*Figur*] of reality the demand for its [reality's] real change always follows promptly' (129). Here the materialist dialectic is supposed to guarantee the translation to praxis because this mode of thought is capable of negating itself in the moment that the answer flashes forth from the constellation of historical objects and the question is consumed. The lightning flash is all there is to relate the static qualities of construction with the dynamic of history. The formal aspect of the procedure (as a function of human reason) is needed to obviate the predetermination which would otherwise undercut the possibility of change:

> The historical images [...] do not lie organically ready in history [...] They are not sent magically by the gods to be taken in and venerated. Rather, they must be produced by human beings and are legitimated in the last analysis alone by the fact that reality crystallises about them in striking conclusiveness. (131)

Here Adorno aims to protect his theory from the blind immediacy of being and from mythic archetypes. The dialectic must provide the way back for illumination to enter history. For this to succeed, a materialist discipline is required to maintain the arrangement—the invention or the fantasy, as Adorno variously expresses it—of the constellation exactly within the orbit of its material elements.

There is something tentative about Adorno's approach, his polemical fervour notwithstanding, and this is carried through in his characterisation of the manipulation of conceptual material by philosophy, speaking 'purposely of grouping and trial arrangement, of constellation and construction' (131). He is all too keenly aware of the immanent impossibility of developing in 'completeness and generality' the programme he has just set forth. His utopianism eschews the ideal, and like Benjamin's, points to the possibility of redemption. In Adorno, the lightning flash insists on this possibility out of the darkness of its unlikelihood. Uncomfortable as Adorno was with any kind of positive utopianism, even this appears somewhat anomalous. Adorno returned to this point in an unpublished note, cited by Rolf Tiedemann, composed while he was editing Benjamin's *Schriften* in 1955. Tiedemann suggests that Adorno did not include the comment in his introduction to Benjamin's writings because he could not be sure that it did not represent his own version of the dialectical image instead of his friend's.

> [Dialectical] images are not unmediated intuitions, but rather emerge from constellations of concepts, and presuppose thinking labour—namely, expanded theory—: these are the constructions out of concepts. The utopian effort of this method, which amounts to the utopian goal of Benjamin's philosophy, simultaneously fixes the impossibility of its completion: the fragmentary character is the irrevocable price that Benjamin's philosophy must pay for its refusal to leave off from the absolute.[25]

Though, as this instance suggests, one should be cautious about reading Benjamin through Adorno, it could be argued that 'The Actuality of Philosophy,' reflects much of the change in Benjamin's thought in the late 1920s, in particular the orientation of his work towards dialectical materialism. This turn, and his growing sympathy with marxist political aspirations, had begun before he had finished work on the *Trauerspiel* book and is attributed to the impact of reading and, perhaps more importantly, of his personal associations (for example, his relationship with Asja Lacis who influenced him to visit Moscow at the end of 1926 and who introduced him to Berthold Brecht in 1929, the start of an important friendship), as well as the realisation of his own social position as a freelance writer. His renewed contacts with Adorno in this period resulted in an intense exchange of ideas and the conversations during which they came to feel that theirs was a shared philosophical project.[26]

■

Benjamin wrote in 1931 of his *Trauerspiel* study, 'This book, of course was certainly not materialistic, even if it was dialectical.'[27] It was a frequent point of reference in the 1930s, especially in connection with the methodological reflections associated with Benjamin's work on the Paris arcades that he had begun in 1927 as an essay and which ended up as his unfinished *magnum opus*. Although, as Benjamin wrote in 1935, 'the analogies between this book [the Acades Project] and my baroque [*Trauerspiel*] book become apparent much more clearly',[28] the one by no means flowed into the other. The caesura between them, rather than the transition, could be represented by another work.

*One-Way Street* is a collection of fragmentary observations, dreams and aphoristic miniature essays presented under the signs of urban phenomena, indeed, under the phenomena of urban signs: 'This Space for Rent', 'Office Equipment', 'Mixed Cargo: Shipping and Packing', 'Closed for Alterations', as one finds opening the book at random as one might emerge from a subway in an unfamiliar town. *One-Way Street* was begun concurrently with the *Trauerspiel*

25 Rolf Tiedemann, 'Concept, Image, Name: On Adorno's Utopia of Knowledge', in *The Semblance of Subjectivity: essays in Adorno's Aesthetic Theory*, ed. by Tom Huhn and Lambert Zuidervaart (Cambridge MA and London: MIT Press, 1997), pp. 135–136.
26 Adorno later referred to 'our unforgettable conversations in Königstein'. (Theodor W. Adorno and Walter Benjamin, *Complete Correspondence 1928–1940*, ed. by Henri Lonitz, trans. by Nicholas Walker (Cambridge: Polity Press, 1999), p. 281.
27 *Correspondence 1910–1940*, p. 372.
28 *Correspondence 1910–1940*, p. 489.

study and appeared in print alongside it in 1928. It would be legitimate to regard *One-Way Street* as the counterpart, and for Benjamin it perhaps provided the counterweight, to the reflections on the theory of representation, of allegory and of historiography contained in his *Trauerspiel* study. One might also add to the notions of recovery, salvage, or salvation exercised there, the *recherche* of history: in 1926 Benjamin undertook a translation of Proust.

In *One-Way Street*, the signs which identify the passages of the text do not appear at all enigmatic. They are distinguished above all by their banality. But they have been stripped of their intentionality—not, however, so Benjamin can assign them to some other symbolic order. Although Benjamin allows objects mediated by their signs and the signs themselves as objects to come forward as if as emblems that hover in his text or that insert themselves between its passages, he does not attribute meaning to them allegorically, that is, so that they become signs for those meanings. He makes no attempt to fasten meaning to objects or build a system of such meanings, as an allegorical approach would imply. Instead, what Benjamin seems to be aiming for is a practical demonstration of 'the salvation of phenomena' that he claimed as the task philosophical history. Consistent with his *Trauerspiel* theory, this must be accomplished through representation: hence a literary experiment. The street signs which name his fragments become, for Benjamin, the nuclei around which his thought can crystallise, although only fleetingly, as in the glance of the passer-by. It is a materialist project in so far as it is an attempt at writing history concretely so that the objects of remembrance regain actuality in their presentation. It is a process of concentration in which the arbitrariness of the allegorical sign is excluded, albeit at the price of ambiguity.

What is at stake here is a reconstruction of the role of subjectivity in knowledge and representation, an issue which is reflected in the problematics connected with astrology and with constellation. The definiteness of the object (its stubborn non-identity) does not allow it to be defined (or redefined) *as* anything. Nonetheless it makes it possible for it to be apprehended as an image. The method of *One-Way Street* corresponds with 'the elementary doctrine of historical materialism' as Benjamin formulated it in a note for the Arcades Project:

> (1) An object of history is that through which knowledge is constituted as that object's rescue. (2) History decays into images, not into stories. (3) Wherever a dialectical process is realised, we are dealing with a monad. [...][29]

*One-Way Street* could therefore be understood as the prototype of the project he embarked on soon afterwards. Benjamin makes it clear that this is how he understood it in a letter to Gershom Scholem (30 January 1928). A 'highly remarkable and extremely precarious essay "Paris Arcades: A Dialectical Fairy Play"', he promised his friend, was all that stood in the way of his devoting himself to the study of Hebrew (with a view to taking up a position in Jerusalem that Scholem had gone to some trouble to arrange). In an attempt to justify his

29 *Arcades Project*, p. 476. Further page references in brackets in the text.

procrastination, Benjamin claimed it would bring to a close 'one cycle of production, that of *One-Way Street* [...] in much the same way in which the *Trauerspiel* book concluded the German cycle.' As if to underline the materialist side of the Arcades Project and register its resistance to the theological side of his work which, in Scholem's view, justified Benjamin's coming to Jerusalem (not to mention the precariousness of Benjamin's life in Europe), Benjamin continued, 'The profane motifs of *One-Way Street* will march past in this project, hellishly intensified. As for the rest, I am still unable to tell you anything about it, and do not even have a precise conception of its length. In any case it is a project that will just take a few weeks.'[30] As we know, this 'essay' remained unfinished at the end of Benjamin's life.

■

Despite what Scholem regarded with suspicion as Benjamin's flirtation with Marxism, the theological motifs were allowed to re-emerge in Benjamin's work during the 1930s, or at least, eventually, Benjamin made no secret of how he had hidden them.

The Arcades Project, *Paris, Capital of the Nineteenth Century*, to give it its projected title, as a philosophical project would also be obliged, as Benjamin declared in the first line of the *Trauerspiel* prologue, 'continually [to] confront the question of representation' (27). This time, the topic was not literary texts as such, but the phenomena of the recent past as phantasmagoria. The aim was a philosophical history of the nineteenth century taking its material not from nineteenth-century philosophy or from the political economy of industrialisation, but from its ephemeral products: fashions in architecture and interiors, clothing and shopping, entertainment and self-representation (photography, panoramas, world fairs).

The theoretical reflections from which I quoted at the beginning of this essay are found at the centre of a vast amount of excerpts, comments and quotations collected under concrete themes. ('Convolute N' where they were filed, it has been remarked, falls in the alphabetical middle of the manuscript.)[31] The late formulations suggesting relations between construction, constellation, monad and dialectical image display the 'central categories' of the methodology Benjamin sought in order to make something of his almost overwhelming material. However, the meaning of those categories, as the editor of the notes and materials points out, 'remained iridescent; it never achieved any terminological consistency.'[32]

During more than ten years of work on the arcades, the notion of constellation underwent several refractions. An account of them could be summarised under the following headings: Construction (*montage*), Awakening (*Jetztzeit*), The Language of Things (*mimesis*).

The method of construction which emerged in Adorno's programme, the 'changing constellations' or 'trial combinations', present a problem to which, Adorno was aware, 'The

30 *Correspondence 1910–1940*, p. 322.
31 Richard Sieburth, 'Translators' Introduction to "N"', in *Benjamin: Philosophy, Aesthetics, History*, ed. by Gary Smith, (Chicago and London: University of Chicago Press, 1989), p. 40.
32 'Dialectics at a Standstill', p. 284.

Actuality of Philosophy' did not provide a satisfactory answer. How exactly were such constructions of historical objects as Adorno recommended to be prevented from becoming merely arbitrary? In other words, how would they avoid being *intentionally* determined like allegorical figures: empty signifiers lacking the saturation of dialectical tensions Benjamin later insisted on? How does the constructor achieve the precision necessary to ensure the constellation is objective and can indeed disclose intentionless reality? Does the philosophical functioning of interpretation *produce* such constellations which somehow communicate themselves, or are the constellations the *objects* of philosophical interpretation?

Benjamin had high hopes that the principle of *montage* could carry his project through, and in this respect he declared a loyalty to modern(ist) art, and in particular—though not exclusively or uncritically—to Surrealism. The notes for the Arcades Project contain the provocative statement: 'Method of this project: literary montage. I have nothing to say. Only to show' (460).[33] What Surrealism represented for Benjamin was not the artistic clique it might suggest to an art historian. Surrealism meant a mode of experience that yielded, through its affinities with the world of things and with the world of dreams, what Benjamin called 'profane illumination'.[34] As Richard Wolin puts it, 'Benjamin's search for transcendence transpires, like the Surrealists', *within* the sphere of immanence.'[35]

However enticing the analogies might be, one should be wary of conjuring an image of Benjamin's notion of montage from the history of art. His essay 'Surrealism: The Last Snapshot of the European Intelligentsia' which he described to Scholem cryptically as 'screen [*Paravent*] placed in front of the *Paris Arcades*'[36] cites pictures only negatively: 'no face is surrealistic in the same degree as the true face of a city. No picture by de Chirico or Max Ernst can match the sharp elevations of the city's inner strongholds.'[37] Benjamin's model of Surrealist representation is predominantly literary. The Surrealist writers had the knack presenting the experience of the objects and spaces of urban life with the charge and vivid quiddity of dreams. Benjamin told Adorno how his experience of Surrealism in the form of Aragon's *Paysan de Paris* belonged to the origin of the Arcades project: 'Evenings, lying in bed, I could never read more than two to three pages [...] because my heart started to pound so hard that I had to put the book down.'[38] Yet, though the shock and lucid juxtapositions of Surrealist presentation were powerful stimuli, they did not fulfil Benjamin's methodological or his theoretical project.

The analogy Benjamin chose for his idea of montage does not suggest Surrealist imagery as much as it does that of a contemporaneous, and some art historians might say, complementary movement of modern art, namely Constructivism—though again Benjamin never refers to it in terms of visual art. Heightened graphicness is the Surrealist criterion when Benjamin asks himself:

33 As translated in *The Dialectics of Seeing*, p. 222.
34 Walter Benjamin, 'Surrealism: The Last Snapshot of the European Intelligentsia', in *One Way Street and Other Writings*, p. 227.
35 Richard Wolin, 'Benjamin, Adorno, Surrealism' in *The Semblance of Subjectivity*, p. 98.
36 *Correspondence 1910–1940*, p. 348.
37 'Surrealism: The Last Snapshot of the European Intelligentsia', p. 230.
38 *Correspondence 1910–1940*, p. 488.

> in what way is it possible to conjoin a heightened graphicness to the realisation of the Marxist method? The first stage in this undertaking will be to carry over the principle of montage into history. That is, to assemble large-scale constructions out of the smallest and most precisely cut components. Indeed to discover in the analysis of the small individual moment the crystal of the total event. (461)

This is not the kind of montage we would associate, for example, with Surrealist collage, assemblage or 'exquisite corpse'. The model that Benjamin invokes is (literally) the pinnacle of nineteenth-century industrial engineering and prominent precursor of the methods that came to dominate architecture in the twentieth: the Eiffel Tower. Benjamin comments and quotes from *Eisenbauten* by A. G. Mayer:

> These [i.e. the 'minimal', the 'little', the 'few'] are dimensions that were well established in technological and architectural constructions long before literature made bold to adapt them. Fundamentally it is a question of the earliest manifestation of the principle of montage. On building the Eiffel Tower: 'Thus the plastic shaping power abdicates here in favour of a colossal span of spiritual energy, which channels the inorganic material energy into the smallest, most efficient forms and conjoins these forms in the most effective manner … Each of the twelve thousand metal fittings, each of the two and a half million rivets, is machined to the millimetre … On this work site, one hears no chisel-blow liberating form from stone; here thought reigns over muscle power, which it transmits via cranes and secure scaffolding.' (160–161)

Benjamin's sense of how Surrealism and construction imply one another is also suggested by a note included among the reflections on the theory of knowledge that I have already cited. He writes, 'To encompass both Breton and Le Corbusier—that would mean drawing the spirit of contemporary France like a bow, with which knowledge shoots the moment in the heart' (459).

The problem, however, with Surrealist experience and Surrealist representation lies in its capitulation to the world of objects. Its dream-consciousness is not the unfettered subjectivity it wishes it were; it is outstripped both by an authentic individual unconscious and the obdurate shocks of actual reality. The dream does nothing but (sur)render Surrealism to the fetishism of commodities. So, more or less, is how Adorno would have it.

For Benjamin, the shortcomings of Surrealism did not seem as perilous to his project as they did to Adorno who warned his friend urgently of letting his dialectical images fall in to the same trap as Surrealism had done. Benjamin's approach, while it expresses a certain distance from Surrealism, maintains, alongside construction, the dream as that which sets the project in motion. '[W]hereas Aragon persists with the realm of dreams,' he says, 'here [i.e. in the Arcades Project] the concern is to find the constellation of awakening' (458).

Benjamin's earlier schemata for the Arcades project (up to the *Exposé* of 1935) contained the notion of the dialectical image as dream- or wish-image, suggesting that under a Surrealistic gaze, the half-forgotten artefacts and commodities of the recent past, sunk in dream-consciousness or emerging as if from childhood memory, could reveal themselves as expressions of a collective unconscious and therefore become available to interpretation on a Freudian model. If 'Chaque époque rêve la suivante,' as one of Benjamin's mottoes has it, then the present is still in thrall to the past. Awakening—now with the impetus behind it of Marx, who provides the other motto for the head of 'Convolute N' ('The reform of consciousness consists *solely* in [...] the awakening of the world from its dream about itself')—releases the utopian moment in the wish-images of the nineteenth century from the spell cast over them by reification and captures the revolutionary (or Messianic) potential of the present moment.

Adorno's criticism of the 1935 *Exposé* warned Benjamin of attributing the dialectical image to some kind of consciousness instead of approaching it as a 'constellation of the real.'[39] He was anxious that Benjamin's concept of the collective unconscious(ness) could not be distinguished from Jung's and so would sacrifice its dialectical character: 'It is up to us to polarise and dissolve this "consciousness" dialectically between society and the single subject, not to galvanise it as the metaphorical correlate of the commodity character.'[40] He urged on Benjamin the notion that he had sketched in 'The Actuality of Philosophy,' itself influenced by Benjamin's *Trauerspiel* theory:

> dialectical images as models are not social products, but objective constellations [*Konstellationen*] in which the social condition represents itself.[41]

In his own defence, Benjamin made a point of 'how apt [Adorno's] definition of the dialectical image as a "constellation"' seemed to him to be, but, he continued:

> how indispensable certain elements I pointed out in this constellation [*Konstellation*], appear to be: namely, the dream forms. The dialectical image does not simply copy the dream—it was never my intention to suggest this. But it does seem to me to contain the instances, the irruptions of waking consciousness, and indeed from such situations to configure itself as a constellation [*Sternbild*] emerges from luminous points. Here too, therefore, a bow must be stretched and a dialectic forged: that between the image and the act of awakening.[42]

It appears that Benjamin dropped the version of the dream-image that Adorno had indicted as undialectical, but he took up the image of constellation. However, he did not

39 *Correspondence 1910–1940*, p. 496.
40 *Correspondence 1910–1940*, p. 497.
41 *Correspondence 1910–1940*, p. 499–500.
42 Modified translation. Cf. *Correspondence 1910–1940*, p. 508 and *Complete Correspondence 1928–1940*, p.119.

adopt Adorno's model. He kept faith with the montage-like method of presentation, much to Adorno's dismay. Searching for a dialectics of awakening, which he also called the 'constellation of awakening', Benjamin asked himself:

> Is awakening perhaps the synthesis of dream consciousness (as thesis) and waking consciousness (as antithesis)? Then the moment of awakening would be identical with the 'now of recognisability' in which things put on their true—Surrealist—face. (463–464)

What Benjamin claims from the oneiric is the power of the eidetic. What he appears to be impatient with in Adorno's constructed constellations is their very coherence and convincingness. His own sense of construction appears to be more intricate. To be sure, Adorno's constructions are figurative, but they require, as it were, a plane of projection, which for all the light it might transmit, neutralises the explosive power of the strictly temporal constellation of past with present.

Whereas the literary-critical ideas that related the historical objects of the *Trauerspiel* study to the present were relatively conventional—the attempt to draw analogies between the allegorical drama of the Baroque period and contemporary expressionist theatre—ten years later, the practice of historiography required more than mere relevance. What mattered for the present was not the moral of the story, the lesson learned always too late that historicism teaches. The point was to shatter the continuum of history in which the sleepwalking world dreams of progress. The constellation of the past with the present does not simply release the significance of the past, but in redeeming it, engenders a revolutionary consciousness which releases the possibility of redemption latent in the present moment. In this light:

> A historian [...] stops telling the sequence of events like the beads of a rosary. Instead, he grasps the constellation [*Konstellation*] which his own era has formed with a definite earlier one. Thus he establishes a conception of the present as the 'time of now' [*Jetztzeit*] which is shot through with chips of Messianic time.[43]

This idea of constellation as a charged instant intensifies the connection with astrological notion of constellation as the simultaneous disposition of the stars and planets that was first suggested by Benjamin's invocation of the monad in the *Trauerspiel* prologue. It is a matter of seeking the conjunctions and oppositions of phenomena that occur in an instantaneous moment, that flash across the unbridgeable distances between them. Meanwhile, in Benjamin's thought, the monad now appears to take on aspects of the earlier *Sternbilder,* with which Adorno's constructed constellations had kept faith. This is possible because constellation is now, as it were, emancipated from the theory of ideas. Monadological structure now characterises the world of dialectical images, both in their relations to one another and their

43 'Theses on the Philosophy of History', p. 263.

internal composition. That means monad applies directly to historical objects constellated without the mediation of 'ideas'. What the historical object shares with the 'idea' of the *Trauerspiel* prologue is its intentionlessness. The clue—and here I am speculating somewhat—is in what appears to be, for Benjamin, the corollary or complement to the constellation of awakening.

'To discover in the analysis of the small individual moment the crystal of the total event'[44] evokes not only the transparency and flashing luminosity of a gem but points to the crystal's structural principle, that is, how the crystal expresses in its macroscopic shape the microscopic and invisible molecular structure of its material. Discovering the 'crystal' of something is therefore not the same as discovering the meaning of it as if that were separate from the object. It means discovering the reciprocity between its macroscopic and its microscopic structure. Similarly, Benjamin suggests a reciprocity between the dialectical image or monad that appears, apparently engendered by the historical constellation 'saturated with tensions', and the constellation that is discovered in the 'interior' of object itself because of its latent monadological structure. Construction merges with awakening in this process of discovery only at the moment of recognisability.

> If the object of history is to be blasted out of the continuum of historical succession, that is because its monadological structure demands it. This structure first comes to light in the extracted object itself. And it does so in the form of the historical confrontation that makes up the interior (and, as it were, the bowels) of the historical object, and into which all the forces and interests of history enter on a reduced scale. It is owing to this monadological structure that the historical object finds represented in its interior its own fore-history and after-history. (475)

Benjamin's 'constructive principle', however, remains as ambiguous as the monad as long as the latter is not reducible to an equivalent to the molecules which secure the crystal analogy.

When Adorno read Benjamin's first draft of the essay on Baudelaire commissioned by the Institut für Sozialforschung for its journal, a piece conceived of as a 'miniature model' of the Arcades Project, he was much alarmed, apparently by just such a methodological obscurity as I have suggested from a reading of the notes for the Arcades project itself. Though Adorno did not have access to those notes at the time, his criticism is instructive. He complains, 'Motifs are assembled but they are not developed,' and he asks, 'is this [i.e. panorama and traces, the flâneur and the arcades, modernity and the ever-same] "material" that can patiently wait for interpretation without being consumed by its own aura?'[45] He accused Benjamin of 'asceticism' with regard to the theory that could do justice to his materials in his own terms

44 See above, page 19.
45 *Correspondence 1910–1940*, p. 580.

and suggested it might be the result of a misplaced attempt at accommodation with Marxism. 'The "mediation" I miss and find obscured by materialistic and historiographic invocation, is however, nothing other than precisely the theory from which your study has abstained.'[46] Adorno felt that Benjamin's hesitation to set out his theory left his Marxism falling short of the thorough-going analysis the material would demand. Even the kind of unorthodox Marxist analysis favoured by the Frankfurt School, would, in any case, still miss the point as long as Benjamin's boldest and most original ideas were not permitted to come out. In an often-quoted formulation he acknowledged the area of Benjamin's theory that seemed to have been hidden in the Baudelaire essay, and which without adequate theoretical mediation risked vitiating its power of illumination:

> [T]he theological motif of calling things by their names tends to switch into the wide-eyed presentation of mere facts. If one wanted to put it more drastically, one could say that your study is located at the crossroads of magic and positivism. This spot is bewitched. Only theory could break this spell—your own resolute and salutary speculative theory. It is simply the claim of this theory that I bring against you here.[47]

We have seen how, in the *Trauerspiel* prologue, Benjamin linked the epistemology elaborated there to his earlier esoteric speculation on the origin and the theory of language. The 'language of things', which established for Benjamin a basis beyond conventional linguistics for his speculation on the nature of language and the relations between language and nature, is perhaps the 'red thread' of all Benjamin's writing, and here too underlies his efforts towards a materialistic historiography.

The 'language' of things implies the possibility of translation, and, where the muteness of things implies language as *script*, the possibility of the *reading* of things. Benjamin wrote in 'On Language as Such and on the Language of Man', 'The translation of the language of things into that of man is not only a translation of the mute into the sonic; it is also a translation of the nameless into name.'[48] Benjamin's concept of name differentiated between what is expressed *in* language and what is expressed *through* language, but it required that he describe a mode of perception that corresponds with the former, that is, what in the nature of language cannot be accounted for by a system of signs. It was in this connection that Benjamin developed the idea of the 'mimetic faculty' which is documented in writings dating from 1933 but which, according to Scholem, stemmed from a preoccupation of Benjamin's they discussed as early as 1918. From what Scholem says, it appears that Benjamin's ideas at that time were related to unpublished writings such as 'On the Program of the Coming Philosophy' (a text preoccupied with the concept of experience) and could also have been close to the concerns expressed in fragments dating from 1917 such as 'Painting

46 *Correspondence 1910–1940*, p. 582.
47 *Complete Correspondence 1928–1940*, p. 283.
48 'On Language', p. 117.

and the Graphic Arts' and 'Painting, or Signs and Marks' where Benjamin explored the difference between 'signs' and 'marks'; between the configurations of drawing, painting and writing. The latter are certainly of interest in the present context, but it is the work on the 'mimetic faculty' that is of direct relevance now.

Scholem writes, 'Even then [around 1918] he occupied himself with ideas about perception as a reading in the configurations of the surface, which is the way prehistoric man perceived the world around him, particularly the sky. This was the genesis of the reflections he made many years later [Doctrine of the similar things]. The origin of the constellations as configurations on the sky surface was, so he asserted, the beginning of reading and writing, and this co-incided with the development of the mythic age. The constellations were for the mythic world what the revelation of Holy Writ was to be later.'[49] It is not clear whether the indication Scholem gives here of Benjamin being interested in the origin of the constellations, that is, *Sternbilder*, is his recollection of the conversations of 1918 or whether it is a misrecollection of the later texts, because in 'On the Doctrine of the Similar' and 'On the Mimetic Faculty' (1933, both unpublished in Benjamin's lifetime) the constellation Benjamin cites as the exemplar of the mimetic faculty is without doubt the horoscope. The theory of 'similarity' that Benjamin developed in the 1930s certainly encompasses the signs of the zodiac and the rest, but his reference to the horoscope launches a much bolder thesis which may give some idea of what kind of weight Benjamin might have put on the idea of constellation in the methodological epistemology that was being worked out in the notes for the Arcades Project.

Benjamin asserts that similarity is a natural phenomenon and that man is endowed with a prodigious faculty for mimesis. The mimetic faculty, however, has a history and we should not assume that man's perception of similarity has remained constant throughout the ages, even if today the world of 'magical correspondences and analogies'[50] perceived by ancient peoples comes down to us only as legend, or is glimpsed only in child's play. He suggests that astrology provides a useful indication when assessing the alleged decay of the mimetic faculty in so far as it might be considered, as it were, as a horizon or limiting case of mimesis. Benjamin's reference to astrology in 'On the Mimetic Faculty' is severely abridged compared with what he writes on the 'Doctrine of the Similar':

> as inquirers into the old traditions we must take into account the possibility that human beings might have perceived manifest formations, that is, that objects had a mimetic character, where nowadays we would not even be capable of suspecting it. For example, in the constellations [*Konstellationen*] of the stars.
>
> To grasp this, the horoscope must be understood as an original totality which astrological interpretation merely analysed. (The stars [*Gestirnstand*] formed a characteristic unity and the character of the individual planets was only recognised by the way they

49 Gershom G. Scholem, *Walter Benjamin: the story of a friendship*, trans. by Harry Zohn (Philadelphia: Jewish Publication Society of America, 1981), p. 61. Interpolation in the translation.
50 'On the Mimetic Faculty', in *One Way Street and other Writings*, p. 161.

> function in relation to the stars.) We must always take account of the fact that celestial processes could be imitated by those who lived earlier, both collectively and individually. Indeed, the possibility of imitation contained the instruction to make use of an already present similarity. This possibility of human imitation, that is, this mimetic faculty which human beings possess, may have to be regarded, for the time being, as the sole basis for astrology's experiential character. If, however, mimetic genius was truly a life-determining force among the ancients, then it is scarcely possible not to attribute complete possession of this gift to the newborn—especially when it is regarded as complete mimetic adaptation to the form of cosmic being.
>
> The moment of birth, which here decides everything, is but an instant. This directs our attention to another peculiarity in the area of similarity. The perception of similarity is in every case bound to an instantaneous flash. It slips past, can possibly be regained, but really cannot be held fast, unlike other perceptions. It offers itself to the eye as fleetingly and transitorily as a constellation of stars. The perception of similarities thus seems to be bound to a time-moment [*Zeitmoment*]. It is like the addition of a third element, namely the astrologer, to the conjunction of two stars which must be grasped in an instant. Here the astronomer is cheated out of his reward, despite the sharpness of his observational tools.
>
> The reference to astrology may already suffice to make comprehensible the concept of a non-sensuous similarity. The concept is obviously a relative one: it indicates that in our perception we no longer possess what once made it possible to speak of a similarity which might exist between a constellation of stars and a human being. Nonetheless, we too possess a canon on the basis if which we can bring towards clarification the obscurity attached to a concept of non-sensuous similarity. And that canon is language.[51]

Another fragment apparently written a year earlier contains some of the same considerations almost verbatim. It concludes, 'This [i.e. learning language], then is the complete prolegomenon of every rational astrology.'[52]

Mimicry in language is therefore extended to the point where onomatopoeia would only be the most obvious example of what makes any linguistics that regards language merely as a semiotic system incomplete. Non-sensuous similarity runs through the whole of language down to proper names, and what is more, 'it is non-sensuous similarity that establishes the ties not only between the spoken and the signified but also between the written and the signified, and equally between the spoken and the written.'[53]

51 Walter Benjamin, 'Doctrine of the Similar', trans. by Knut Tarnowski in *New German Critique* 17 (1979), p. 66–67.

52 'On Astrology' in *Selected Writings Volume II 1927–1934* , p. 685. See also Benjamin's reflections on mimesis in 'The Lamp', short piece introduced with a passage attributed to Lichtenberg: 'In this way the marks on the bottom of a pewter plate tell the story of all the meals it has been used for. In the same way, the form of every piece of land—the shape of its dunes and rocks—contains in natural script the history of the earth; every rounded pebble that the ocean casts on the shore could tell that story to a soul that is chained to it, as our soul is chained to our brain.' (*Selected Writings Volume II 1927–1934*, p. 691)

53 'On the Mimetic Faculty', p. 162.

The passage quoted above shows clearly that, for all the ambiguity which lurks in his methodological design, Benjamin had a far from vague conception of constellation and that he was ready to take it extremely seriously. Benjamin's thesis is without doubt extravagant, particularly the proposition that the basis of astrology is the mimetic faculty of man, that a constellation could be imitable and that human language has no less a basis in mimesis. What makes it seem far-fetched is Benjamin's objective which is, as he expresses it in the fragment 'On Astrology': 'the attempt to procure a view of astrology from which the doctrine of magical "influences," of "radiant energies," and so on has been excluded.'[54] In a corresponding formulation in a letter to Adorno (31 May 1935) Benjamin comments that the emerging connection of the Arcades Project with the earlier *Trauerspiel* study suggested to him 'a particularly striking confirmation of that general process of fusion which has led the entire conceptual mass of this material, originally motivated as it was by metaphysical concerns, towards a final shape in which the world of dialectical images is immune to all objections that can be raised by metaphysics.'[55]

In these reflections on astrology, as with his interest in graphology, Benjamin shows an abiding concern that Scholem recalls him expressing in 1918 in 'an extreme formulation: "A philosophy that does not include the possibility of soothsaying from *coffee grounds* and cannot explicate it cannot be a true philosophy."'[56] In the not simply ominous, but increasingly dangerous political climate of the 1930s, it could seem perverse of Benjamin to lay stress on such categories however precisely oriented his position was; to take such risks with the dialectic of enlightenment; to invoke magic against itself, especially against the background of the kind of irrationalism he met in the guises of some of the leading intellectual lights of the Weimar period (not to mention the semi-educated 'philosophies' of popular beliefs). The review of *The Occult Sciences in the Light of Our Age* in which Benjamin expressed his adamant hostility to such movements was written in the same year as the notes on astrology we have just discussed.

The difficulty with which Benjamin leaves us, for his project was never finished, is *how* the process of demythologisation is to be carried through without reverting to myth as Adorno feared. How can the stuff of dreams be won back for the sake of awakening? How can illumination be won back from obscurantism?

■

Adorno became not only Benjamin's literary executor and editor of his *Schriften*, but the inheritor of these problems. His approach to them, immersed in the history of philosophy, was, compared with Benjamin's, extremely circumspect. For Adorno, to preserve the aspirations that he shared with Benjamin meant burying them deeper and at the same time exposing them mercilessly to their own contradictions. The method of immanent critique, which

54 'On Astrology', p. 684.
55 *Complete Correspondence 1928–1940*, p. 89.
56 *Walter Benjamin: the story of a friendship*, p. 59.

Adorno pursued consistently, could not be credible unless it were reflexive. It therefore does not offer the critic a privileged domain or archimedian point. Instead it requires thought to think out of its own contradictions. Whereas, in his collaboration with Horkheimer, the *Dialectic of Enlightenment,* he analysed by means of an ideological critique of bourgeois culture, how enlightenment reverts to myth, in his own writings he persistently pursued the problems outlined in 'The Actuality of Philosophy' into the structures of language—particularly philosophical and musical language. This is not to say that Adorno developed a 'language philosophy', implying as this might a metalanguage in which to formulate it. Instead, language was the matrix and medium of whatever it was possible to achieve in philosophy. In *Negative Dialectics* (1966), Adorno makes clear that what he is talking about is not a philosophical method or a standpoint, but is a question of representation.

> Dialectics—literally: language as the organon of thought—would mean to attempt a critical rescue of the rhetorical element, a mutual approximation of thing and expression, to the point where the difference fades. Dialectics appropriates for the power of thought what historically seemed to be the flaw in thinking: its link with language, which nothing can really break.[57]

It is the idea of the name (which as it were plants the non-identical within a system of identities, of concepts and categories) and the notion of the mimetic element in language—both derived from Benjamin—that offer the chance of preserving the non-identical within thought, which otherwise proceeds by identification. Objectivity becomes a virtual structure of language mediated subjectively.

> The name of dialectics says no more, to begin with, than that objects do not go into their concepts without leaving a remainder, that they come to contradict the traditional norm of adequacy. Contradiction [...] indicates the untruth of identity, the fact that the concept does not exhaust the thing conceived. (5)

Adorno's idea of constellation describes a mode of interpretation or interrogation of an object which can restore to conceptual thinking what conceptual thinking necessarily excludes. It is an epistemology which supposes a correspondence between language and reality, but not through a system of abstraction and definition. Instead, the inadequacy and contradictoriness of any concept means that other concepts must be applied[58] until they can configure the object, as it were in language-space, as a pattern of contradictions.

57 Theodor W. Adorno, *Negative Dialectics* (London: Routledge & Kegan Paul, 1973), p. 56. Further page references in brackets in the text.

58 'The determinable flaw in every concept makes it necessary to cite others; this is the font of the only constellations which inherited some of the hope of the name.' (53)

> [C]oncepts enter into a constellation. The constellation illuminates the specific side of the object, the side which to a classifying procedure is either a matter of indifference or a burden.
>
> The model for this is the conduct of language. Language offers no mere system of signs for cognitive functions. Where it appears essentially as a language, where it becomes a form of representation, it will not define its concepts. It lends objectivity to them by the relation into which it puts the concepts, centred about a thing. Language thus serves the intention of the concept to express completely what it means. By themselves, constellations represent from without what the concept has cut away within: the 'more' which the concept is equally desirous and incapable of being. By gathering round the object of cognition, the concepts potentially determine the object's interior. They attain, in thinking, what was necessarily excised from thinking. (162)

The 'conduct of language' with which this process corresponds is the experience of the acquisition of language, where the meanings of words are assembled from the implications of the variety of contexts in which we meet them. (A favourite analogy of Adorno's for philosophical interpretation was that of one reading in a foreign language without a dictionary.) Similarly Adorno does not expect any single concept to account entirely for any object, so an interpreter would be ill-advised to seek anything like an essence. The unity of the object is its 'monadological insistence' (163). The idea of the monad, as we have seen in Benjamin, is the doctrine of reciprocity. It preserves the 'otherness' of the object—that remainder of non-identity that all concepts leave behind and which identification discards—while at the same time allowing it to be intelligible, through mirrors if not through windows.

> Becoming aware of the constellation in which a thing stands is tantamount to deciphering the constellation which, having come to be, it bears within it. [...] The history locked in the object can only be delivered by a knowledge mindful of the historic positional value of the object in its relation to other objects—by the actualisation and concentration of something which is already known and transformed by that knowledge. Cognition of the object in its constellation is cognition of the process stored in the object. As a constellation, theoretical thought circles the thought it would like to unseal, hoping that it may fly open like the lock of a well-guarded safe deposit box, in response, not to a single key or a single number, but to a combination of numbers. (163)

In *Negative Dialectics* Adorno no longer speaks of flashing illumination. The metaphors he chooses and the tactics he uses appear to suggest a stealthier, more finely structured approach than in his earlier writings or in Benjamin's: the 'logic of disintegration' rather than the brilliance of fragments. The darkening of Adorno's work after the Second World War is witness not only to the European catastrophe. Beyond, also, the personal tragedy it was for Adorno to

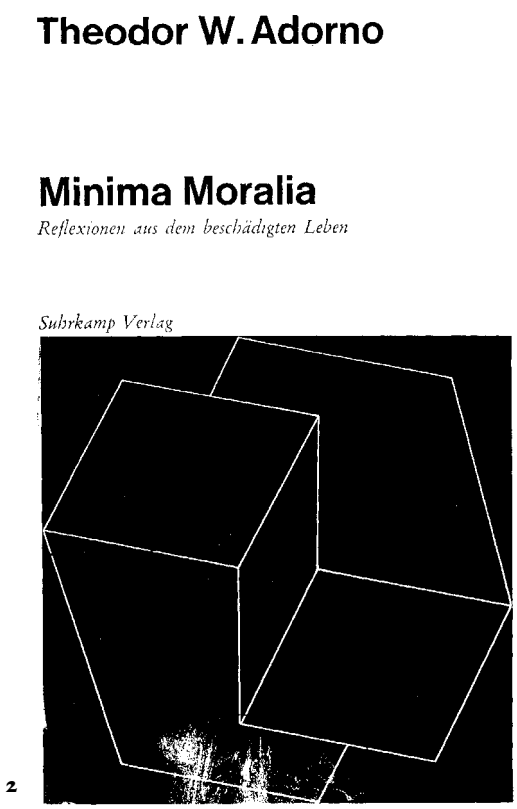
lose his most vital intellectual light when Benjamin committed suicide, he faced the immanent problematics of the aspirations they had shared until 1940. His philosophical critique of philosophy, moreover, had to amount to more than the justification of his own *métier* if it was to keep faith with those aspirations. Benjamin's 'admission of surrender'—Benjamin had said it seemed to him that the Arcades Project could only be accomplished as an 'impermissible "poetic"' work—was, in Adorno's diagnosis, 'probably due to Benjamin's acceptance of dialectical materialism as a *Weltanschauung*, so to speak, with closed eyes. But,' Adorno continues, 'the fact that he could not bring himself to put the definitive version of the [Arcades Project] in writing reminds us that philosophy is more than bustle only where it runs the risk of total failure' (18–19).

My synopsis of *Negative Dialectics* has perhaps lent a deceptive clarity to the epistemological aspect of constellation. Not that Adorno's thoughts are not clear, or that I have, by selection, disguised inconsistencies in the work. But *Negative Dialectics* is not a book on epistemology and the definition of constellation is neither one of its aims nor one of its results. Adorno's brief elaborations function within the text to suggest how one should expect the concept of negative dialectics to emerge from his critique of Kant, Hegel and Heidegger, whose writings provide the historical objects of Adorno's philosophical interpretation. At the same time, the notion of constellation Adorno expounds paraphrases the criterion of negative dialectics which binds it to language and does not permit its mere adoption as a 'standpoint' (5), or, as Jarvis underlines, as a 'portable methodology or a world-picture' which would distort it into 'a kind of new mythology.'[59] Constellation is not a theorem. The idea of constellation has to constitute itself every time from out of the things constellated in any act of interpretation or representation.

The apparent consequence—and in critical relation to Benjamin's and his own earlier use of the term, the possible aim—of the elucidation which *Negative Dialectics* provides of the relations between language, knowledge, concept and object, of the monadological structure of constellation, is the disappearance of its image-character. This 'radically darkened'[60] constellation is constellation subject to the ban on images: the theological injunction which was brought by materialism 'into secular form by not permitting Utopia to be positively pictured' (207). It was only by such renunciation, Adorno argued, that the utopian moment in philosophy (or in art) could be preserved.

59 *Adorno: a critical introduction*, p. 179.
60 Theodor W. Adorno, *Aesthetic Theory*, ed. by Gretel Adorno and Rolf Tiedemann, trans. by Robert Hullot-Kentor (London: Athlone Press, 1997) p. 19.


1

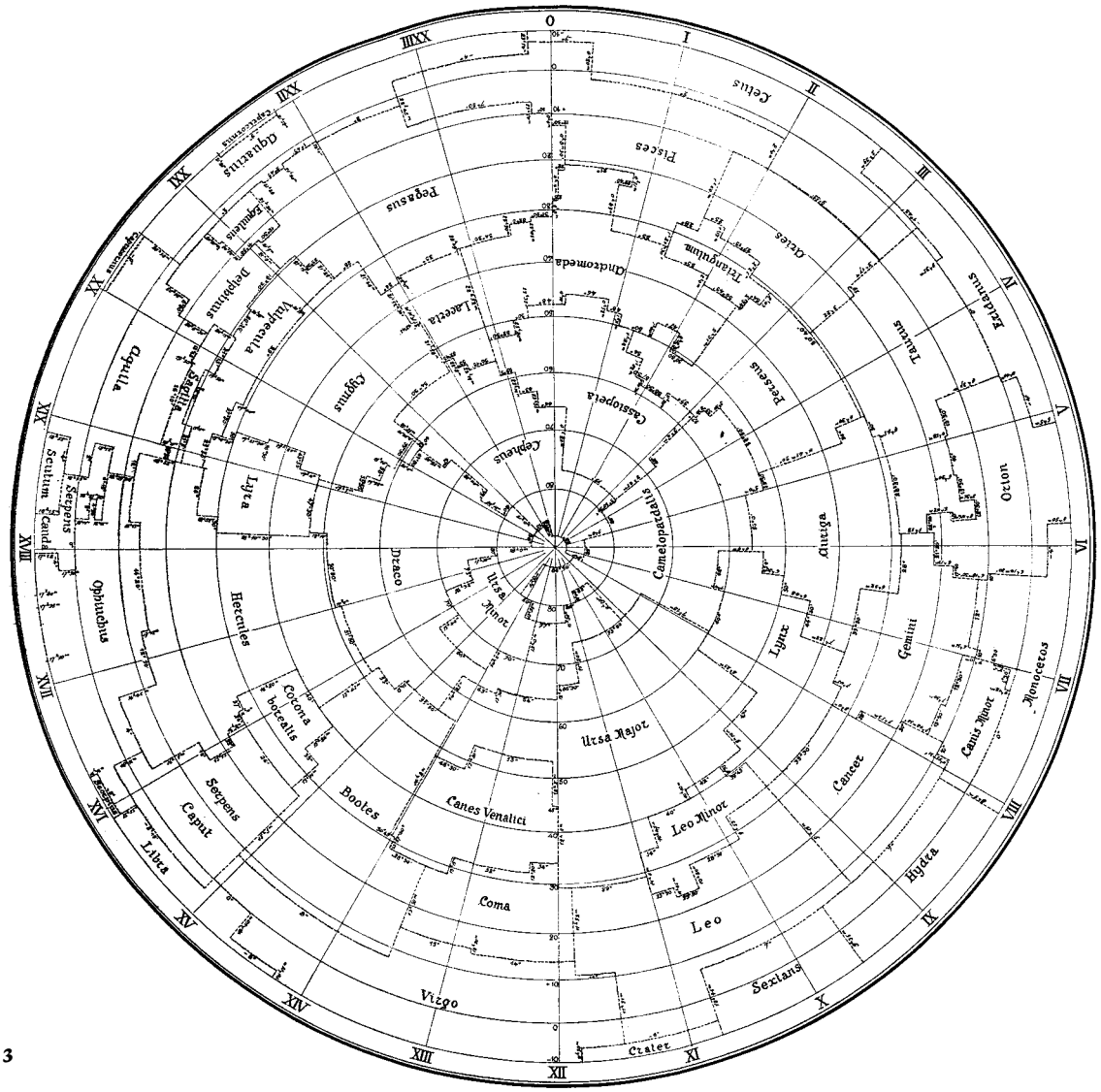



2

**1, 2 In 1962 Suhrkamp began publishing the paperback series 'Vorzeichen' (meaning 'signs' as in 'early symptoms', 'omens', 'prognostics' or, in music, 'signatures') edited by H. M. Enzensberger and Martin Walser. The series included books by Kracauer (*Das Ornament der Masse: Essays*, 1963), Benjamin (*Ursprung des deutschen Trauerspiels*, 1963), Adorno (*Minima Moralia: Reflexionen aus dem beschädigten Leben*, 1962) and Schweppenhäuser (*Verbotene Frucht: Aphorismen und Fragmente*, 1966). The covers, designed by Willy Fleckhaus (1925–1983), feature *Structural Constellations* by Josef Albers. Fleckhaus who produced a large number of distinctive covers for Suhrkamp, including the famous 'Rainbow Series', is known for his highly economical and imaginative use typographic elementsin book design—letters, words, colour—but he seldom used illustrations. The 'Vorzeichen' series is an exception.**

## II On Constellation and Drawing: the semiotics of star maps

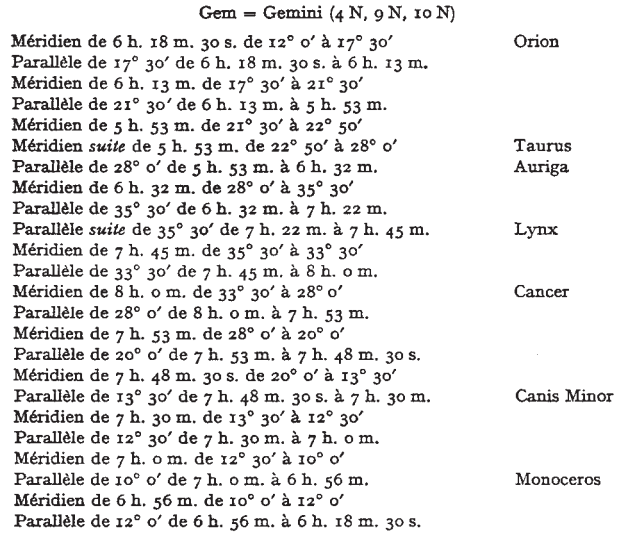
*We have expressed the whole terrestrial globe in two circles, and the infinity of the firmament in a scattering of dots as fine as dust on a cosmographic atlas.*
(El Lissitzky, 'New Russian Art: a lecture', 1922)




3

*La Délimitation Scientifique des Constellations*, published by the International Astronomical Union (IAU) in 1930, is possibly one of the most bizarre products of the dialectic of enlightenment **(3)**. At its founding in 1919 the IAU nominated eighty-eight constellations that would be officially recognised. The third general assembly of the IAU (1925) adopted a resolution calling for the constellations to be rigorously defined. That meant the eighty-eight constellations should be clearly separated from one another and should add up

**3 Northern hemisphere from Eugène Delporte, *Délimitation Scientifique des Constellations*, Cambridge, 1930**



Gem = Gemini (4 N, 9 N, 10 N)

| | |
|---|---|
| Méridien de 6 h. 18 m. 30 s. de 12° 0′ à 17° 30′ | Orion |
| Parallèle de 17° 30′ de 6 h. 18 m. 30 s. à 6 h. 13 m. | |
| Méridien de 6 h. 13 m. de 17° 30′ à 21° 30′ | |
| Parallèle de 21° 30′ de 6 h. 13 m. à 5 h. 53 m. | |
| Méridien de 5 h. 53 m. de 21° 30′ à 22° 50′ | |
| Méridien *suite* de 5 h. 53 m. de 22° 50′ à 28° 0′ | Taurus |
| Parallèle de 28° 0′ de 5 h. 53 m. à 6 h. 32 m. | Auriga |
| Méridien de 6 h. 32 m. de 28° 0′ à 35° 30′ | |
| Parallèle de 35° 30′ de 6 h. 32 m. à 7 h. 22 m. | |
| Parallèle *suite* de 35° 30′ de 7 h. 22 m. à 7 h. 45 m. | Lynx |
| Méridien de 7 h. 45 m. de 35° 30′ à 33° 30′ | |
| Parallèle de 33° 30′ de 7 h. 45 m. à 8 h. 0 m. | |
| Méridien de 8 h. 0 m. de 33° 30′ à 28° 0′ | Cancer |
| Parallèle de 28° 0′ de 8 h. 0 m. à 7 h. 53 m. | |
| Méridien de 7 h. 53 m. de 28° 0′ à 20° 0′ | |
| Parallèle de 20° 0′ de 7 h. 53 m. à 7 h. 48 m. 30 s. | |
| Méridien de 7 h. 48 m. 30 s. de 20° 0′ à 13° 30′ | |
| Parallèle de 13° 30′ de 7 h. 48 m. 30 s. à 7 h. 30 m. | Canis Minor |
| Méridien de 7 h. 30 m. de 13° 30′ à 12° 30′ | |
| Parallèle de 12° 30′ de 7 h. 30 m. à 7 h. 0 m. | |
| Méridien de 7 h. 0 m. de 12° 30′ à 10° 0′ | |
| Parallèle de 10° 0′ de 7 h. 0 m. à 6 h. 56 m. | Monoceros |
| Méridien de 6 h. 56 m. de 10° 0′ à 12° 0′ | |
| Parallèle de 12° 0′ de 6 h. 56 m. à 6 h. 18 m. 30 s. | |

unambiguously to the whole sphere (that is, to a unity and a totality). The task was allotted to Eugène Delporte of the Royal Observatory of Belgium and it was decided he should work alone on the project. His labour culminated in the publication of the *Délimitation*, which consisted essentially of a new map of the whole sky divided into eighty-eight contiguous patches. In accordance with Delporte's brief, the boundaries of the patches were aligned with the meridians and parallels of the co-ordinate system **(4)**.

To be sure, the project was a pragmatic one rather than a semantic one. But, despite the hope expressed in the title, the *Délimitation* was a semiotic enterprise, not a scientific one. The qualification 'scientifique'—with the promise that it might deliver a fully rationalised, not to say objective system of constellations—masks the fundamental contradiction of the project: at the same time to uphold and to liquidate a tradition which extends from the earliest recorded astronomical activity.

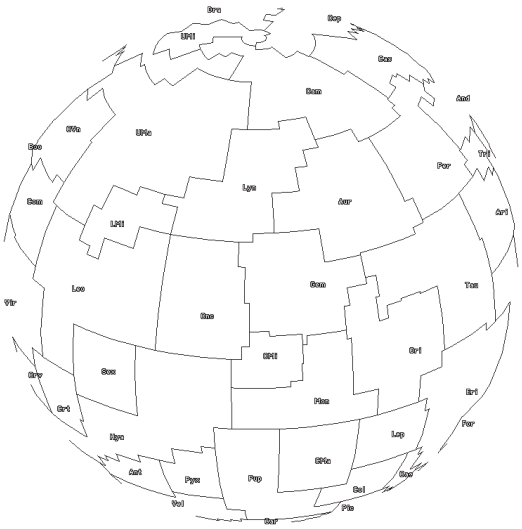
**Memo 1: Not Semantic**

In the twentieth century, any discussion of the meaning of the constellations had long since fallen into disrepute as far as scientific astronomers were concerned. A century earlier, John F. W. Herschel had made the point with some impatience:

> Of course we do not speak here of those uncouth figures and outlines of men and monsters, which are usually scribbled over celestial globes and maps, and serve, in rude and barbarous way, to enable us to talk of groups of stars, or districts in the heavens, by names which, though absurd and puerile in their origin, have obtained a currency from which it would be difficult to dislodge them.[1]

**4 The delimitation of Gemini from Eugène Delporte, *Délimitation Scientifique des Constellations*, Cambridge, 1930**

1 John F. W. Herschel, *Treatise on Astronomy* (London: Longman, 1833), p. 252.



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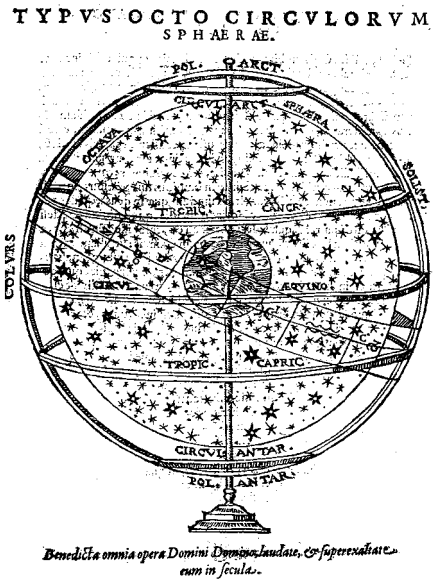



6

Constellation lore was reduced to an officially abbreviated legend, And, Ant, Aps, Aqr, Aql, Ara, Ari, Aur, Boo, Cae, Cam, Cnc, CVn and so on, according to the codification adopted by the IAU in 1922 **(5)**.

The rationale applied by Delporte failed to objectify the constellations, but tended to undercut the pragmatic function which justified preserving the constellations in the first place. The constellations defined by figures had had a virtue in their vagueness. The rationale of subjecting the constellations to the geometric order of the grid, moreover, exposed the result to natural history. Because of the precession of equinoxes, any observation recorded in a frame of reference centred on the observer is correct only for a specific time or 'epoch'.

**Memo 2: Precession**

The earth's axis does not point constantly in the same direction, but, owing to gravitational perturbations, slowly describes a circle. The phenomenon is known as the precession of equinoxes because, as the poles migrate, so do the equinoxes, that is, the points where the ecliptic (the apparent path of the sun) crosses the celestial equator (the projection of the earth's equator) **(6)**.

Although it was published in 1930, the *Délimitation* was defined with respect to epoch 1875. The editor of a later twentieth-century atlas noted with some irony:

> [The boundaries] do not change their positions among the stars, thus the objects can always be correctly located, though owing to precession, the arcs of right ascension and declination of today no longer follow the boundaries, and are steadily departing from them. After some 12,900 years, however, these arcs will begin to return towards

**5 The IAU abbreviated constellation nomenclature (computer generated chart)**

**6 The armillary sphere from Giovanni Paolo Gallucci, *Theatrum Mundi*, 1588**

> the boundaries, and 12,900 years after this, on completing the 25,800-year precessional period will approximate to them, but not exactly coincide.[2]

However, for the present study, the most important aspect of the contradictoriness of the *Délimitation* resides in fact that its implicit claim to be the last word on the constellations binds it inescapably to their history as signs, even though the *Délimitation* seems to have eliminated the traditional signifiers.

To explain in detail why that is so and how the *Délimitation* is bound up with the history it was supposed to bring to a close would require a semiotics of star maps. Such a semiotics would understand star maps as documents of the mutual mediation of constellation and drawing.

**Memo 3: Discontinuity**

What distinguishes astronomical charts from their terrestrial counterparts is, above all, the discontinuity of the data on which they are based. Lennart Lindegren and Michael Perryman noted in their proposal for the European Space Agency's current satellite-based astrometric project:

> Until the advent of astrophysics a century ago, astronomy consisted only of astrometry, and its theoretical counterpart, celestial mechanics. Practically all that was known about the Universe had been obtained by astrometric techniques. Increasingly precise angular measurements provided celestial mechanics with the data needed for its growth as an inductive science, and provided cosmology with the foundations necessary to take it beyond mere speculation.[3]

Accordingly, before the twentieth century, maps of the sky represented little more than angular measurements of the positions of individual point-like objects and their estimated relative brightness. Furthermore, until relatively recently, it was possible for an astronomical atlas to represent almost the sum total of accepted astronomical knowledge. From the early seventeenth century (with the advent of telescopic observation) to the end of the nineteenth century, the most significant change in the data base affecting celestial cartography was not the quality (i.e. the accuracy) of the data, nor the availability of data on the qualities of astronomical objects, but the sheer quantity of data – all as discrete as ever.

The attempt to elaborate a semiotics of star maps would find its most valuable documents at the moments of hesitation which punctuate a history dominated by the continua of tradition and progress. The *Délimitation*, like other attempts at reform of the representation of the starry sky before and after it, presents one such moment that would repay closer scrutiny.

2 Arthur P. Norton, *A Star Atlas and Reference Handbook* (Edinburgh: Gall & Inglis, 1966), p. 2.
3 L. Lindegren and M. A. C. Perryman, *Global Astrometric Interferometer for Astrophysics: A Concept for an ESA Cornerstone Mission* ‹http://nastol.astro.lu.se/~lennart/gaia—rep9409/node13.html›1995 [14 November 2000] (not published).

**Memo 4: Historiography of Astrography**

The standard texts on astrography tend to regard its history as already finished. It is presented as either the march of progress from myth and superstition towards the enlightenment of exact science, or as a compendium of stories behind the printed matter of interest to antiquarians. As the author of the catalogue of an exhibition devoted to celestial charts put it:

> An exhibition of the great celestial atlases would normally end in 1801, when Johann Bode published his *Uranographia*, the most monumental of all star atlases.[4]

The nineteenth century, which set the scene for the triumph of progress – or from the antiquarian's point of view, the decline of astrography – was perhaps the period of the most rapid change, but it has not received as much scholarly attention as the preceding periods.

But what is my project? I propose a semiotic 'assay' of star maps. That is, a test of their quality and purity as signs. Unlike a chemical assay, however, such a test will not give a 'true or false' answer. Nor is it intended solely as a critique of documents like the *Délimitation* whose more modest prospects were acknowledged by the president of the IAU commission on astronomical notations which ordered it 'with [...] the hope of gradually introducing uniformity of notation as far as such uniformity is feasible and desirable.'[5] My aim is to map the grounds for a discourse on representation as it relates to drawing. In the context of the present thesis, that means more specifically to suggest a different discourse from the ones to which art history customarily appeals. Star maps are exceptional candidates as the concrete objects of this study for this reason: arguably, star maps present us with drawing in a particularly autonomous mode. The maps are not primarily pictures. The data they represent are highly specific objects of knowledge mediated in as austere a way as could be imagined. Any graphic elaborations originate in and belong entirely to drawing. In cartographic terms: star maps permit an extremely sharp distinction to be made between the 'base data' and the 'map data'. Moreover, the base data are to all intents and purposes fixed and the same for all maps. So, in a comparative or historical study of star maps, they cancel, like a common denominator. What remains are the elaborations alone in relation to one another. The elaborations on star maps are constellations.

The polemical objective of my exploration would be to defend a view of constellation against a kind of essentialism which I think results from the ideological hybridisation of

4 William B. Ashworth Jr. *Out of This World, The Golden Age of the Celestial Atlas* ‹http://www.lhl.lib.mo.us/pubserv/hos/stars/welcome2.htm› 1995 [15 May 2000]. Marc Lachièze-Rey and Jean-Pierre Luminet (*Figures du Ciel*, Paris: Seuil/Bibliothèque Nationale de France, 1998) agree. Deborah J. Warner draws the line at the end of the eighteenth century in *The Sky Explored: Celestial Cartography 1500–1800* (New York and Amsterdam: Alan R. Liss, 1979). So does George Sergeant Snyder in *Maps of the Heavens* (London: André Deutsch, 1984). Basil Brown lists some nineteenth- and early twentieth-century maps but with virtually no commentary in *Astronomical Atlases, Maps and Charts: an historical and general guide* (London: Search Publishing, 1932), which is something of an antiquarian's guide. The exhibition *Celestial Images: Astronomical Charts from 1500–1900* (Boston, MA: Boston University Art Gallery, 1985) went up to 1900. Peter Whitfield's *The Mapping of the Heavens* (London: British Library, 1995) groups nineteenth- and twentieth-century maps together in the final chapter.

5 Eugène Delporte, *Atlas Céleste* (Cambridge University Press, 1930).

notions of eternity associated with the 'stars in heaven' (and thence appropriated by the truth-claims of astronomical lore) with notions of progress associated with scientific astronomy. For example: the familiar style of constellation drawings where a figure is made by connecting the bright stars with straight lines is frequently assumed to be the essential form of constellation—as if it were the primordial form revealed thanks to progress in science and art. My study can be expected to show that this kind of assumption is untenable from a theoretical or a historical point of view.[6]

**Memo 5: Punishment of Tantalus**

References to astronomy have seemed to prompt or have been used in cultural commentary to authorise grand claims (along with much pseudo-erudite verbiage) which scholarship is probably powerless to resist. A remark on Josef Albers's *Structural Constellations* by one of the artist's most dedicated supporters is a case in point.

> The name 'constellations' is apt; Albers drew them by connecting dots with straight lines. The points of intersection appear to fluctuate in space, like stars that seem to move because of their brightness and gaseousness. Stellar constellations are an attempt of man to organize the infinite, to pin down the eternal; Albers too wanted a handle on vast, timeless phenomena.[7]

Rendering the artifact to the eternal, such a chain of associations succeeds only in removing its topic beyond the reach of the critic.

I have mentioned a tradition and the reforms which are bound up with it. A tradition survives its reforms by permitting modifications in its relationship with a canon, which is nonetheless maintained in that status. A tradition, one might say, is a discourse which ascribes eternity to a canon, even if the canonical text makes no claims for itself as originary or eternal. A canon loses its status not through reform but only through revolution. The canon of astrography (and of astronomy in general until the seventeenth century) is Claudius Ptolemeaus's compendium known as the *Almagest* (c. 140 CE). Ptolemy's account of astronomical knowledge and mathematical techniques included a geometric model of Aristotelean cosmology and a catalogue of 1,022 stars organised in forty-eight constellations.[8]

6 See Part I, page 2n.

7 Nicholas Fox Weber, *The Drawings of Josef Albers* (New Haven and London: Yale University Press, 1984), p. 44. See also Neal David Benezra *The Murals and Sculpture of Josef Albers* (New York and London: Garland Publishing, 1985), p. 149: 'Because [Albers] began each *Constellation* drawing with lines linking points on graph paper, [the title] *Gemini* may also refer to the similar process by which constellations of stars are composed by astronomers. Inevitably, the reference is metaphorical as well. Albers' non-Euclidean geometry postulates a sphere of the imagination where such relations are possible. In titling his work *Structural Constellations* and *Gemini*, Albers encouraged his viewers to look beyond their immediate realities to those more elusive and sublime.' Albers's *Gemini* was a pair of *Structural Constellations*.

8 Ptolemy's mathematical world system was an ingenious device of deferents, epicycles and equant points which succeeded 'encouragingly well' (Michael Hoskin, *The Cambridge Concise History of Astronomy*, Cambridge: Cambridge University Press, 1999, p. 46.) in saving the phenomena, that is, in calculating the positions of the planets in the sky. Ptolemy's *Tetrabiblos*, the astrological companion to the *Almagest*, probably had an even longer-lasting influence than his mathematical treatise.

7

For each star, the catalogue provided a description of its position within a constellation figure, its latitude and longitude on the ecliptic system and its relative brightness (magnitude). The *Almagest* contains no map, but it implies the existence of diagrams and globes inscribed with constellation figures (none of which survives) and thus points to an already established graphic identity for the constellations.[9] Ptolemy refers to the work of his most important Greek predecessor Hipparchus, but acknowledges how he has adapted it:

> We have not used for each of the stars altogether the same formations as our predecessors, just as they did not use the same as their predecessors. But often we use others according to the greater propriety and fittingness of the configurations—as, for example, when those stars which Hipparchus places in the shoulders of the Virgin, we call her sides because their distance from the stars in the head appears greater than that from the hands, and thus they better fit the sides and are quite different from the shoulders. But the correspondence of the differently designated stars would be easy to ascertain by the comparison of their recorded positions.[10]

Stars which did not fall within a given constellation figure were put down in Ptolemy's catalogue as 'unformed' or 'unfigured' stars associated with that constellation. The anatomical specifications given in the *Almagest* suggest a fairly elaborate constellation-drawing. Ptolemy's catalogue of the stars in the constellation of Gemini (the Twins) starts like this:

**7 The Farnese Globe from G. B. Passeri, *Atlas Farnesianus*, Florence, 1750**

9 Astronomical globes in use in Ptolemy's time might have looked the one supported by the figure of Atlas in what is thought to be a Roman copy of an earlier Greek statue. The so-called Farnese Globe depicts the constellation figures in relief but not the individual stars. It is possible the stars might once have been painted on the stone (**7**).

10 Claudius Ptolemaeus, *Almagest*, ed. by Robert Maynard Hutchins (Chicago and London: Encyclopaedia Britannica, 1938), pp. 234.

**8**

The star in the head of the western Twin
The red star in the head of the eastern Twin
The star in the left forearm of the western Twin
The star in the same arm
The star east of this one and in the broad of the back
The one east of this in the right shoulder of the same Twin
The star in the eastern shoulder of the eastern Twin
The star in the right side of the western Twin
The star in the left side of the eastern Twin
The star in the left knee of the western Twin
The star under the left knee of the eastern Twin
The star in the left testicle of the eastern Twin
The star under the bend of the right knee of the same Twin [**...** and so on][11]

**Memo 6: When is a drawing a map?**

In the Arabic culture to which we owe the preservation of Greek astronomy, three types of representation of the sky were used: globes inscribed with stars and constellations, drawings illustrating astronomical and mythological texts, and astrolabes. The constellation figures they used followed the classical Greek models while showing the influence of native styles of drawing, costume and accessories **(8)**. The globes and illustrations played a role in transmitting the Greek iconography of the heavens to later cartographers, but neither uses projection, which is the distinguishing feature of a map. The globe is a miniature model or analogue of the celestial sphere. The illustrations do not pretend to

**8 Drawing of an Arab celestial globe from Adolph Dreschler, *Der Arabische Himmelsglobus des Mohammed ben Muyid el-'Ordhi vom Jahre 1279*, Dresden, 1922**

11 *Almagest*, pp. 244.


**9**

show the relative positions of the stars in a geometrically consistent way. The 'rete' of an astrolabe, on the other hand, represents the positions of a selection of stars on a stereographic projection (as described by Ptolemy) but it is hard to call the instrument a drawing.

Incidentally, it could be argued that the celestial sphere is already a map (but not a drawing), being the imaginary surface upon which the apparent positions of the celestial objects are projected. Aristotelean cosmology hypostatised this imaginary sphere centred on the observer. It should be remembered that the concept of 'space' as we understand it today did not take hold until the second half of seventeenth century (following the acceptance of the heliocentric theory) and attempts to obtain the distances of stars by measurement did not succeed before 1838. The demonstration of the stars' positions in space, and the vast, but ordinarily imperceptible (linear) distances between them, underlines the fact that the constellations are configurations on a surface.

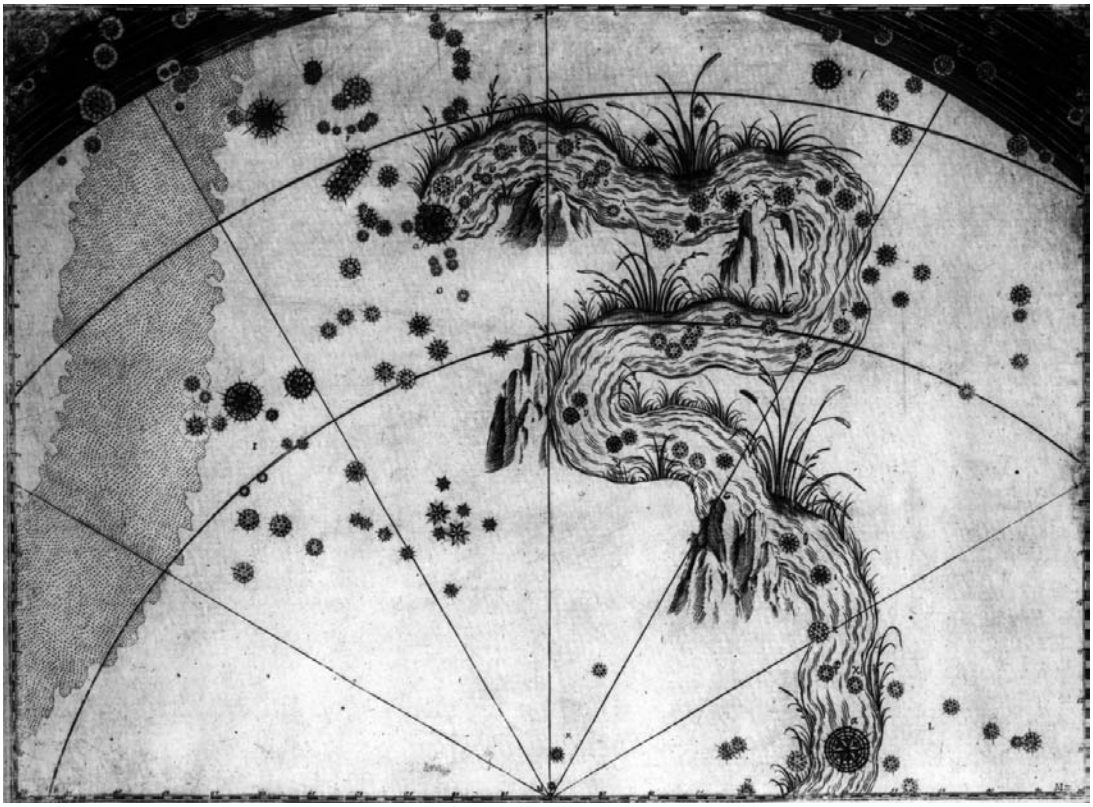
There is no evidence before the fifteenth century of the stars and constellations as were marked on globes, or pictured in illustrations, being combined with a formal projection such as was used on astrolabes. The 'Vienna Manuscript' (c. 1440) is regarded as one of the earliest 'genuine' maps and was an important model for later printed maps such as Albrecht Dürer's planispheres **(9)**.

Johann Bayer's[12] *Uranometria* (Augsburg, 1603) has been called 'the first true star atlas.'[13] The work does indeed stand at the head of a tradition of engraved star maps which lasted

**9 Albrecht Dürer, *Imagines coeli septrionales cum dudecim imaginibus zodiaci*, woodcut, 1515**

12 A sky atlas is usually the work of many hands: astronomers, editors, graphic artists, engravers. I refer to Bayer as the 'author' of the work only in a conventional way. For details of collaborators (where known) on this and other maps I discuss, see *The Sky Explored*.

13 Ashworth (*Out of This World*) is in agreement with George Lovi ('Uranography Yesterday and Today', in *Uranometria 2000.0,* vol. 1 (Richmond, VA: Willman-Bell, 1987). Warner gives the distinction to Piccolomini's *De Le Stelle Fisse* of 1540 (*The Sky Explored*, p. 200) or Gallucci's *Theatrum Mundi* of 1588 (p. xi).



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until the middle of the nineteenth century. It is worth examining in order to identify the 'elements' of celestial cartography in more detail.

The Ptolemaic canon was honoured in the arrangement of the atlas, but instead of old observations updated for precession, Bayer used new observations of the northern hemisphere by Tycho Brahe (1598), observations from south of the equator by Pietr Dirksz Keyser (1595)[14] and also included some nebulae and novae. Bayer's name is remembered today for the system of star nomenclature he introduced which is still in use. The 'Bayer letters' label the principal stars of each constellation with the letters of the Greek alphabet (usually in order of magnitude).

The atlas consists of fifty-one plates accompanied by tables: one for each of the forty-eight Ptolemaic constellations, one map of the southern circumpolar constellations and two general maps of the northern and southern hemispheres.

It is possible to distinguish the following components of the maps, each with different semiotic characteristics. I hesitate to arrange them hierarchically because it is the graphic integration of them on which I would like to comment.

### Grid

The main reference system is the ecliptic. The graticule is expressed by a calibrated border at the edges of the drawing, marked at intervals of one degree. Meridians (celestial longitude)

**10 The constellation of Eridanus from Johann Bayer, *Uranometria*, Augsburg, 1603**

14 Ptolemy, of course, had never seen these stars.

are ruled across the maps at intervals of 30° and converge towards the north or the south poles. The simple (mainly trapezoidal) projections allow co-ordinate positions to be read off the map using straight edge and compasses. A band 8° on either side of the ecliptic is marked prominently by closely spaced parallels ruled across the maps. Also marked are the Arctic and Antarctic circles and the Tropics of Cancer and of Capricorn, which, being parallel to the equator—that is, inclined with respect to the ecliptic—are represented as curves.

**Notation**

The notation of the stars consists of elaborate rosettes of various sizes for the different magnitudes. The symbols are not meant to show the angular extent (which is in fact not observable) nor the scintillating appearance of the stars. The symbols correspond to six categories of estimated brightness. The Milky Way is drawn as a well-defined, uniformly shaded path with irregular, though well-defined edges **(10)**.

**Labels**

The stars of the constellation which is the main subject of an individual map are labelled with Greek letters. Small Roman capital letters indicate (among other things) the locations of parts of other constellations, for example, H in the upper left corner of the Orion plate indicates the 'feet of Gemini'. The names of the constellations are not printed on the maps.

**Constellation Figures**

The constellations are inscribed with elaborately engraved pictures. Each plate composes a single constellation figure more or less centrally. While stars belonging to neighbouring constellations are present, their constellation figures are omitted. Where the figures are entwined according to the constellation lore, for example, where Ophiuchus (sometimes called Serpentarius, the Serpent Holder) struggles with Serpens, the drawing of the figure which is not the main topic of the map is subdued. Some of the Ptolemaic constellation-centred maps also include other asterisms not in the Ptolemaic canon such as Antinous, Columba and Crux (some of ancient, some of more recent pedigree), but the stars of these asterisms were not ordered separately in the tables. The way in which they are presented clearly suggests their subordination to the Ptolemaic constellations. In one case, which is interesting in that it hints at the variety of sources from which Bayer drew **(11)**, the peripheral stars on the Böotes plate are formed into the figure of a wheat sheaf **(12)**. This figure is not mentioned in Bayer's text and the same stars are incorporated in the figure Coma Berenices at the western edge of the plate for Ursa Major.

The iconography of Bayer's figures, that is, their attributes and poses, was based partly on printed constellation illustrations, in turn based on earlier manuscripts. Bayer's figures are artistically sophisticated but they are not orthodox. They were much admired and copied but they were also criticised, notably by John Flamsteed (1646–1719) who complained around


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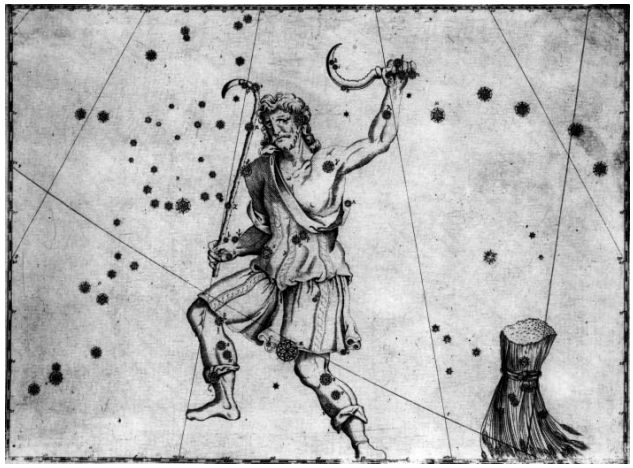

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the turn of the eighteenth century that Bayer contradicted the descriptions provided by Ptolemy. In his own plans for a star atlas, Flamsteed endeavoured to restore the figures to their ancient models. Bayer's figures also waver between two different conventions of star mapping. Early flat maps were drawn representing not the sky as it is seen, but the view of a celestial globe, that is, the celestial sphere viewed as if from the outside. The constellations, described originally as if facing the observer in the sky, were therefore depicted on the globes as if seen from behind. Bayer's map is geocentric—that is, it represents the sky the same way round as we see it—but his constellation figures are mixed **(13)**.

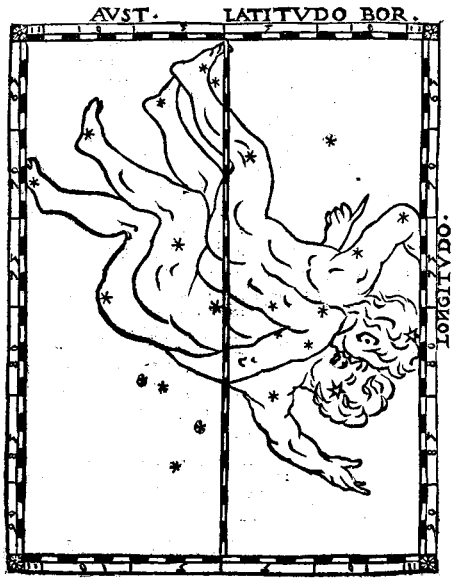
Looking more closely, it is not possible to discern any systematic correlation between the star positions and the figure drawings. By that I mean there is no consistent or preferred relationship between the star positions and the features of the constellation-drawing. The relationship of the constellation pictures with the symbols indicating the stars certainly appears more opportunistic than systematic. If anything, the configuration tends to be arranged so that the star symbols do not obscure details or important features of the drawing (faces, hands, feet) and the autonomous articulation of the drawing is preserved as far as possible.

Bayer's maps could be considered constellation 'portraits': the emphasis being on framing each constellation individually. The atlas seems more like a gallery of constellations, akin to a mediaeval illustration book, than the systematic portrayal of the sky such as we would expect, say, from a twentieth century atlas. Before judging it as archaic, however, we should consider whether the constellations amount to a system.

The scale and framing of the individual maps appears to be motivated primarily by picture making. The wide variation of angular extent among the traditional constellations means that the scale of the Bayer maps is adjusted to show each of the constellations in its

**11 The constellation of Böotes from C. Julius Hyginus, *Poeticon Astronomicon*, Venice 1482**

**12 The constellation of Böotes from Johann Bayer, *Uranometria*, Augsburg, 1603**

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entirety in a similar printed format. For a constellation of large angular extent, the scale is reduced and for a constellation of small angular extent, it is magnified. The images are organised so the figures are oriented in a plausibly picture-like way in relation to the rectangle, although not always the 'right way up'.[15]

The constellation pictures frequently transform other map elements into props. For example, the figure of Böotes, depicted in a dynamic pose, appears to step off from the calibrated border of the map as if this were a solid object **(11)**.[16] A variety of different graphic devices is also used to help establish a relationship between the figure and the frame. On some plates, the border slightly overlaps the figure, suggesting a pictorial space. In the cases of Aquarius and Eridanus, the device helps resolve the vagueness of the form of the image itself—that is, the depiction of running water **(10)**.[17]

**Memo 7: Terms of Reference**

Modern theories of signs tend to be divided between two complementary (or in some instances competing) schools: one which follows the work of Ferdinand de Saussure (1857–1913) and one which follows the work of Charles Sanders Peirce (1839–1914). While Saussure's *semiologie* was an attempt at a general linguistics, Peirce aimed at a more general semiotics and tends towards epistemology. This theory seems to be more versatile in dealing with non-verbal signs. Peirce suggested a triadic structure of signs, or perhaps more accurately, a triadic process of semiosis: the 'representamen', 'interpretant'

**13 The constellation of Gemini from Giovanni Paolo Gallucci, *Theatrum Mundi*, 1588. This atlas presented the sky as it would appear on a globe, that is, as if looking at the celestial sphere from the outside. Hence the constellation figures are depicted as if seen from behind.**

15 The actual orientation of the maps is frequently ignored when they are reproduced in books merely as pictures.
16 See also Hercules and Orion
17 Other examples are the plates for Aquila/Antinous, Capricornus, Cetus, Cygnus, Leo, Libra, Pegasus, Scorpio and Taurus.

and 'object'. Peirce wrote:

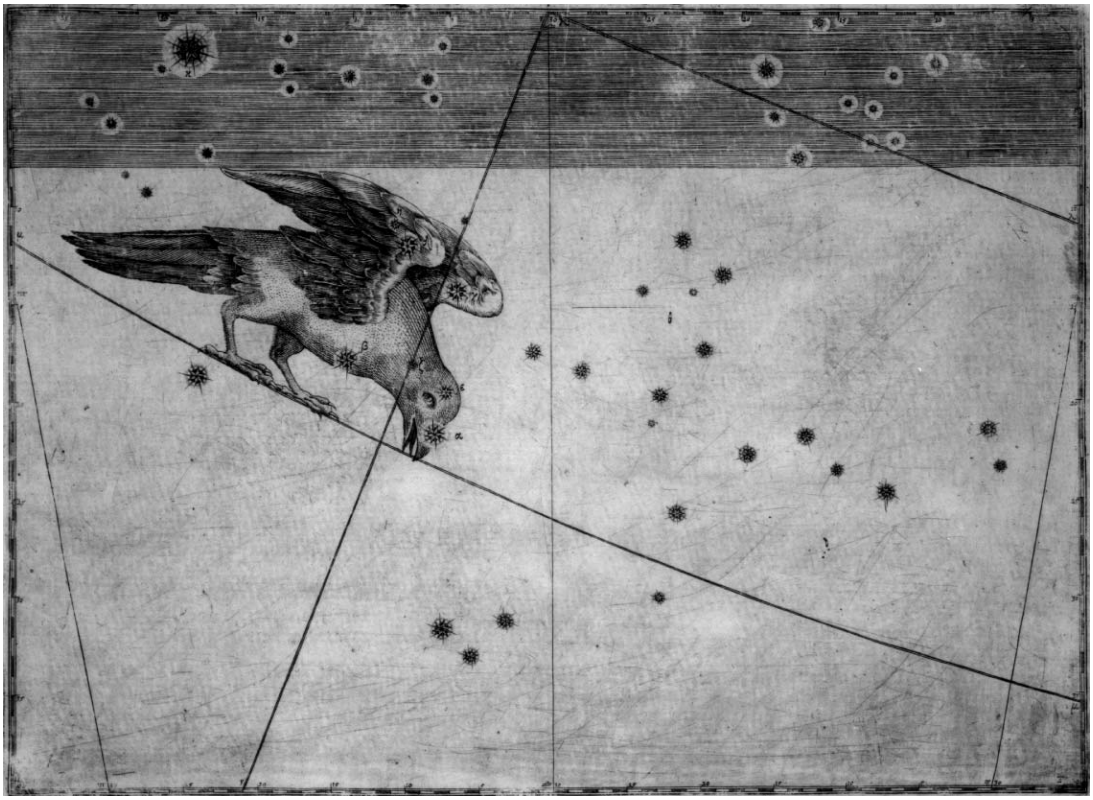
> 'A sign or representamen, is something which stands to somebody for something in some respect or capacity. It addresses somebody, that is creates in the mind of that person an equivalent sign, or perhaps a more developed sign. That sign which it creates I call the interpretant of the first sign. The sign stands for something, its object. It stands for that object, not in all respects, but in reference to a sort of idea.'[18]

Umberto Eco emphasises that the 'interpretant' does not necessarily involve a human subject, and that the 'somebody' Peirce mentions is really only a possible somebody.[19] I shall use a revision of the triadic terms which is probably less confusing in the context of my discussion: respectively, 'sign vehicle' (the form of the sign), 'sense' (the sense made of the sign), 'referent' (the thing the sign 'stands for'). Also due to Peirce is a triadic distinction of modes of signification usually understood as follows: symbolic (a mode in which the form of the sign does not resemble the sense or the object for which the sign stands, but its relationship to it is arbitrary or conventional), iconic (a mode in which the sign vehicle has some physical or perceptual resemblance or similarity to what is signified), indexical (a mode in which the sign vehicle is physically or causally connected in some way with what is the signified). When I am using them as technical terms, I have put words such as 'sense', 'referent', 'indexical', 'iconic' etc. in inverted commas.

Bayer's plate showing the constellation of Corvus, the Crow or Raven **(14)** is a remarkable example of the graphic integration of the various semiotic elements of the map. On it, what we would call in Peircean terms the 'symbol' of the constellation—image of a bird standing for Corvus, motivated by nothing other than the name—is rendered to a high degree of pictorial elaboration. The 'iconic' aspect of the image therefore seems to outstrip any other in so far as the drawing is overdetermined in relation to its emblematic or titular function and in relation to its function of animating or articulating the anatomy of the constellation as described (after Ptolemy) in the tables. The depiction of individual feathers clearly has nothing to add to the 'symbolic' function nor to the specifications given in the star catalogue. A graphic fantasy is permitted free play on the surface of the map precisely because of the discontinuity, and indeed the sparsity, of the 'hard' data represented by the star symbols and the abstract notation of the map's equipment. The bird, of course, is not copied from the sky and is no more subject to the map projection than the graphic forms of the star rosettes. Only the locations within the grid on which the rosettes are centred are controlled by the map projection. The engraver has depicted the bird perched on the Tropic of Capricorn. Traditionally, the Crow rides the tail of Hydra, the water snake whose stars are 'unformed' on this map. The animal's beak is open and it appears about to eat the parallel of declination it is standing on.

There are other ways too, one might say, the image consumes other elements of the map.

18 See Winfried Nöth, *Handbook of Semiotics* (Bloomington: Indiana University Press, 1990), p. 42.
19 See Umberto Eco, *A Theory of Semiotics* (Bloomington: Indiana University Press, 1979,) p. 16.



**14**

The way in which the bird is drawn asks to be interpreted as a naturalistic depiction of a three-dimensional creature. The drawing is able to incorporate other graphic components of the map in support of its own regime of representation by interpreting them differently and forcing that interpretation on the viewer. The apparent behaviour of the bird lends substance to the Tropic of Capricorn and transforms the rest of the grid lines into some kind of rigging. The calibrated border of the plate is transformed into a picture frame, the band of the ecliptic into a horizon. No mark within the frame then escapes the possibility of a spatial interpretation, even if most will not make sense in the way, for instance, the modelling of the form of the bird does.[20]

The kind of redundancy which results from the 'sign vehicle' taking on more of the qualities of the supposed 'referent' and hence becoming overspecified for a conventional, 'symbolic' meaning is one of the distinctive characteristics of the 'iconic' sign. The recognisability of any 'icon'—that is, how we know this sign is meant to signify something by means of resemblance or similarity—is nonetheless dependent on habits or conventions and so is itself mediated 'symbolically'. Above, I drew attention to the framing devices on Bayer's maps which support their picture-like qualities, but one could also point to the graphic conven-

**14 The constellation of Corvus from Johann Bayer, *Uranometria*, Augsburg, 1603**

20 This is not enough to justify the claims made in Samuel Y. Edgerton Jnr in 'Artistic Form in the Study of the Stars' to the effect that maps like Bayer's 'anticipated' the scientific discovery of the three-dimensional structure of the universe. The fact is, this is no more credible than his assertion that 'Renaissance art in effect "depicts" Newton's physics' *avant la lettre* (in *Celestial Images: Astronomical Charts from 1500–1900*, p. 27) or that similar connections can be traced between Cézanne and Maxwell and between Picasso and Einstein. Edgerton's view reflects a popular misunderstanding of science propagated in part through art criticism in the twentieth century. See Part III, below.

tions that help to signify the three-dimensional modelling of form or material qualities of the objects depicted (hair, water, feathers). It's worth remembering that the resemblance in the drawing will always be closer to *other drawings* than to the supposed 'referent' (man, river, bird). Similarly, the interpretation of so-called 'indexical' and 'symbolic' signs is mediated by their resemblance to other signs, for they need to be recognised as 'replicas' of the 'type'—in other words 'iconically'. Furthermore, any 'sign vehicle' has material qualities that are open to interpretation on an 'iconic' basis, regardless of intention. In short, the 'sign vehicle' is also a sign.

The entwining of 'icon' with the other modes of signification described in Peirce's trichotomy does not really vitiate the distinctions he made, but underlines the fact that semiotic analysis can be more reasonably expected to reveal aspects than yield clear-cut classifications.

Works of art school us in the interpretation of 'icons' to the point where the existence or non-existence of any real 'referent' which the 'icon' is supposed to resemble is a matter of indifference. It is clear, on examining and interrogating the particularities of the 'sign vehicle', as the conventions of art instruct, that 'the exhibitive import [of the sign] may consist in a relation between sign [-vehicle] and *interpretant* [sense] rather than between sign [-vehicle] and *object* [referent].'[21]

However, such schooled habits would confine us to too narrow a band of the semiotic spectrum. Peirce's concept of 'icon' encompasses more abstract-seeming signs than pictures. He envisages 'iconic' configurations of signs that are not themselves 'iconic'. Thus he declares an algebraic formula an 'icon', 'rendered such by the rules of commutation, association, and distribution of the symbols.'[22] The capacity of revealing 'unexpected truth' (as Peirce calls it) about the object of representation is achieved by the graphic arrangement of the formula which demonstrates relationships between symbolically represented values and coefficients. Peirce supports his example of the algebraic formula by an analogy with a map drawn by a photogrammetric process: 'Thus by means of two photographs a map can be drawn ...'[23] The point seems to be that the map reveals something about the landscape that the photographs alone are incapable of showing. The map's 'iconic' relationship with its 'object' is not directly visual, but is mediated by a quasi-algebraic process involved in cartography. It is the configuration of such a process that is displayed by an algebraic formula (and is implicit in the map too) which qualifies it as an 'icon'.[24]

This suggests another 'iconic' aspect of the star map which could otherwise have been overlooked, namely, that the configuration of signs representing the stars, though not the signs themselves, constitute an 'iconic' representation. Clearly, the star map is not in any

21 Douglas Greenlee, *Peirce's Concept of Sign* (The Hague and Paris: Mouton, 1973), p. 82. Emphasis in the original. Greenlee criticises Peirce's tendency to stress the sign-object relationship, although what Peirce means by 'object' is not always so simple.
22 Quoted in *Peirce's Concept of Sign*, p. 78.
23 Quoted in *Peirce's Concept of Sign*, p. 78–79.
24 Peirce, incidentally, was professionally involved in cartographic work for the United States Coast and Geodetic Survey and devised a novel map projection (apparently the first use of elliptic functions for a map projection, see John P. Snyder and Philip M. Voxland *An Album of Map Projections (US Geological Survey Professional Paper 1453)* (Washington DC: United States Government Printing Office, 1989), p. 190–191).

ordinary sense a picture of the sky. The stars have hardly any perceptible qualities, let alone ones which could easily be imitated in a drawing. So, analogously with the framing devices or conventional marks which ensure the interpretability of the picture as 'icon', what mediates the star map's 'iconic' relationship with its 'objects'? I think an examination of Peirce's concept of 'index' will help answer this question.

> An index represents an object by virtue of its connection with it. It makes no difference whether the connection is natural, or artificial, or merely mental. There is, however, an important distinction between two classes of indices. Namely some merely stand for things or individual quasi-things with which the interpreting mind is already acquainted, while others may be used to ascertain facts. Of the former class, which may be termed *designations*, personal, demonstrative and relative pronouns, proper names, the letters attached to a geometrical figure, and the ordinary letters of algebra are examples. They act to force attention to the things intended ... The other class of indices may be called *reagents* ... Just as a designation can denote nothing unless the interpreting mind is already acquainted with the thing it denotes, so a reagent can indicate nothing unless the mind is already acquainted with its connection with the phenomenon it indicates.[25]

The class of reagents is the one most commonly emphasised (at the expense of designations, perhaps in an attempt to make Peirce's divisions of signs simpler and more exclusive) and it implies a physical connection or cause between the sign and what it signifies. One of Peirce's favourite examples is a weathercock. Now it is not obvious why designations and reagents should be two classes of the same thing or what might be the connection between them. Peirce appears to argue for an analogous compulsion on the one hand through force of habit and on the other hand by dint of the physical cause, which of course requires some habit or convention to be interpreted as a sign anyway. Elsewhere he aims to generalise the idea of the physical connection not just to all 'indices' but to all signs. Citing the weathercock again, he writes, '[it] is a sign of the direction of the wind. It would not be so unless the wind made it turn round. There is to be such a physical connection between every sign and its object.'[26] Peirce's notes go on to explain how, on this view, a portrait painting is a physical effect of the sitter (mediated by the painter), a statement of fact 'is caused or determined by the fact,' and how 'the feeling there is in thinking' is a material quality and so semiosis is, as it were, a chain of physical causes. Peirce may have had his philosophical reasons for asserting the continuity of the material and the mental, but it seems an obscure way of reconciling his two classes of indices.

We have seen how a physical effect alone does not amount to a sign. An 'index' must be a complex of a physical effect and some kind of significative apparatus. In this respect, the

25 Quoted in *Peirce's Concept of Sign*, p. 87.
26 Charles Sanders Peirce, 'On the Nature of Signs', in *Peirce on Signs: Writings on semiotic,* ed. by James Hoopes (Chapel Hill and London: University of North Carolina Press, 1991), p. 141.

weathercock is already rather elaborate. Why not choose any other 'natural sign' of which way the wind is blowing such as which way the clouds are moving or the leaves are blowing? These would be 'indices' provided we supply a significative apparatus in the form of a known pattern of inference, but no further physical intervention is required. The weathercock, typically equipped with an arrow and indicators of the cardinal points, provides a concrete significative apparatus and tells us more than that the wind is blowing this way or that. The instrument tells us also whether the wind is blowing from north, south, east or west, which of course is a matter of indifference to the wind. Now the cardinal points are not arbitrary, even if the conventional symbols that mark them, N, S, E, W, and the arrow heads and tails we find useful are.

Whether or not the significative apparatus is expressed in a concrete instrument, the 'indexical' sign combines both Peirce's classes. In the case of the supposedly natural sign, the designators are 'this' and 'that'. The weathercock provides a more developed system of labels and pointers. One may say, then, that the forms of calibration of a significative apparatus (Peirce's designations) have an indexical *function* even though they do not participate directly in an indexical *process* (Peirce's reagents).

It could be argued that a notion of 'index' is at the heart of astronomy (and indeed it has been regarded as paradigmatic of natural science in general). Constellation, the means by which the stars become star-signs, has its origin in an indexical relationship. The history of astronomy and astrology might well be construed as the elaboration and adaptation of the significative apparatus of this indexical project.

The correlation, say, between the heliacal rising of such-and-such a constellation and the beginning of a certain period in the agricultural calendar does not depend on *knowledge* of the nature of the indexical process. Speculation on how the process works has been the preoccupation of cosmology and celestial mechanics ever since the correlation was noticed, but is not essential to the correlation. The minimum requirement of the significative apparatus of this hypothetical primordial astronomy is being able to say, '*This* is the same star or bunch of stars I saw a while ago.' In other words, establishing the identity of an object through the resemblance of perceptions separated over time. 'This' is the designator (perhaps a better word next to reagent than 'designation') from which an entire system can be propagated. The role of the 'iconic' mode of signification in identification will have already been noticed, but the identity is not complete without the 'symbolic' enunciation, 'This is the same ...' or better still, a name, and thence the limitless qualifications that can be attributed to the 'sign vehicle'.

The 'symbolic' attributes and their supplementary 'iconic' elaborations secure the designators within a multitude of semiotic 'codes' and in turn support their role in maintaining the significative apparatus of the system. In other words, the constellation figures imagined or inscribed on globes, diagrams and maps provide a body which in turn can be divided into parts and so integrate the mass of otherwise discontinuous data. Their indexical *function* consists in establishing a more or less differentiated sphere of fixed stars. The indexical *process*

obtains in the dynamic relations between this sphere and the earth, sun and planets. This is what makes the constellations signs of something other than themselves, the time of year, for example, or, in combination with the planets, possibly a man's fate.

It is easy to overlook this aspect of the constellation figures in favour of their autonomous picture-like qualities, especially if we feel remote from any practical use that could be made of the maps we are looking at—either because they are old and obviously obsolete or because they seem to belong to a forbidding technical specialism.

This more subtle concept of 'index' should also help clarify the issue of the 'iconic' configuration of the stars plotted on the map which I remarked above. We have seen how Bayer's atlas takes up what we could now call the 'indexical' system of constellations and elaborates it in pictures in a manner that could be regarded (in view of the 'iconic' aspects of the 'sign-vehicle') as highly redundant. *Uranometria* also employs another 'indexical' system or significative apparatus, namely the spherical co-ordinate system. But I will have to explain why this is 'indexical'.

The imaginary parallels and meridians which divide the sphere provide the means to carry information away, to record it in symbolic form, or possibly to apply it to a physical model such as a globe. The likeness between the positions marked on a globe and those measured on the celestial sphere qualifies the configuration as an 'icon' although it does not constitute a picture. As such it is not affected by the absence of special designators, because there is a uniform, point-to-point correspondence between the two spheres. Because, geometrically speaking, the two are similar, the globe itself suffices (although in practice it is useful to mark at least the axis and principal circles). However, to carry this information consistently onto the flat surface of a map requires the mediation of a map projection. For the 'iconic' status of the configuration to be maintained on the flat surface in a way analogous with that on the globe, designators are needed. The graticule of the map has this 'indexical' function and is thus the guarantor of the 'iconic' aspect of the graph. The important difference between this 'indexical' system and that of the constellation figures is that the latter applies in a variety of graphic, imaginary or symbolic environments and is concerned with dynamic relations or with specific relations between parts. The graticule, on the other hand, *designates* an indexical process, namely *projection*, that obtains between two surfaces. Whereas the constellation figures overcome the discontinuity of the data by incorporating it, the graticule casts a net over the surface as an empty continuum.

The harmony or the conflict between the multiplicity of codes which operate in any given star map can only be interpreted in the context of its pragmatics, which is to say, in a historically specific context of use. The remarkable thing about Bayer's work is how different orders of signs supporting different aspects of astronomical practice and communication seem to be integrated in his atlas. *Uranometria* is admired today for its 'historical significance' and its 'artistic merit'. In so far as the latter is a measure of its semiotic economy—in other words, its ability to contain a multiplicity of meanings or connotations: what makes it irreducible to a

single denotative meaning—the work's 'artistic merit' cannot be divorced from its historical situation. Bayer's work stands in relation to the past as a self-conscious attempt at recovery and renewal. Like many technical innovations of the Renaissance, it was dressed as the revival of ancient (Greek) knowledge. It is therefore concerned to reconcile the Ptolemaic scheme with modern observations and, moreover, to demonstrate this graphically in a manner which dignifies the past according to the visual codes of his own time—and, of course, to dignify itself with the prestige of the past. Standing at the threshold of the era when astronomy was revolutionised by the introduction of telescopic observations, it was perhaps the last map in which the old tradition and new aspirations could be so easily integrated. Bayer's maps reflect codifications which remained complementary in the practice of his day. The ingenuity of Bayer's engravings permits the coexistence of two indexical systems, that is, the constellation figures and the grid (to which Bayer adds a third in the form of his Greek-letter labels). It permits the 'iconic' aspects of the constellation pictures and the configuration of the stars to be developed independently, but the very graphic integration of the plates disguises a splitting of functions that can be traced in various ways in subsequent developments of celestial cartography.

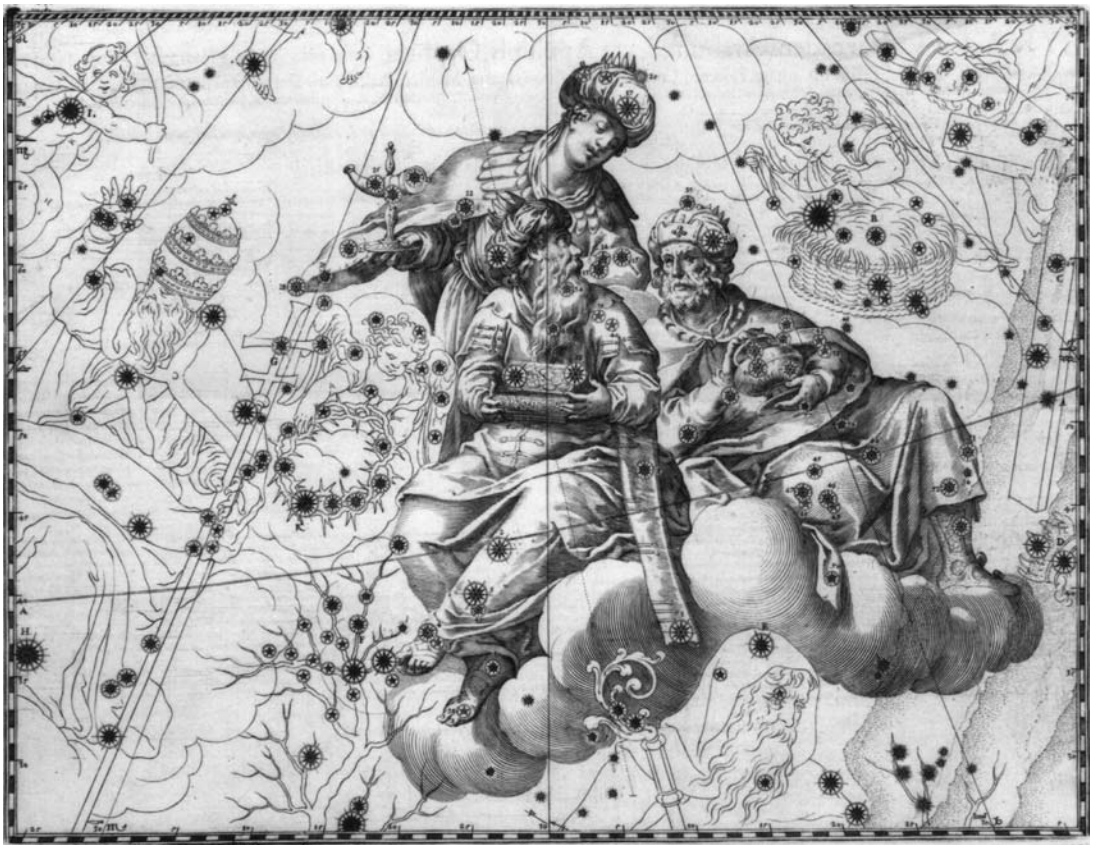
Julius Schiller's *Coelum Stellatum Christianum* (Augsburg, 1627) is best remembered for its failed attempt to replace all the Ptolemaic constellations with biblical figures, even though this reconfiguration was, in a way, a magnificent success. It eventually reached a wide audience through the reproduction of Schiller's synoptic charts by Andreas Cellarius in 1661, but the scheme did not catch on. In the present context I will consider the rationale of Schiller's publication and its counter-edition.

Schiller's work is essentially a revision, or 'upgrade', of his fellow Augsburger's pioneering effort. Bayer himself collaborated on the project. The atlas follows Bayer's model in its arrangement as a series of maps centred on the major constellations.[27] It adopts a similar convention of star notation and calibration of the grid, although, whereas *Uranometria* was geocentric, the *Coelum Stellatum Christianum* is external, that is, drawn as if viewing the celestial sphere from the outside as would be the case when looking at a globe. The most drastic departure from Bayer's model, and from nearly all earlier practice, is the iconography of the constellations. The constellations of the northern hemisphere are represented by figures from the New Testament, those of the southern hemisphere by figures from the Old Testament and the signs of the zodiac by the twelve apostles.[28]

In the light of the semiotic analysis I have initiated, the suggestion that the constellations are 'represented' by figures is a potentially troubling statement. It seems to presuppose the constellations as objects whereas my earlier discussion had admitted only their sign-character

27 Schiller's plates follow the same order of Bayer's and on the polar maps display the same cartographic error in the construction of the grid.

28 Schiller also went so far as to rename the Milky Way, to identify the sun with Christ, the moon with the Virgin Mary and the planets with various other biblical characters. See *The Sky Explored*, pp. 229–232 for details.



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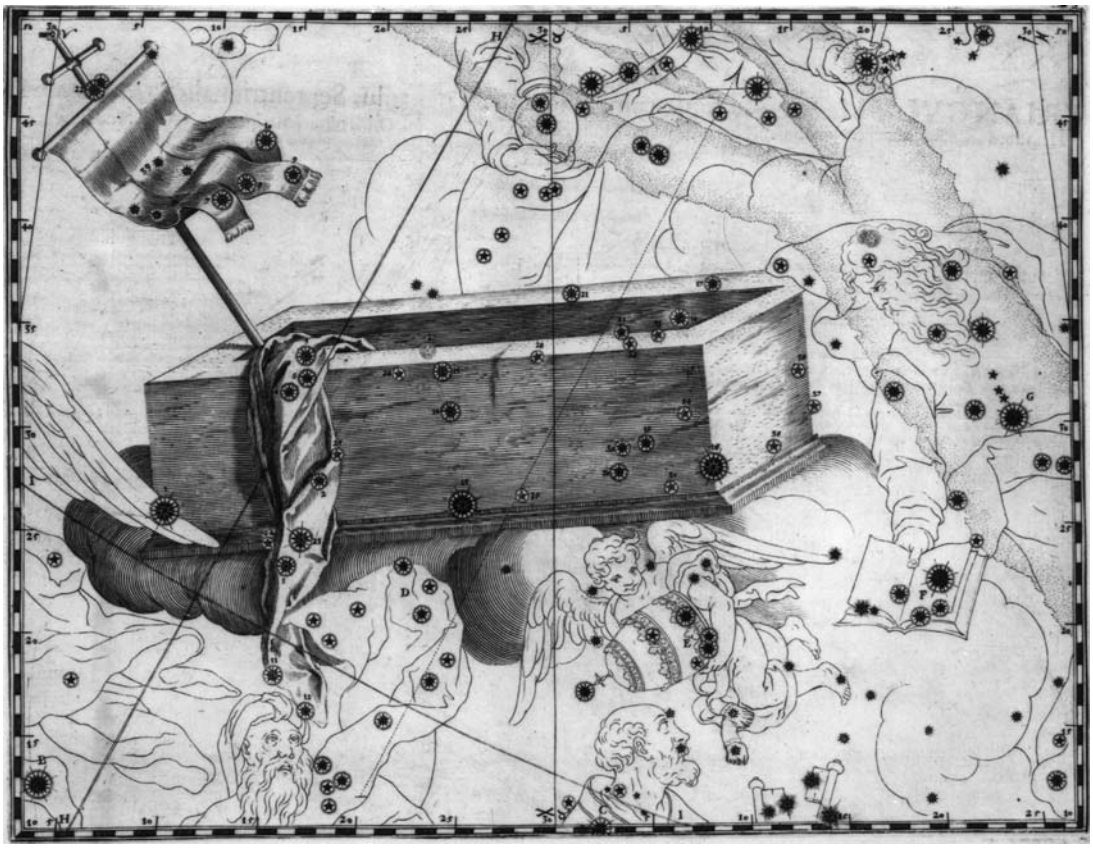
and hinted at the unlimited possible transformations which proceed from their 'symbolic' aspects. This needs to be examined more closely, but I should first explain Schiller's procedure.

Schiller accepted the constellations as defined by Ptolemy's catalogue and its more recent supplementary modifications (Bayer's tables, for example). There, the constellation consists of a list of stars, each identified by its position within the co-ordinate system and within a figure. The latter were described after a drawing. The lists are thus records of drawings from Ptolemy's day which are no longer extant and therefore serve as instructions how to inscribe the figures on a map (or globe). In turn, the figure on the map serves as an 'index' to help identify the stars by the description in the list. The perception of the constellation as a *Gestalt* is thereafter mediated by the drawing. What Schiller did was to make new figures to incorporate the old list of stars. This is not something which could be derived from observation or from the interpretation of a *Gestalt* (if one could be identified independently—I use the term to underline the subjectivity of the form) but from an act of inscription. Schiller did not therefore begin with a tabula rasa or with a mystical vision which revealed to him the saints in heaven or god-sent signs among the stars.

The scheme of the *Coelum Stellatum Christianum* is laid out on two synoptic charts. The two planispheres are unusual (probably unprecedented at this early time in the history of cartography) in that they are centred on the equinoxes rather than, as was customary, on the poles. On other words, they represent the eastern and western halves of the sphere. This

**15 Sanctis Tribus Regibus (Hercules) from Julius Schiller, *Coelum Stellatum Christianum*, Augsburg, 1627**



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arrangement anticipates the design of the individual plates in that the new figures are all oriented north-up, rather than wheeling around the pole or like the jumble of mythological characters and creatures which populated the Ptolemaic sky. Even the constellations invisible from the northern hemisphere are drawn this way, maintaining the pictorial unity of the planispheres. But these then little-explored southern constellations were not the subjects of detailed charts. Each figure on the hemispheres is labelled with its Christian name, its classical alias and the plate number of the relevant detailed map. In addition to the 'indexical' functions I have discussed, these plates are clearly the index to the atlas. The concordance of Christian and pagan constellations is followed through in tables presented opposite each detailed chart which give the co-ordinates according to most the authoritative observations then available and the anatomical specifications after Ptolemy as well as after the new constellation figures.

The individual constellation-centred maps are remarkable essays in picture making. On each map the main constellation figure is finely modelled, while surrounding constellations are rendered in outline **(15)**. As in Bayer's atlas, there is no systematic correlation between the star-rosettes which pepper the maps and the figure drawings. If anything, the star-rosettes are integrated graphically (clearly *ad hoc*) almost to the point where they are hidden. Normally, they are not permitted to disturb important details of the figures such hands and feet. Sometimes, but only in relatively marginal situations, a star-symbol is given figurative duty: for instance, three stars are allowed to stand in for eyes and nose on the face of the lion

**16 The Holy Sepulchre (Andromeda) from Julius Schiller, *Coelum Stellatum Christianum*, Augsburg, 1627**

next to St Jerome (Auriga), stars form the centres of the flowers of Frondis Roseae (Equuleus) and the eye of the eagle next to St John (Cancer).

The facility of the substitution of one figure for another compromises the case for any compelling resemblance between the constellation figure and the stars normally associated with it (or rather, the shape of the group of stars). Obviously, the Archangel Michael does not resemble a bear, Christ's Sepulchre **(16)** does not resemble a woman chained to a rock (Andromeda) any more than a perceived group of stars resembles an animal or mythological scene, or vice versa. The perception of a group of bright stars as a *Gestalt* does not by itself give rise to the figure. As I remarked earlier, the resemblance which is at the heart of the constellation is the self-similarity of the *Gestalt* over time. The application of the figure is the 'symbolic' enunciation of this resemblance. The figure gives rise to the *Gestalt* retrospectively by suggesting the figure's origin lies in an objective form. We have seen how the objectivisation of the constellation was, for Schiller and his predecessors alike, mediated by Ptolemy's lists, which were in turn dependent on drawings. With Schiller's atlas, two figures now compete for the same origin. If this probing of the matter seems to suggest a circularity in its logic (which I do not think is actually the case), it points to the fact that the objectivisation of the constellation can be found only in the sign and not in the sky.

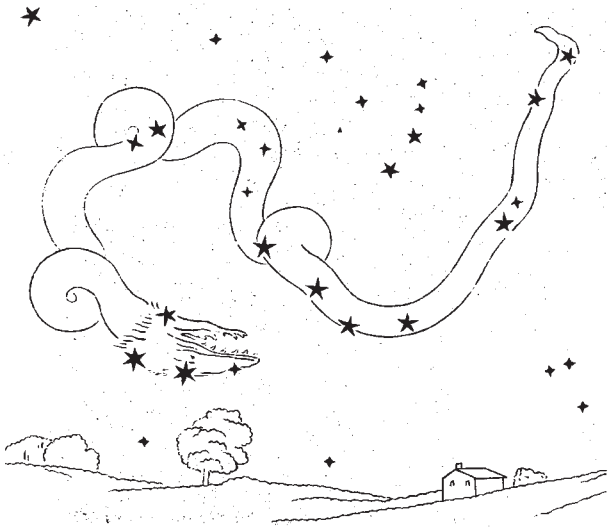
The supposed 'referent' of the constellation-sign (what it represents) is established by the sign itself. This is what Pierce calls an 'immediate object' or 'Object within the Sign': the object 'as the Sign itself represents it, and whose Being is thus dependent upon the Representation of it in the Sign.'[29]

**Memo 8: Charms of Resemblance**

Walter Benjamin's notion of the 'mimetic faculty' seemed to propose constellation as its epitome or primordial form.[30] It could be argued conversely that constellation as it is commonly understood puts a potentially distorting aura around the mimetic faculty in so far as the conventional constellations are accepted as the archive of primordial mimetic perception. The distortion arises from the translation into ideology of what Peirce called the 'immediate object'. The attempt to locate more precisely the moment of resemblance in constellation helps to separate the ideological content of the constellations as cultural inheritance, and hence obtain a clearer view of the kind of mimetic behaviour involved in constellation (and hence incidentally a more reliable approach to the idea Benjamin also traced in play, script and language). The reflections of a nineteenth-century educator illustrate a meeting between the perceptual and the cultural phantasmagoria of constellation.

> In those modern maps which show the constellation figures, the Dragon is represented differently [compared with the map presented by the author], and generally somewhat

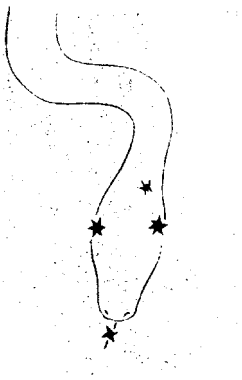
29 See *Handbook of Semiotics*, p. 43.
30 Scholem was certainly correct to understand it this way, although as I have shown, Benjamin took the idea further. See Part I, above p. 24.



**17**

as in Fig. [**17**] (knots and all). But you cannot *imagine* the stars to form a dragon or a snake, in that way. Now we may be sure that the ancients, when they called a group of stars by any name, really imagined some resemblance between the star-group and the figure after which they named it. I have heard it said that the liveliest imagination cannot form figures of familiar objects out of the stars; but this is certainly a mistake, for I know that when I was a lad, and before I had learned to associate the stars with the constellations at present in use, I used to imagine among the stars the figures of such objects as I was most familiar with. In the constellation of the Swan, I saw a capital kite. In the Great Bear I saw the figure of a toy very common at that time in England, representing a monkey that passed over the top of a pole. The three stars forming the handle of the Plough (η, ζ and ε made the tail of the monkey; and if you look at the Great Bear in the position it now occupies in the early evening, you will readily see the figure of a climbing monkey. In Perseus I could see a garland of flowers such as my sisters used to make. Orion was a climbing giant in the east, – a giant going down hill as he passed over to the west. In the Serpent-bearer and the Serpent I saw a monstrous sword, shaped like the curved sabre which Saladin wielded and so forth. No doubt in the infancy of astronomy, or the world itself, men were fanciful in the same way, and the figures they assigned to the star groups really seemed pictured in the heavens. Add to this the consideration that it would not be among the stars overhead, but among those towards the horizon, that they would imagine such shapes, and I think we can understand where and how they saw a dragon in the stars shown in the lower part of our northern map. It was not such a nondescript as Fig. [**17**] which they saw, but really a snake-like figure; and for my own part I have no doubt whatever that the stars β and γ were the eyes of the dragon they imagined, and that its head was

**17 The constellation of Draco from Richard A. Proctor, *Easy Star Lessons*, London, 1881**



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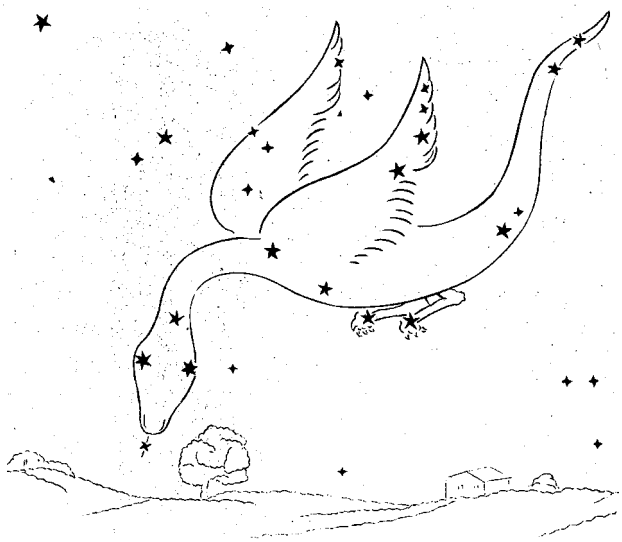

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pictured in their imagination somewhat as shown in Fig. [**18**]. On referring to the northern map, you will see that I have borrowed a star from Hercules to make the snake's head complete. But that does not trouble my mind in the least. The idea of separating the constellations one from another was a much later one than that of merely naming the more remarkable star-groups. If one set of stars seemed to resemble any object, and another set to resemble another object, I think the corresponding names would have been given even though some stars of one set were included within the other set. In fact this very constellation of the Dragon seems to me to show that our modern constellation figures have been largely reduced in extent. When I look northward at the Dragon placed as in the northern map, I see not a mere snake with his head as in Fig. [**17**], but a monstrous winged serpent, as in Fig. [**19**]; only to make the figure complete, I have to take a large piece from the Little Bear. The stars thus borrowed make a great wing for the Dragon; the stars ο, π, 15 etc. of the Dragon make another wing; and the neck, body and tail run from ζ through ε, θ, ι] and α to λ.[31]

From the point of view of semiotics, Schiller's assumption—that there is no reason why the constellation figures should not be different from how they are—is perfectly justified. By the same token, it would be impossible to claim theological (or, for that matter 'scientific') authority for the scheme. It could be convincing only artistically. In this respect the project succeeded. The atlas is still much admired and prized for its artistic sophistication and its adaptation of Mannerist or Baroque styles reminiscent of religious paintings of the period. But that success misses the mark if Schiller's intention was the acceptance of his scheme

**18 The head of a serpent from Richard A. Proctor, *Easy Star Lessons*, London, 1881**

**19 A monstrous winged serpent from Richard A. Proctor, *Easy Star Lessons*, London, 1881**

31 Richard A. Proctor, *Easy Star Lessons* (London: Chatto & Windus, 1881), p. 24–26. The book is intended as a modern guide to astronomy for young people.

among a community of astronomers. It has been suggested that in Schiller's cultural milieu, the aim of Christianising the heavens would have been regarded as 'neither an eccentric nor a controversial ambition,'[32] and Schiller could have expected a sympathetic reception from his contemporaries. Nonetheless, the scheme was perhaps too radical a contravention of traditional usage for astronomers to accept and, though its pious intentions could not be more obvious, its ambiguity in relation to astrology (which we should not forget remained important in Schiller's time) could have been an obstacle to its acceptance by the church.

It has also been noted that from a scientific point of view Schiller's maps were 'the best available until Hevelius published his atlas 60 years later.'[33] It is not difficult to see how, from the map-historian's point of view, this aspect of his work has been obscured by Schiller's theological and artistic extravagance. It is also hard not to imagine that even for his contemporaries the symbolic paraphernalia of the atlas compromised its practical use. It appears that Schiller anticipated this and did not stake everything on his Christianising project. In a gesture that seems to express the split I suggested was latent in Bayer's maps, Schiller separated the scientific content of his atlas. After the stars and the map equipment had been engraved and before the constellation figures were added, Schiller produced a counter-proof edition of the atlas. A counter-proof, offset from an impression of the plate, is reversed again, making the maps geocentric. He thus produced a set of plain maps representing the best knowledge available at the time to a high standard of accuracy. The geocentric view moreover is adapted to the activity of observing. The existence of the geocentric counter-proof edition seems to compensate for the archaism of the external figured maps. Apparently, Schiller felt it would be disrespectful to show the biblical characters on the maps from behind in the way earlier globes and maps had depicted the old constellation figures originally pictured facing us in the sky. So he depicted the holy figures face on. Consequently, if one wanted to adopt the Christian figures for observation, then one would have to imagine them with their backs turned. I think this suggests a limit to Schiller's expectations. The plain maps, alongside the tables, formed an excellent tool for an astronomer who by this time would have expected to be equipped with a telescope. Such maps would help with the positive identification of bright stars and provide the matrix for recording the positions of newly-observed objects relative to the well-known stars of the constellations.

**Memo 9: Notice to All Astronomers and Philosophers**

While Schiller had included a few new objects observed through telescopes, his roster of stars hardly exceeded that of the standard pre-telescopic catalogues. Galileo Galilei first described the potential of the telescope for astronomy in his *Siderius Nuncius* (*Starry Messenger*, 1610). With his telescope, Galileo was able to see hundreds of stars where previously only a handful were observed. He published drawings (but not maps) of the new

32 *The Mapping of the Heavens,* p. 93.
33 *The Sky Explored*, p. 232.

**20**

stars he had seen, for example, in the vicinity of the belt and sword of Orion, 'in order that you may see one or two illustrations of the most inconceivable crowd of them, and from their example form a judgement about the rest of them' **(20)**. He explained the drawings as follows:

> I decided to reproduce two star groups. In the first I had decided to reproduce the entire constellation of Orion, but overwhelmed by the enormous multitude of stars and lack of time. I put off this assault until another occasion. For there are more than five hundred new stars around the old ones, spread over a space of one or two degrees. For this reason, to the three in Orion's belt and the six in his sword that were observed long ago, I have added eighty others seen recently, and I have retained their separations as accurately as possible. For the sake of distinction, we have depicted the known or ancient ones larger and outlined by double lines, and the other inconspicuous ones smaller and outlined by single lines.[34]

The technology which revealed untold numbers of new stars among the ancient constellations was also used to survey the southern sky, which had remained uncharted by European astronomers until the sixteenth century. As the number of 'unformed' stars proliferated, new constellations were introduced to form them. Over the seventeenth and eighteenth centuries new figures were designed to fill the gaps in the Ptolemaic system and the twelve southern circumpolar constellations formed from the data brought back by Pietr Dirksz Keyser and

**20 Orion's belt and sword from Galileo Galilei, *Siderius Nuncius*, Venice, 1610**

34 Galileo Galilei, *Siderius Nuncius or the Siderial Messenger*, trans. by Albert van Helden (Chicago and London: University of Chicago Press, 1989), p. 59–61. Galileo's title page announced a book 'Containing and Explaining Observations Recently Made, With the Benefit of a New Spyglass, About the Face of the Moon, the Milky Way, and Nebulous Stars, about Innumerable Fixed Stars and also Four Planets hitherto never seen, and named Medicean Stars.' These last, the satellites of Jupiter, he declared in his introduction, 'greatly exceed all admiration,' and were what 'especially impelled us to give notice to all astronomers and philosophers.'

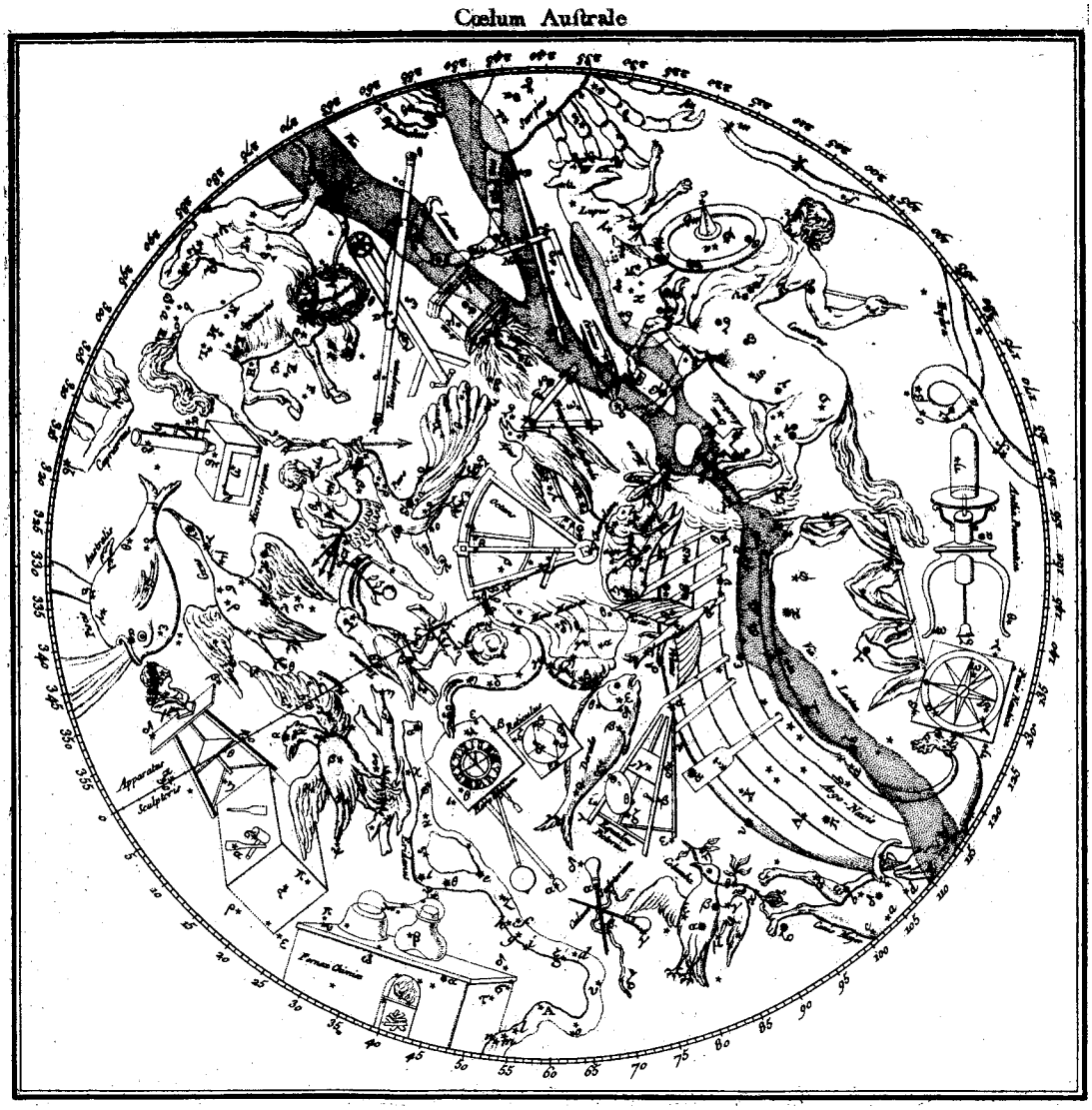
Frederick de Houtman at the end of the sixteenth century (which Bayer had helped to canonise)[35] were supplemented by a proliferation of new mythological creatures, exotic animals, Christian symbols, political tributes and, later, machines. It is possible to trace a variety of interests motivating the choice of the symbolic figures which supply the forms of the constellation pictures, some deliberately archaic, others reflecting the age of exploration of the southern hemisphere, political and religious allegiances and new technologies. However trivial or opportunistic the motivations, for every cartographer forming a constellation seems to have been a bid for the kind of immortality represented by the constellations associated with the name of Ptolemy. The fact that many of the new constellations were formed about relatively faint stars and so were never conspicuous in the sky suggests the constellations were in the first instance located on maps. Any asterisms that the first explorers of the southern oceans might have adopted for the purposes of navigation when the familiar constellations disappeared over the horizon are not recorded.

For my purposes it will suffice to consider one (relatively late) example. From 1751 to 1752 Nicolas Louis de Lacaille made Table Mountain at the Cape of Good Hope the base for a systematic telescopic survey of the southern sky. His work resulted in a catalogue of some 9,800 stars (greatly augmenting Edmond Halley's earlier effort). He produced a polar map extending to the Tropic of Capricorn on which he included fourteen constellations of his own invention, namely:

Antila Pneumatica (air pump)
Apparatus Sculptoris (sculptor's apparatus)
Caelum Scalptorium (engraver's burins)
Circinus (drawing compasses)
Equueleus Pictoris (painter's easel)
Fornax Chimiae (chemical furnace)
Horologium (clock)
Microscopium (microscope)
Mons Mensae (Table Mountain)
Norma (set square)
Octans (navigator's quadrant)
Pixis Nautica (nautical compass)
Reticulus (the reticule of a telescope)
Telescopium (telescope)

The list epitomises an Enlightenment agenda celebrating the technology of discovery and of representation, including Lacaille's own equipment as an astronomer and cartogra-

35 These constellations were apparently formed by Petrus Plancius and first produced by him on a celestial globe.

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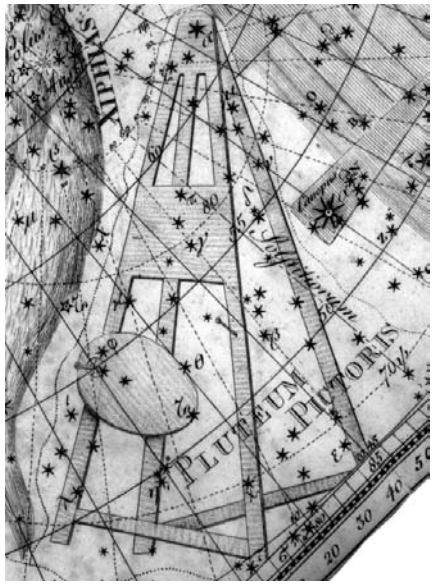
pher. To see how the new phase of constellation forming—and Lacaille's shift from constellation figures associated with nature and myth to emblems of the modern arts and sciences—affected the semiotics of constellation, we will have to consider the relationships between the catalogue, the map and the constellation drawings. Lacaille's planisphere includes the southernmost Ptolemaic constellations, the sixteenth-century additions and his own interpolations. The new constellations of previously unformed stars are inscribed in a manner consistent graphically with the older constellations **(21)**. This in itself is noteworthy in so far as it seems the modernising agenda of the iconographic themes is not carried through in any new graphic approach. The continuity Lacaille established with tradition doubtless made it easier for his innovations to be accepted by the scientific community who, of course, would also have felt sympathetic to, if not flattered by, the elevation of the tools of their trade. But the warm reception of Lacaille's constellations might have been short-lived had they not been backed by the authority of his catalogue. This is what would have been

**21 The Southern hemisphere by Nicolas Louis de Lacaille from *Coelum Australe Stelliferum*, Paris, 1763**

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recognised as the true monumental art of astronomy and it is the catalogue which discloses a new approach to constellation.

Lacaille organised his survey in geometrically defined zones. In the catalogue, the zones are headlined with a short list of prominent stars given by constellation and 'Bayer letter'. The headline lists and the tables which follow give the objects' co-ordinates, but have completely abandoned specifications referring to the constellation figures. However detailed the graphic elaboration of the constellation-drawing, even the traditional figures of humans and animals support only a handful of useful anatomical descriptions. Lacaille's equipment hardly lends itself to such articulation, certainly not for hundreds of discrete points. The parts of objects they depict, moreover, often defy naming. It is, I would suggest, because the constellation figures were relieved (or deprived) of this 'indexical' function that was possible for Lacaille to adopt the constellation pictures he did. The particularities of some of the illustrations (the microscope or the air pump, for instance) mark them out as historical objects in contrast with the earlier natural or mythological figures. The generality of others (the various pieces of geometer's equipment, for example) seems to reinstate the undifferentiatedness the constellation figures were originally introduced to overcome. There is no attempt on the map to correlate the star positions with any distinctive features of the constellation drawings. However, the constellation figures retain the 'indexical' function of relating the zoned tables to the map. The images act as a symbolic key to the tables in so far as they locate themselves, readily, if only roughly, in a wider context on the map. The reduction of their function to visual labels for roughly defined areas of the sky, which permitted Lacaille to articulate his drawings autonomously from the stars on the map (it was sufficient that they should be easily distinguished from one another) also affected the status of the older constellations as far as pragmatics is concerned. It is characteristic of the conservatism of celestial cartography

**22 The Painter's Easel from Johann Elert Bode, *Uranographia*, Berlin, 1801. Cf. 21.**

that despite the restricted function of the figures—and indeed the restricted function of the map itself—in relation to the ever-growing star catalogues, the detailed forms of Lacaille's constellation figures were slavishly copied on most later maps, and even provided with additional graphic elaboration **(22)**.

Although the constellation figures ceded much of their former role to the co-ordinate specifications, the catalogues continued to associate new discoveries with constellations, as if this redeemed them as objects of knowledge. We have just seen how the proliferation of new objects compromised the ability of a figure to *form* the stars into a constellation or, for that matter, for the stars to close together in a figure. In other words, the mimetic aspect of constellation, however involuted it might always have been, seemes to fade. At the same time, the 'iconic' aspect of the constellation figures (old and new) as pictures of things inscribed on the map began to fail its original purpose. From functioning as a system articulated graphically and bound by various narratives, the figures became instead a collection of symbolic objects scattered apparently arbitrarily across the sky, like the useless tools strewn around the dejected figure in Dürer's engraving *Melencolia I* **(115)**. The constellations, however, retained a pragmatic role as long as observing instruments which could be set directly to co-ordinates were not widely available. The situation called for a revision of the idea of constellation and a graphic form which could reconcile the catalogues with the maps.

Robert de Vaugondy's *Uranographie* (1763) appears to have been the first map to propose constellation boundaries. Vaugondy's way of justifying his reform pragmatically attests to the continuing sway of tradition: 'If I have departed from the ordinary route in the manner of representing the constellations, it is not my purpose to strike against the customs accepted up to now; utility alone seemed to oblige me to engage with them.'[36] He explains his scheme as follows:

> I consider the constellations as celestial provinces designated under their proper names, and of which each of the stars carries its own symbol. The colours applied to the contours of each of these regions surely makes the study of the stars easier than those figures whose intermingling features often throw one into error and make one mistake for stars what are nothing of the sort. Moreover, one will not have to worry about to which constellation should be attributed the stars known as 'unformed', which the usual proportions of the figure drawings fail to encompass.[37]

The objective expressed here was not actually achieved before the *Délimitation Scientifique des Constellations* was adopted by the IAU more than 150 years later. Vaugondy's planispheres express the various more or less conflicting conventions of celestial cartography then still in

36 Robert de Vaugondy, *Uranographie; ou, description du ciel en deux hémisphères* (Paris: Antoine Boudet, 1763), p. iii. See **Appendix B** for originals of my translations from the French in Part II.
37 Vaugondy *Uranographie*, p. vi.


23

use, to which he adds his innovation: a web of constellation boundaries. The maps (centred on the equatorial poles) are equipped with graticules for both ecliptic and the equatorial co-ordinates. The view is external, but his constellation figures are based on Bayer, whose maps were geocentric and whose figures were mixed. Vaugondy's versions are drawn only in outline. Constellations introduced since Bayer are drawn in faint dotted lines, although they are delineated by solid boundaries like the rest. The constellations are labelled with their names in French supplemented by anatomical labels (*la Tête*, *la Queue*, *la Jambe droite* and so on). Bayer letters and some proper names of stars are also provided **(23)**.[38]

The lines describing the constellation boundaries thread their way between the stars and negotiate the separation of the domains of each of the constellation figures. This is sometimes a delicate matter where the traditional figures overlap. Since Vaugondy's map included only the most prominent stars, the task of corralling graphically the stars attributed to a particular

**23 The northern hemisphere from Robert de Vaugondy, *Uranographie*, Paris, 1763**

38 The constellation figures were engraved on a separate plate and printed in red. It is not clear whether an edition without the figures was ever published.

constellation is quite easy and yields relatively simple shapes. Provided a shape is closed, it unambiguously divides an 'inside' from an 'outside'. The simpler the shapes, the easier it is to see at a glance which constellation any star marked on the map belongs to. However, this does not necessarily establish the 'provinces célestes' Vaugondy fancied.

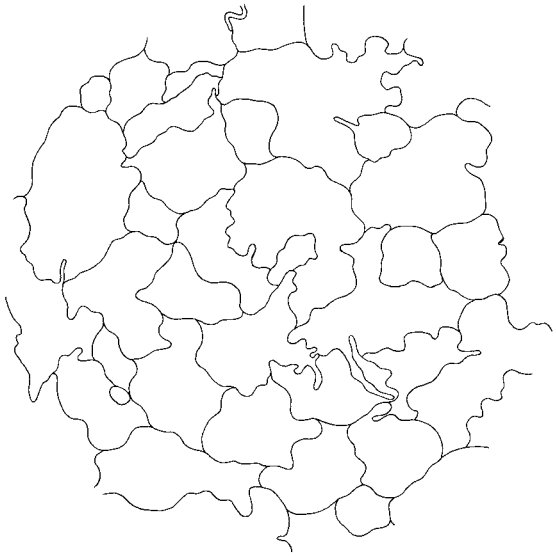
Constellation boundaries were widely adopted in the nineteenth century. However, various cartographic (and epistemological) difficulties arise from Vaugondy's initiative which go to the heart of constellation as a method capable of gathering up discrete particulars and bringing them to the world of signs. The multitude of graphic solutions proposed over the years attests to the persistence of the problem. The comparison of a sample of maps produced between 1763 and 1928 illustrates the struggle for consistency that the *Délimitation Scientifique des Constellations* aimed to overcome (**Appendix C**).

The boundary lines necessarily fall *between* the data recorded on the map. They have no substratum other than the blank surface of the map on which they are inscribed. There is therefore a considerable amount of 'play' in the line. There can be no certainty about the exact extent of the 'provinces' in any objective sense. Nonetheless, *de facto*, the boundaries describe a set. In this respect, the lines are certainly definitive, but *only* for that particular map. Their authority is asserted by the graphic gesture alone.

The definition of the constellation-set in this way potentially rivals the authority of the set already defined by the ascription of stars to constellations in the catalogues. The two ought to agree in so far as the ultimate reference for both the catalogue designations and the constellation boundaries is the form of the constellation figures drawn on earlier maps. However, the catalogues, revered as archives of knowledge accumulated and refined over centuries, preserved many anomalies resulting from assigning 'unformed' stars uncertainly or mistakenly. Map-makers who tried to reconcile cartographic with astronomical authority exhibited such anomalies graphically. Warner remarks that in Johann Elert Bode's *Vorstellung der Gestirne* (1782) the author's literal adherence to Flamsteed's catalogue 'led to ludicrous gerrymandering.'[39] Graphic simplification of the over-complicated jigsaw puzzle of constellations which resulted from such pedanticness would imply a correction of the accepted catalogue designations, but would still be unable to shake off the arbitrariness that goes with the status of being in-between things.

The ambiguity of constellation boundaries is this: in tracing themselves on the surface of a map they are definitive, but arbitrary. It is not possible to predict from knowledge of the discrete objects they encompass how the boundaries should be drawn any more than it was possible to predict the forms of the constellation figures (which the boundaries echo vaguely). In order to lend a semblance of objectivity to a scheme of constellation boundaries—to overcome the autonomy of the line—cartographers sought to attach an ulterior 'sense' to the graphic pattern. In other words, to assert the 'sign-vehicle' (the line) as a sign. On some maps this consists in imposing a stylistic unity on the pattern of constellation boundaries such as

39 *The Sky Explored*, p. 36.



**24**

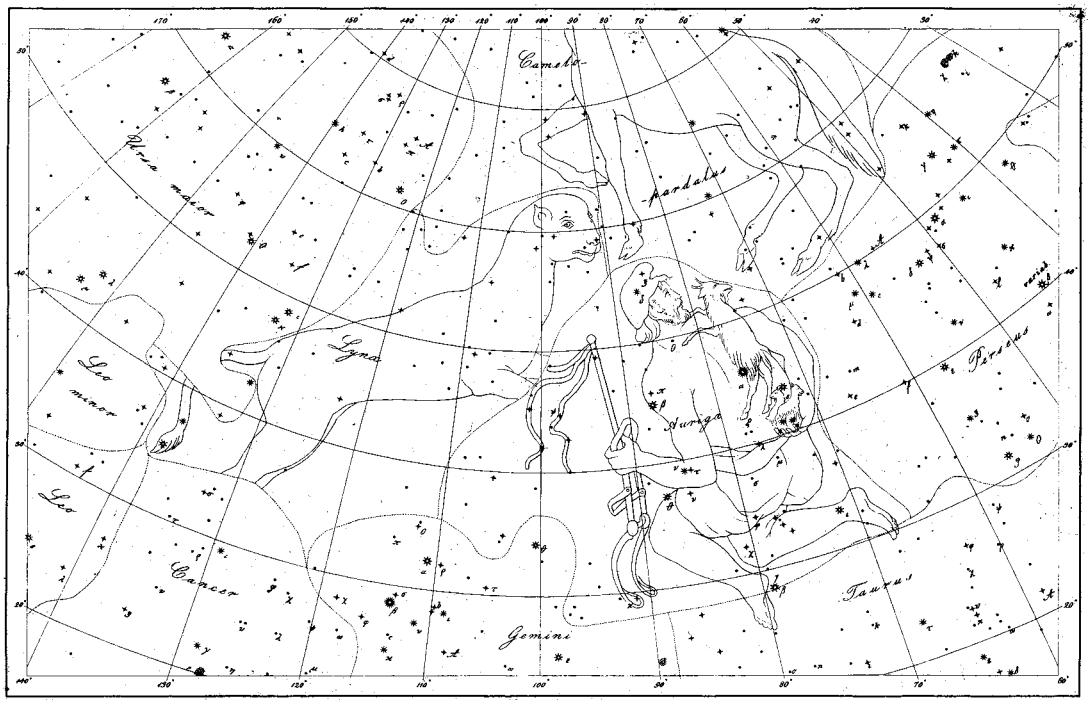
the arabesque-like web of meandering lines which describe the constellations on Wollaston's *Celestial Hemispheres* (1809) **(24)**. Argelander's *Uranometria Nova* (1843) is outstanding for the graphic sophistication it displays in reconciling the boundary lines with the constellation figures also inscribed on the map **(25)**.[40] Other maps borrow from the language of terrestrial cartography. In Kendall's *Uranography* (1844), according to the author, 'the dotted boundary line marks the space allotted to each constellation in the heavens, in the same manner as nations and provinces are designated in common geography.'[41] This atlas 'designed for academies and schools' showed the traditional constellation figures in subdued outlines and the constellation-territories filled in various colours as on a political map. 'Geography of the Heavens' was the title of more than one popular atlas in the mid-nineteenth century. The *Délimitation Scientifique des Constellations* finally aligned the boundaries with the equatorial grid standing at epoch 1875.

Bode's celebrated *Uranographia* (1801) is sometimes given credit for introduction of constellation boundaries. Although there are several eighteenth century examples following Vaugondy, it is true that Bode's atlas was the more influential. I would like to examine it in a little more detail. Bode's graphic solution for the constellation boundaries was adopted by several of his successors although they discarded most other features of Bode's maps. The boundaries proposed in *Uranographia*, I think, are open to two different interpretations. But before commenting, I would like to put them in context.

Bode's atlas is often cited as the terminus of an era of celestial cartography which began in the Renaissance. In Warner's words, 'the successor to the celestial atlases of Bayer, Hevelius, and Flamsteed, [*Uranographia*] was the most extensive and the last great atlas of its kind.'[42] But

**24 The pattern of constellation boundaries after M. Wollaston, *Celestial Hemispheres*, London 1809**

40 In 1867, the Astronomisches Gesellschaft expressed the wish that Argelander's boundaries should be accepted as standard. This wish was not fulfilled.
41 E. Otis Kendall, *Uranography; or, a description of the heavens* (Philadelphia: Butler & Williams, 1844), p. v.
42 *The Sky Explored*, p. 39.

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it is also worth considering its position at the beginning of an era in which the role and the means of representation of the constellations was (more or less radically) reassessed.

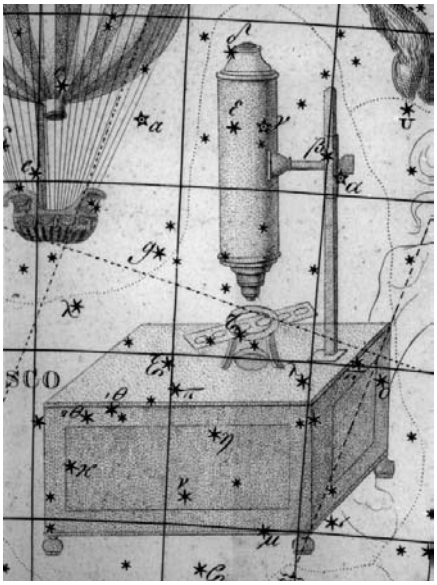
*Uranographia* consists of twenty very large engraved plates (560 × 760 mm): eighteen centred on the major constellations and two hemispheres centred on the equinoxes. It maps 17,240 stars as well as a large number of double stars, nebulae and star clusters. It is organised into around a hundred constellations, including five appearing for the first time in this atlas.[43] The detailed maps feature boundaries to define each constellation. Equatorial and ecliptic graticules and 'Bayer letters' are also provided.

Although the presence of constellation boundaries suggests an awareness of the limitations of constellation figures amidst the proliferation of stars, there is no other reflection of this in the design of *Uranographia*. In fact, the constellation pictures are nowhere more elaborate than on this map. Three different styles of engraving are used: when they appear near the centre of the plate, cross-hatching is used to model the Ptolemaic and sixteenth century constellations and a stipple technique for the later constellations; constellation figures near the edges of the map appear in outline. The iconography of the figures is derived from a variety of sources and, as I have already mentioned, in some cases is entirely new **(22, 26–27)**.

Given the freedom with which map makers approached the design of constellation figures, it might seem surprising that an undertaking as grand as Bode's *Uranographia* should not have been taken as an opportunity for reform or simplification. Instead it appears to have

**25 Lynx and Anviga from F. W. A. Argelander, *Uranometria Nova*, Berlin, 1843**

43 Felis (the Cat), Globus Aerostaticus (the Hot Air Balloon), Lochium Funis (the Nautical Log), Machina Electrica (the Electrical Machine, depicting an electrostatic generator and prime conductor) and Officina Typographica (the Printer's workshop). Bode also accords the what are known as the Magellanic Clouds (actual star clusters) the same status as the constellations, with titles (Nubecula Major and Minor), boundaries and symbolic figures, in this case pictures of clouds **(27)**.

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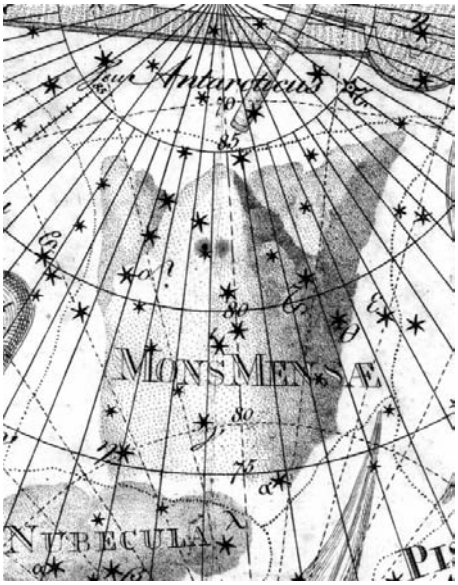


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been taken as an opportunity for a display of the engraver's art. It is possible that the exuberance of Bode's map did as much to promote the increasing drive towards the elimination of atavistic features of astronomical mapping as it did to renew the vigour of those traditions. But Bode's map itself does not give any suggestion that the simplification of the constellation figures was for him either interesting or desirable.

The constellation boundaries in *Uranographia* were revised after those inscribed on his earlier *Vorstellung der Gestirne* which I already mentioned in connection with 'gerrymandering'. The new boundaries rationalised some of the more bizarre results of the earlier effort to follow faulty catalogue designations (although Bode was criticised for this too). Instead of drawing a smooth curve, Bode imparted an arbitrary wobbliness to the dotted lines which describe the network of constellation boundaries. On the one hand, this could be interpreted as expressing an admission of the uncertainty which goes with the in-betweenness of the boundary line. On the other hand, in so far as it is reminiscent of the kind of patterns found on terrestrial maps, it appears to seek authority for the boundaries by mimicking a typical pattern of political borders. Typical, that is, for the old world, where territories tend to be divided along the lines of natural features of the landscape such as rivers or mountain ranges.

Put in the terms of semiotic analysis, the star map is seen to borrow a characteristic behaviour of a line from a terrestrial map (where it would have an 'iconic' and, ultimately, an 'indexical' authority as a trace of a natural process) and deploy it 'symbolically'. By mimicking the other sort of map, the constellation boundaries refer and indeed aspire to the status of political boundaries. However arbitrary the latter might be, they are always capable of being read, marked or contested on the ground. But the constellation boundaries cannot point to any such reality which could fill the place of a 'referent'. Like political boundaries, constellation bound-

**26 The Microscope from Johann Elert Bode, *Uranographia*, Berlin, 1801**

**27 Table Mountain from Johann Elert Bode, *Uranographia*, Berlin, 1801**

aries appeal to a community for agreement, but have no real grounds on which to do so. The behaviour of the line is thus made to evoke a status the line cannot actually achieve.

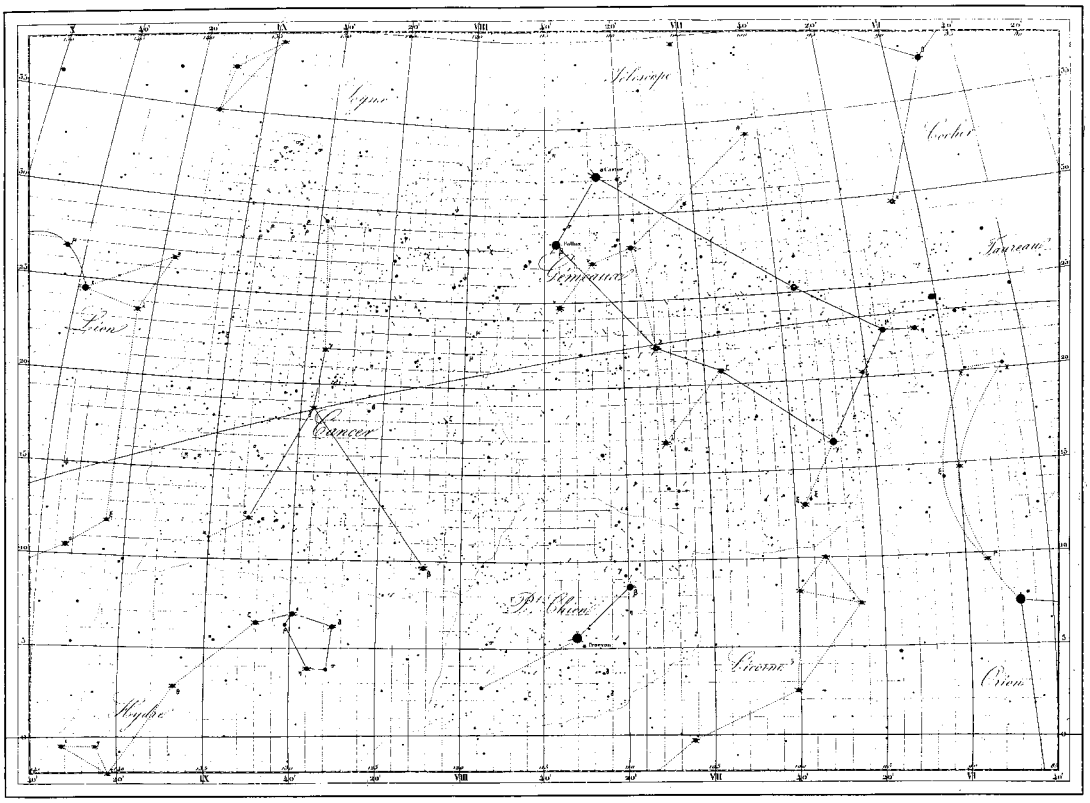
The palimpsest-like quality of *Uranographia*, its overwriting of various constellation 'scripts' makes it something of a lesson in the history of celestial cartography. In this sense it probably deserves the epithet 'monumental' not just because of the size of the plates. But it by no means foretold future directions. As well as making an ostentatious display of honouring the canon, it introduced new constellations representing the technology of the recent past, but in an archaic style. It inscribed a new form of constellation to encompass the old. The new nonetheless depended on the old form, from which it could only establish a factitious independence. The continuous substratum to which the new form appealed matched the imagined objecthood of the traditional figures, but was no more capable than they of establishing an objectivity for the constellations to match that of the discrete objects constellated in the sign.

Despite what is said about Bode's atlas being the last of its kind, a review of star maps produced in the nineteenth century shows that there is no clear break in the tradition of celestial mapping. As long as star maps were intended to mediate the knowledge accumulated by generations of astronomers and assimilate new discoveries within established forms of representation, then one should not expect to find such a break. However one can observe during the nineteenth century a growing divergence of the cartographic needs of professional scientists on the one hand and educators and amateur astronomers on the other. Though it is not possible here to set out all the technological and social conditions which contributed to the growth of popular astronomy, it is worth mentioning that the cultural heritage of astronomy played an important role in the presentation of products to the student or hobbyist. Indeed, the cultural heritage of astronomy was also one of the important selling points of *Uranographia* as much as it had been of the Renaissance atlases. Popular maps continued to show traditional constellation figures and/or constellation boundaries as well as new ways of representing the constellations.

The successors of Bode's atlas on the professional side reflect the rate of accumulation of knowledge of astronomical objects. Whereas in 1801 Bode had recorded the positions of about 17,000 objects amidst what one might call his museum of constellations, Carl Ludwig Harding's *Atlas Novus Coelestis* (1822) included around 60,000.[44] By mid-century Charles Dien's *Atlas Céleste* marked out over 100,000. Boundaries derived directly from Bode were used in both these atlases, where they appeared as the graphic vestiges of the elaborate constellation equipment preserved by Bode. Harding's atlas eliminated everything else except text labels identifying the patchwork of constellations. His maps were not organised around the constellations, but divided the sphere according to the grid. Harding also simplified the star notation.

Dien, in acknowledging his forerunners in the preface to the first instalment of his atlas also found fault with their presentation.

44 From the north pole to 30° south.




**28**

> The figures of men and animals which are still found traced on [Bode's *Uranographia*] greatly spoil the look of the constellations and make their configurations hard to grasp. [...] [Harding's *Atlas Novus Coelestis*], which contains an immense quantity of stars down to the tenth magnitude, is the most complete work that has ever been published. Everything—the configurations, the magnitudes etc.—is represented with an astonishing exactitude. The more one compares it with the sky, the more one recognises how much its author deserves the gratitude of astronomers. [...] It is regrettable then that the graphic presentation of this work does not match the exactitude of its data: the signs representing the stars are not well differentiated, it is difficult to judge their relative magnitudes; the constellations are spread over several sheets: Taurus, for example, is chopped up on three plates, Virgo on five, etc. which is sometimes awkward; the graticule is traced uniformly degree by degree; nothing distinguishes, for example, the hour circles, which, given the large format, can lead to errors in the positions one would like to determine.[45]

On his own effort, Dien notes, 'The plates are organised in such a way as always to give entire constellations. [...] The constellation names are placed, with reference numbers, out-

**28 Gemini, Cancer and Canus Minor from Charles Dien, *Atlas Céleste*, Paris, 1865**

45 Charles Dien, *Atlas du Zodiaque* (Paris: Bachelier, 1841), pp. 5–6. Dien states, 'This atlas is intended particularly to aid the search for and observation of comets, nebulae and telescopic planets.' (p. 6) He therefore expected the user to be equipped with a powerful telescope.

side the frame, so as to spoil the effect of the stars as little as possible.'[46] (In later editions, Dien restored the text labels to the maps probably because the reference numbers on the first edition were very hard to find.) But Dien does not draw attention to the fact that the boundaries he has drawn are copied from Bode (and/or Harding) or to the lines he drew on his maps between the brightest stars within a constellation. In the preface to the later edition he says, without further explanation, 'I also traced geometric figures linking the principal stars of each constellation in the most natural way in order to make the study of them easier **(28)**.'[47]

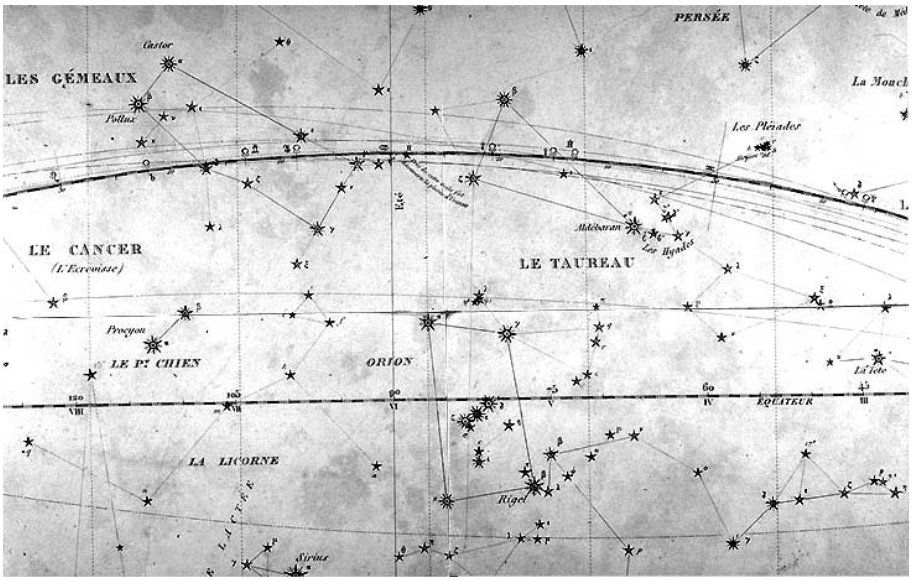
The 'configuration' of the constellations which, Dien claims, Bode's constellation figures obscured and Harding had rendered with astonishing exactitude, seems to refer to the way the individual stars are plotted. The 'figures géométriques' in this context could serve two possible purposes which might touch on Dien's notion of the 'configuration'. Dien uses a range of dots and discs to indicate the brightness category to which each star belongs. The scale of magnitudes which astronomers use is a logarithmic scale. The observed differences in brightness between the categories are therefore much greater than would be possible to represent on a map (most of the stars on the map, it will be remembered, are invisible to the naked eye). By linking up the brightest stars (solid lines between the brightest categories, dashed lines between the next brightest), the map is able to point out those stars which stand out to the naked eye and which might otherwise get lost amongst the mass of black dots. The lines therefore function as an unobtrusive and economical supplement to the star notation. It is, of course, by the configuration of these most prominent stars, traditionally identified with the anatomy of the constellation figures, that the constellations were usually recognised in the sky.

In so far as the lines form distinctive graphic signs (which I shall call joining-the-dots figures), they could also serve another function, especially in the absence of text labels for the constellations delineated only by faint boundary lines. That is, they assume the 'indexical' function of the traditional constellation figures which, on their own, the constellation boundaries failed to fulfil. It is notable that an index map provided with the Dien's first edition of charts carries joining-the-dots figures which match the detailed maps and text labels (which were absent from the detailed maps in this edition) but constellation boundaries that are different from the detailed maps.

Although the *Atlas Céleste* project extended the application of the form and doubtless helped disseminate it, joining-the-dots figures first emerged (in western astrography) in a different context. Dien himself had earlier published a planisphere (*Uranographie*, 1830) aimed at the amateur or educational market on which similar (although not the same) joining-the-dots figures were used to indicate the constellations. This map showed only naked-eye stars, no star was left 'unformed' and the joining-the-dots figures were the only means by which the constellations were separated from one another **(29)**.

Dien's claim that his 'figures géométriques' were somehow 'natural' is not self-evident.

46 *Atlas du Zodiaque*, p. 7.
47 Charles Dien, *Atlas Céleste* (Paris: Mallet-Bachelier, 1865), *Avertissement*.

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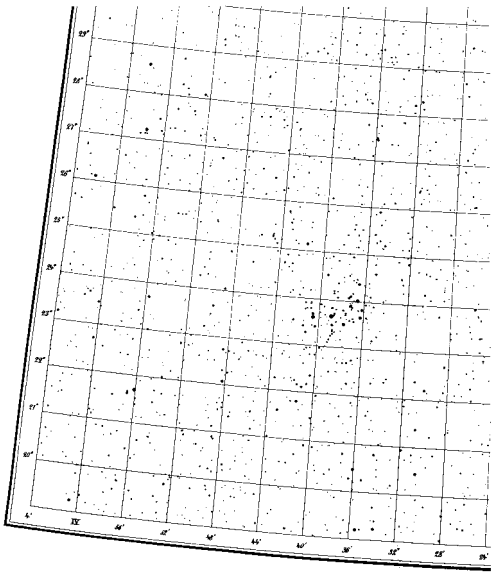
The acceptance of joining-the-dots figures as proxies for the traditional constellation figures (which, as we have seen, never attempted to link stars together nor aspired to geometric forms) warrants investigation, especially in view of the prevalence the style achieved in the twentieth century. The ubiquity of the form seems, like that of the traditional constellation figures before them, to have obscured their historical origins.

**Memo 10: Last of a Kind**

If one were to name the map which could be most convincingly regarded as the last in the tradition stemming from the Renaissance interpretation of Ptolemaic astronomy it would be Friedrich Wilhelm August Argelander's *Atlas des Nördlichen Gesternten Himmels* (1863). This map, however, does not resemble any of its predecessors. Visually, it has characteristics which relate it more closely to later atlases, but these were produced under a different regime of representation. Argelander's atlas is the companion to the catalogue known as the *Bonner Durchmusterung* (BD) which was the result of a sky survey undertaken by Argelander and his assistants beginning in 1852. The catalogue and the maps reflect the ambitions and capabilities of astrometry in the middle of the nineteenth century. The goal of the survey was to obtain a position and estimated visual magnitude for every star visible with the 78mm Bonn telescope. Later extended to cover the whole sky using observations from Cordoba (Argentina), by 1914 the survey numbered more than a million stars. The BD is remarkable for its systematic ambition, organisation and methodology. The positions and magnitudes of stars were recorded as they transited the field of view of the telescope fixed at the mean declination of each zone.

Cartographically, the *Atlas des Nördlichen Gesternten Himmels* consists of the symbolic notation of 324,198 stars positioned by hand within the co-ordinate grid. The range of

**29 Charles Dien, *Uranographie* (detail), Paris, 1830**



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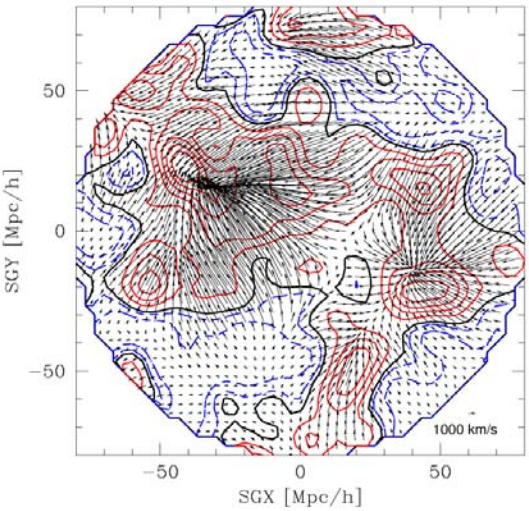


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magnitudes is indicated by small black dots of different sizes, with rays for the brightest stars **(30)**. This much it has in common with previous atlases. The most striking difference between the BD charts and earlier representations of the starry sky is that they have abandoned all reference to the constellations: figures, boundaries or labels. Neither are individual stars named or labelled. Effectively, the whole sky is represented as a single constellation. The map is, explicitly, a testament to the systematic nature of the survey and, implicitly, a monument to this type of knowledge. Consequently (it could be argued) it displays a nakedly disorganised cosmos; in Lissitzky's phrase, 'a scattering of dots as fine as dust.'

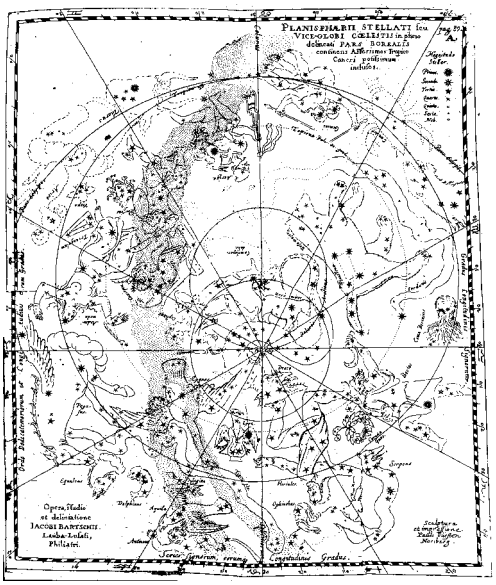
Before the BD was complete, celestial cartography began to be transformed by astrophotography, which introduced indexical 'reagents' to astronomical representation. Other techniques developed in the late nineteenth century added astrophysical and three-dimensional data (spectra, parallax, proper motion) to the basic astrometry which had sustained astronomy as a science since Ptolemy. Astrographers therefore had to contend with a proliferating repertoire of newly differentiated celestial objects. As the scientific objectives of professional astronomers extended beyond the solar system, mapping focused more on statistical analysis of data than on bare positional astronomy **(31)**.

Early examples of joining-the-dots figures are isolated and rare before the turn of the nineteenth century. Jacob Bartsch in his *Planisphærii Stellati* (1624) picked out the asterism known as the Plough or Big Dipper within Ursa Major by linking the seven stars with dotted lines. This gesture was not repeated elsewhere in the book or in other maps of the period **(32)**.

In the seventeenth century, the Chinese system of constellations became known in Europe

**30 F. W. A. Argelander, *Atlas des Nördlichen Gesternten Himmels* (detail), Bonn, 1863**

**31 Data on some 15,500 galaxies surveyed by IRAS PSC Redshift Survey plotted as real space density and velocity fields shown in a slice along the Supergalactic plane.**

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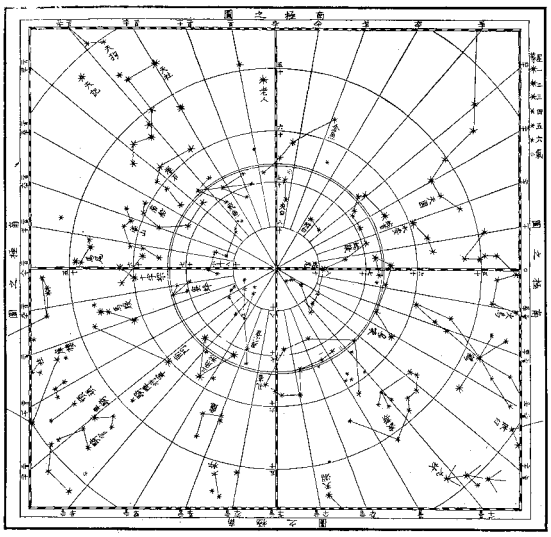

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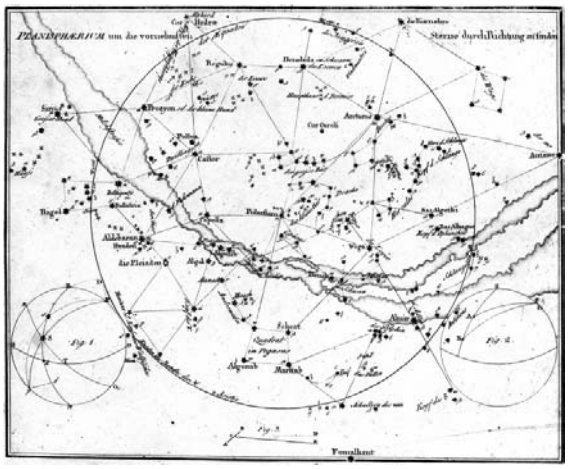
through the work of Jesuit missionaries. The Chinese constellations—entirely independent of western astronomy—were traditionally marked on star maps using joining-the-dots figures. Star maps combining western knowledge with Chinese traditions were printed, but do not appear to have been widely circulated. The maps included adaptations in Chinese style of the southern circumpolar constellations adopted by western astronomers at the turn of the seventeenth century but previously unseen by Chinese astronomers **(33)**. These 'translations', however, were not intended primarily for European consumption.[48] In 1781, the French orientalist Louis Joseph de Guignes presented to the Académie Royale des Sciences maps showing both the western and Chinese constellations. The dual-system maps were published in 1785.

The kind of 'finder' charts that were widely published in the nineteenth century—designed to help amateur astronomers and trainee navigators—in which the brightest stars were connected across a whole hemisphere in a network of lines, might have had precursors in the eighteenth century, but I have not discovered any **(34–35)**. A chart published in 1782 of the Pleiades (in the constellation of Taurus) shows something similar on a tiny scale. It is a

**32 The northern hemisphere from Jacob Bartsch, *Planisphaeri Stellati*, Strasbourg, 1624**

**33 The southern hemisphere from Maria Francesco Grimaldi, *Chinese Star Chart*, Beijing, 1711**

48 The first map of this type to reach Europe was a copy of the *Double Stellar Hemisphere* prepared by the Jesuit astronomer Johann Adam Schall von Bell for the Chinese emperor (1634). Schall von Bell adapted a western star catalogue to the Chinese conventions of astrography. From the southern circumpolar constellations then accepted by western astronomers, he derived a set of asterisms in the Chinese joining-the-dots style. He justified this addition to the Chinese canon as follows: 'In the southern hemisphere // beyond the visible stars there are the stars in the zone of invisibility near the pole. These stars do not figure on the old maps. But, though they are not directly visible from our various provinces, they are visible from the coast down to Malacca. These parts belong to the sphere of sovereignty of // our country; how can the stars visible there be excluded?' and explained his procedure: 'Because of this reason, we observed a certain number of stars which formed a certain number of constellations and added a certain number of stars and a certain number of constellations [...] But because hitherto they were not combined into figures, they bore no name; therefore words transliterated from their original names have been used [...].' Pasquale M. D'Elia, 'The Double Stellar Hemisphere of Johann Schall von Bell S.J.', in *Monumenta Serica,* 18 (1959), pp. 348–356. The 'transliteration' of the 'original' names of these constellations, presumably the ones attributed to Keyser and Houtman, suggests that the names Schall von Bell applied would have no meaning in Chinese, just as the graphic signs he produced seem to have no figurative meaning. Grimaldi's *Chinese Star Chart* (1711), apparently drawn in Italy, but published in China, was based on Schall von Bell's planispheres and, in turn, was the model for de Guignes concordance.



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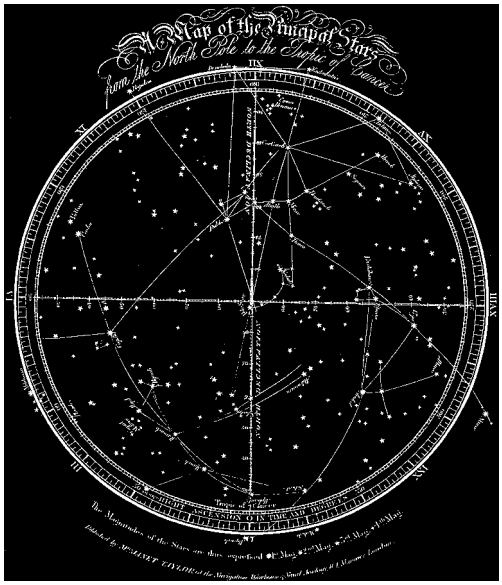


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detailed telescopic observation only a few degrees in extent in which sixty-four stars are connected by straight lines. The configuration, however, is difficult to interpret.[49]

Even where the symbolic object associated with the constellation might have suggested joining-the-dots, it did not occur to Bode to alter the traditional way of drawing constellation figures. Lochium Funis, the Nautical Log, which Bode introduced to accompany Pyxis Nautica, the Mariner's Compass (thus completing the celestial navigators' equipment for dead reckoning), is a knotted string: literally a line with nodes. The image of a rope coils between the stars, picking up some of them on the way, but no knot coincides with the position of any star **(36)**.

**Memo 11: Tracks of Birds and Patterns on the Shells of Tortoises**

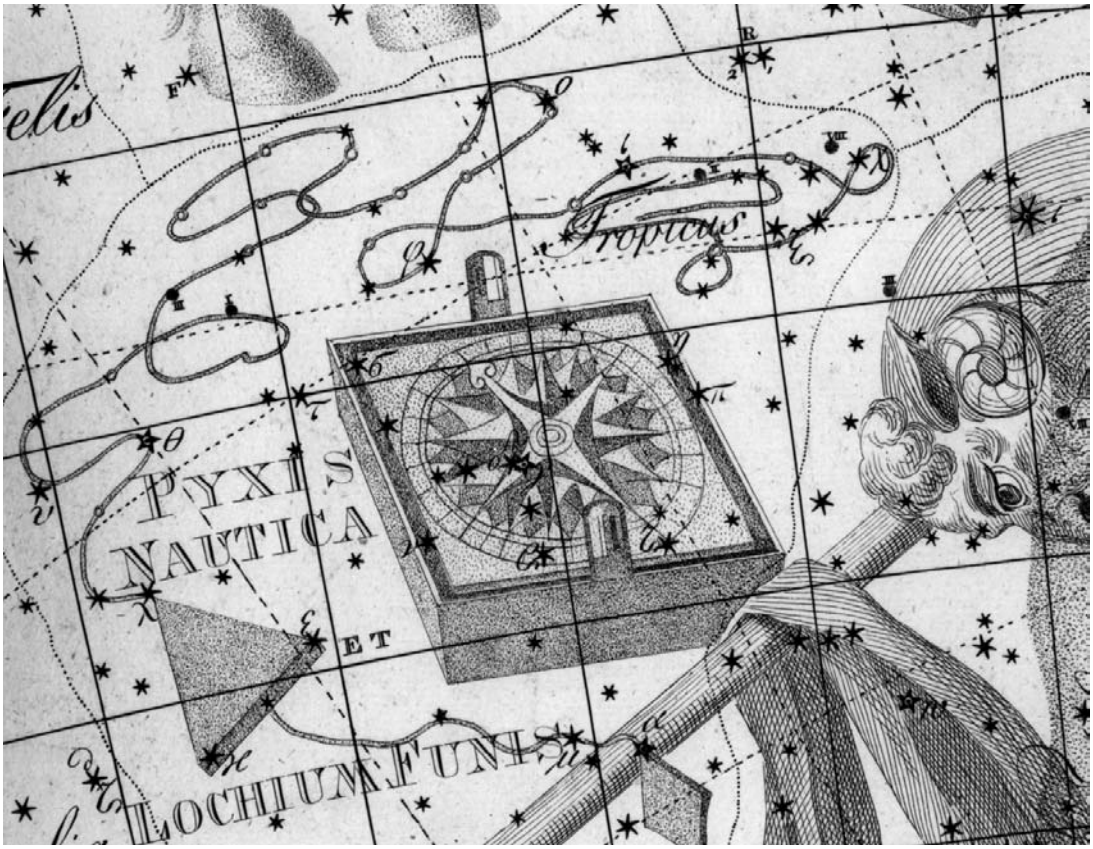
Some of the earliest extant Chinese inscriptions (c. 1300 BCE) mention astronomical phenomena in relation to named stars or star groups. The distinctive system of Chinese astronomy, the twenty-eight *xiu*, or lunar lodges, is known from fifth century BCE. The *xiu* form a set of asterisms which calibrates the equator in a manner comparable with the way the signs of the Zodiac divide the ecliptic in Mesopotamian-Greek astronomy. An inscription on a lid of chest buried in 433 BCE is the earliest known complete list of the *xiu* **(37)**. It shows the determining constellations of the *xiu* in a stylised form of the notation which is characteristic of Chinese star maps. It is notable that the constellation signs here appear alongside illustrations of mythological creatures, animal and other nature symbols, hexagrams and character writing in the style known as 'seal script'.

There is evidence to suggest that around 300 BCE Chinese astronomers already recog-

**34 The 'finder chart' from C. F. Goldbach, *Neuester Himmels-Atlas*, Weimar, 1799**

**35 The northern hemisphere from *Mrs Janet Taylor's Planisphere of the Stars*, London, 1846**

49 Map by Edme-Sébastien Jeaurat. See *The Sky Explored*, p. 134.

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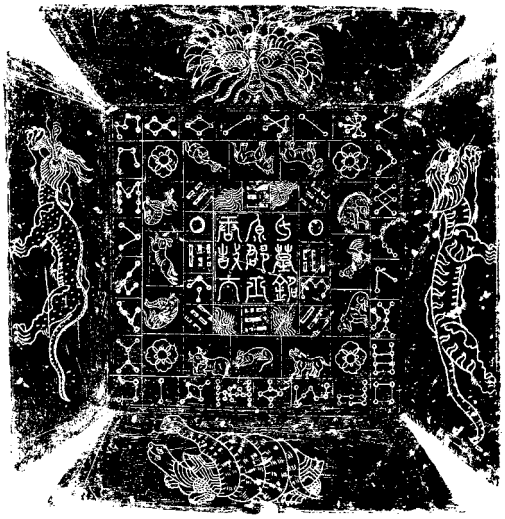
nised nearly three hundred asterisms forming the basis of the Chinese tradition of astrography which developed independently of western astronomy until the intervention of Jesuit missionaries in the seventeenth century. The most striking differences between the Chinese sky and the western version are: the number (around 300) and size (some containing only a single star) of asterisms, the lack of concern about recording the relative brightness of the stars and the graphic form of constellation in which stars are linked together by lines in various chains, patterns and shapes. Symbolically, the constellations were mainly associated with a heavenly model of the world of the court, bureaucracy and the various strata of society ruled by the Chinese emperor, who was the chief client of the Chinese astrologers. The graphic notation of the constellations does not suggest any figurative intention in the representation of the 'celestial officials', as the constellations were known **(38)**.

The distinctions between writing, picture-making and map-making which are readily drawn within western culture – and which probably influence the neatness of the triad, 'symbol,' 'icon,' 'index' – are not so easily made when dealing with the Chinese. Cordell D. K. Yee warns that in an interpretation of Chinese graphic arts including map making 'The usual opposition between visual and verbal, cartographic and pictorial, mimetic and symbolic representation may not apply.'[50]

**36 The Nautical Log and Compass from Johann Elert Bode, *Uranographia*, Berlin, 1801**

50 Cordell D. K. Yee, 'Chinese Cartography among the Arts: Objectivity, Subjectivity, Representation' in *The History of Cartography,* ed. by J. B. Harley and David Woodward, vol. 2, bk. 2 (1994), p. 128.



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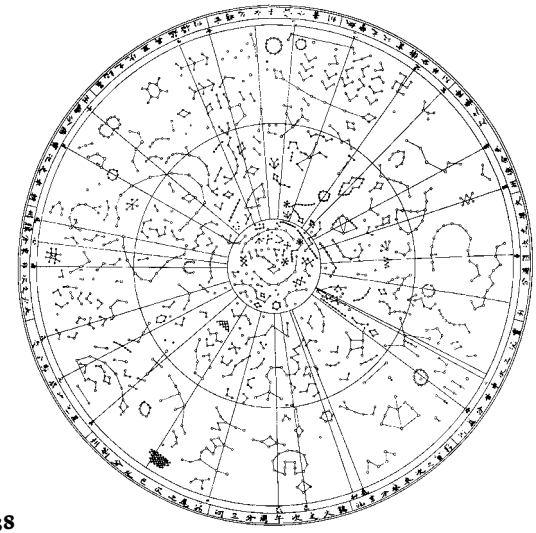

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The Chinese system of writing preserves pictographic and ideographic elements that are almost completely displaced in the alphabetic scripts which dominate western culture. In this context, Chinese astrography suggests a form of 'star-writing' rather than 'star-pictures', as the constellations are normally understood in the west. Indeed, among the many forms of Chinese calligraphy, 'There are, or were in the past, more than one hundred ornamental scripts with fancy names, such as the script of precious stones, the script of the stars, of the clouds, of the dragons, of the birds, of the bells & vases [...] and many magic scripts.'[51] The legendary origins of Chinese script are associated with various kinds of natural signs including the patterns among the stars, the marks made by birds and the patterns on the shells of tortoises from which words/characters were derived in a visionary act of interpretation.

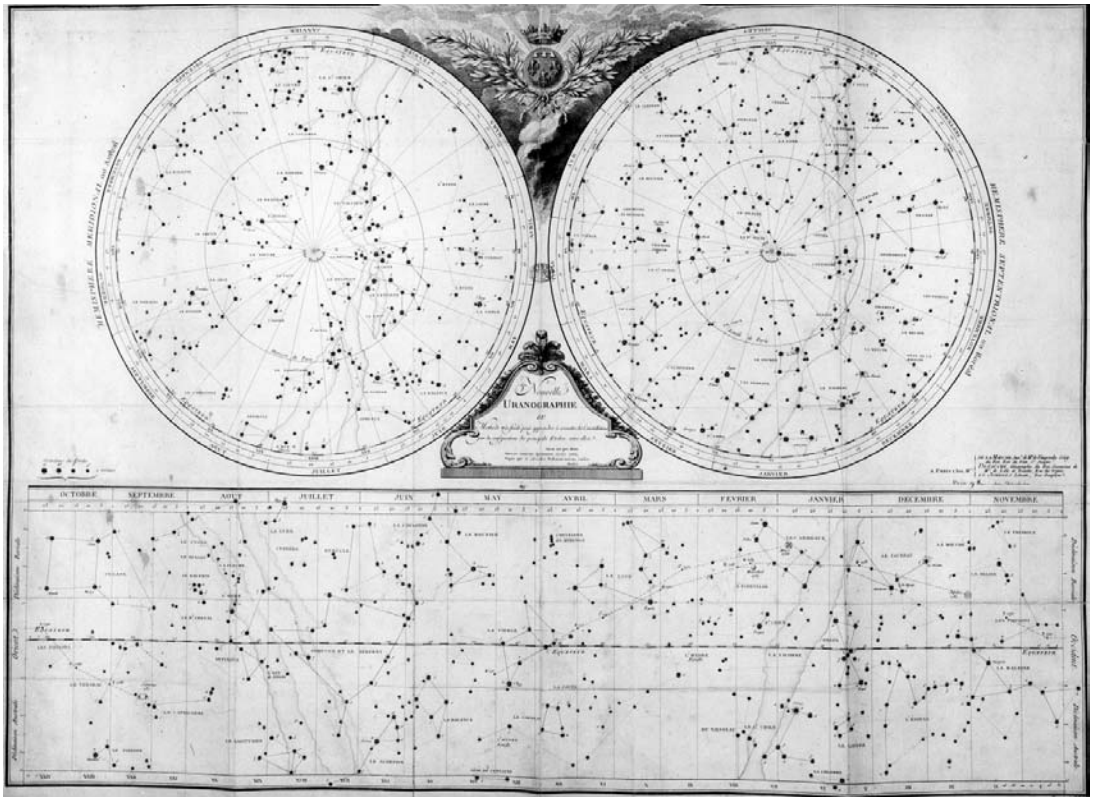
The earliest attempt (in the western tradition) at reconstructing the canon of constellations by means of 'geometrical', or joining-the-dots figures is the *Nouvelle Uranographie ou Méthode très facile pour apprendre à connoître les constellations par les configurations des principales étoiles entre-elles* (1786) by Alexandre Ruelle **(39)**. As the title spells out, the project was placed in the service of education. As with the introduction of the instruments of science and art to the pantheon of constellations earlier in the eighteenth century, it is possible to see in Ruelle's effort an Enlightenment agenda. Like Lacaille's, it was not without equivocation. Ruelle did not question the institution of the constellations, but he aimed to advance the cause of disillusionment.

The rationale Ruelle offers does not rely on mathematics, technology or exotic carto-

**37 An inscribed tomb lid from Nantong, Jiangsu province, (Southern Tang Dynasty) from *Album of Ancient Chinese Astronomical Relics*, Beijing, 1980**

**38 A typical Chinese star map (drawing of a map from Longfu Temple 1453) from *Album of Ancient Chinese Astronomical Relics*, Beijing, 1980**

51 David Diringer, *The Alphabet: A Key to the History of Mankind* (London: Hutchinson, 1947).

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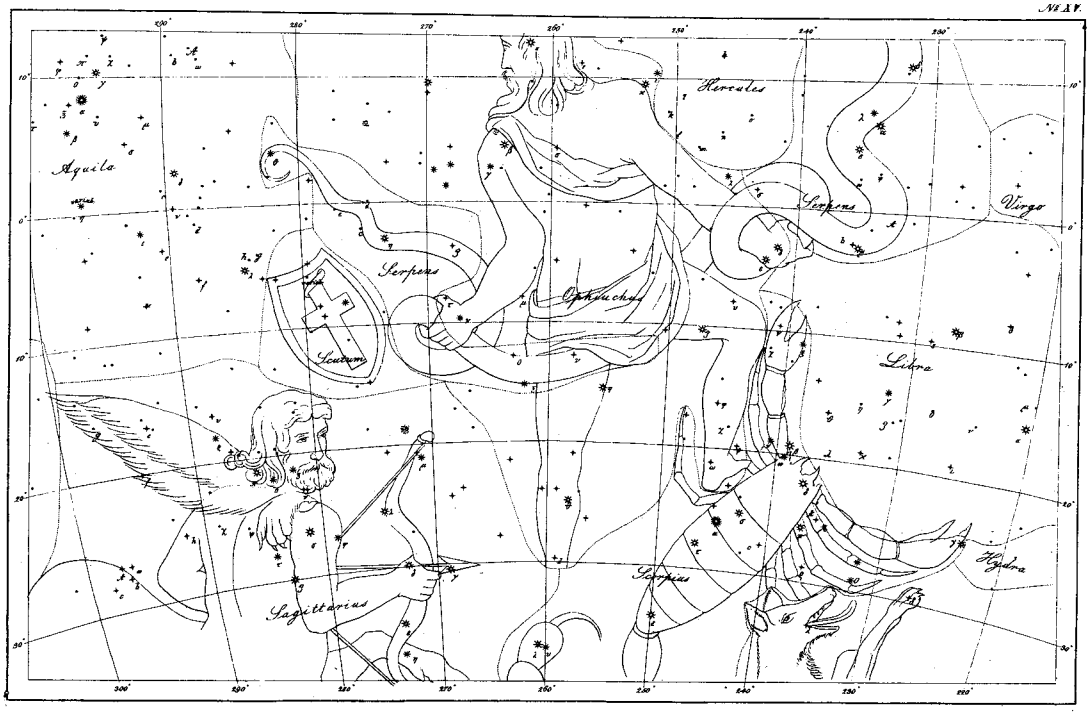
graphy (we can only speculate on their possible influence). It is directed towards obviating an unreasonable expectation of any resemblance or relationship between the traditional constellation figures and the groups of stars designated by them:

> The figures of men and animals that the ancients assigned to the constellations in order to distinguish the various groups of stars which were noticed in the sky do not have, in the way they are drawn, anything to do with the respective configurations of these stars. To be sure, they serve as an aide-mémoire, but cannot help anyone who is looking up at the sky for the first time to recognise the constellations. He would search in vain for that Orion, that Andromeda, that Hercules of which nothing [he could see] would offer him the least resemblance, or the least connection with these characters.
>
> I thought there could be no simpler and easier way of teaching the knowledge of the sky than to substitute for these fantastic figures triangles, squares, polygons or other geometric figures which really make visible the various groups of stars by supposing the brightest stars of each constellation linked together by lines.[52]

The map consists of a pair of planispheres and a map of the equatorial region printed on one large sheet and an explanatory booklet. The maps show only the brightest stars, joined

**39 Nouvelle Uranographie by Alexandre Ruelle, *Nouvelle Uranographie ou Methode très facile pour apprendre à connoître les constellations par les configurations des principales étoiles entre-elles*, Paris, 1786**

52 Alexandre Ruelle, *Nouvelle Uranographie; ou, Methode très facile pour apprendre à connoître les constellations par les configurations des principales étoiles entre-elles* (Paris: de la Marche, 1786,) p. 1.

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within their traditional designations by (mainly) straight lines. The graticule is calibrated as a calendar to assist finding the stars at any time of year **(39)**.

Ruelle's aim of simplifying the process of teaching and learning does not lead him to attempt a simplification of the traditional constellation figures, nor to a way of dealing with the problem of 'unformed' stars. The *Nouvelle Uranographie* is a wholesale substitution of the traditional figures with new ones derived by drawing lines between the stars he marked on the map, apparently without reference to any existing image or symbol. Semiotically speaking, Ruelle's project compares with Schiller's reconfiguration of the constellations as biblical characters (1627) rather than to a simplifying reform such as Argelander's *Uranometria Nova* (1843). Argelander's atlas of naked-eye stars provided subtly drawn constellation figures, based on Bayer and Hevelius, which set a standard for clarity **(40)**. It is worth underlining that the kind of graphic reduction and simplification which *Uranometria Nova* brought to such an elegant achievement in no way tended towards the substitution or the elimination of the constellation figures, nor towards joining-the-dots.[53]

Despite Ruelle's claim that his are the figures which 'présentent *réellement* [my emphasis] à la vue des divers grouppes d'étoiles' they came no closer to the elusive essence of a constellation than Schiller's holy characters. Admittedly, Ruelle qualifies his claim, '*en supposant* [my emphasis] les plus brillantes d'une même Constellation liées ensemble par des lignes'. Clearly, the lines are a function of the drawing, not of reality. But it is worth looking more closely at Ruelle's rationale.

**40 Sagittarius, Ophiuchus, Scorpius from F. W. A. Argelander, *Uranometria Nova*, Berlin, 1843**

53 The stars and graticule of *Uranometria Nova* are printed in black. The subdued traditional constellation figures, constellation boundaries, the star- and constellation labels are printed in red. To my knowledge, no edition was printed without the red plate.

The contrast Ruelle draws between the fantastic and the geometric hints at his evaluation or his expectations of geometry. His triangles, squares, polygons and other geometric figures are not quite as innocent of reference as the opposition to the mythological figures might suggest. In so far as geometry (as a deductive science) was held to be the epitome of rationality, geometric figures could be regarded as rational in themselves. So, at least, they had entered the iconography of art and science as ciphers for an abstract or non-referential truth, a necessary truth which could be held in the mind and hence an ideal form of knowledge. Ruelle's scheme recalls Galileo's famous claim that the book of the Universe, in which philosophy is to be read, 'is written in the language of mathematics, and its characters are triangles, circles, and other geometric figures.' (*Il Saggiatore*, 1623) The development of astronomy up till Ruelle's day certainly supported the close kinship of geometry and astronomy among the liberal arts and he could have confidently expected as sympathetic a reception for his geometric figures from his fellows as Lacaille got for placing the geometer's tools (and traditional iconographic attributes) in the southern sky.[54] The *Nouvelle Uranographie*, incidentally, did not include Lacaille's constellations, possibly because the stars were not bright enough.

In terms of other 'iconic' associations connected with his 'geometric' figures, it is possible that Ruelle encountered the transcriptions of the Chinese system of constellations in the work of de Guignes, or even the giant planispheres of Schall von Bell, a copy of which reached Paris. However, a different form of joining-the-dots is more likely to have had an impact through a another cartographic project. France was the first nation to undertake a systematic survey of its territory. Geodetic activity was closely linked with astronomy through its mathematical foundations, through its use of closely related technology (telescopes, micrometers etc.) and through institutions and personalities. Many of the leading astronomers of the eighteenth century were involved in survey or related work, which was an important official function of the Académie Royale des Sciences and of the Observatoire Royale (where Ruelle worked). The survey of France by triangulation was first proposed in 1681 by Jean Picard, who died the next year. The project was taken up by Jean-Dominique Cassini, of the Observatoire Royale, whose name was associated with the work through three more generations of his family. The project survived political mishaps and years of interruption before the triangulation network and a set of eighteen maps were finally completed in 1744. The completion of the survey was a considerable scientific achievement and was a source of national pride. A second survey designed to cover the whole of France in considerably more detail was initiated almost immediately and was completed in 1788, resulting in a map of France in 180 sheets.

The triangulation lines which were marked prominently on the first series of maps introduced a novel graphic feature to cartography, made all the more conspicuous by the map's lack of other information. The focus of this survey being accurate measurement, the fieldworkers had not collected detailed information about land forms, uses etc. It has been

54 See below, Part III for a discussion of the iconography of geometry.

remarked that 'The triangle networks gave visual graphic proof that the maps' content was reliable, in much the same way as architects sometimes expose structural elements to enhance the impression of a building's strength. In any case, the triangle grid became part of every map reader's mental image of France, as if the lines really existed in space.'[55]

The associations described above conceivably encouraged a radical graphic approach and could have influenced its reception. Ruelle's scheme, like Schiller's, is predicated on the fact that the constellations, though credited by tradition with a kind of eternity, might as well be otherwise. It therefore has to seek an ulterior justification to be convincing (through theological reformation, artistic integration or educational utility). Ruelle did not forget the pragmatic aim of his map and in this respect did not hesitate to restore the 'iconic' aspect of the constellation figures as an aide-mémoire. It seems in this respect he objected only to the extravagance of the traditional constellation-pictures. He advises the student to start with certain constellations whose configurations are the most conspicuous and easy to distinguish, for example:

> The Great Bear, of which the seven brightest stars suggest by their disposition the form of a parallelogram of which one side is prolonged and bent. On this longer side one can attach the idea of the tail of the bear, of which the parallelogram represents the body.
>
> The Swan, of which the five brightest stars form fairly well an elongated cross, the four extremities can be regarded as the ends of the wings, the beak and the tail of the bird.
>
> Orion, one of the most prominent constellations of which the five brightest stars, if joined by lines, form two upside-down cones, recalling the idea of a giant hourglass.
>
> Scorpio, of which the brightest stars linked together by lines pretty much represent the form of a kite.
>
> The Crow, of which the four principal stars form a genuine trapezium. [... and so on][56]

A vestigial loyalty to the traditional figures is occasionally allowed to play a part in the formation of 'geometrical' figures, as with Crater (the Cup), or with Crux (the Southern Cross —whose stars could equally form a trapezium). However, making pictures, however schematic, is not one of the motivations of the drawings. The 'geometric' figures are not designed as reductions of the traditional ones, although they are allowed to generate independent figurative associations which are only occasionally (and certainly not consistently) correlated with the forms of the traditional figures.

On the map, it is difficult to discern a logic by which the paths between the stars of a constellation are chosen beyond the rule stated as follows:

> To render these groups or constellations recognisable, I have linked with a black line

55 Josef W. Konvitz, *Cartography in France 1660–1848* (Chicago and London: University of Chicago,1987), p. 16.
56 *Nouvelle Uranographie*, p. 4.

> only the most conspicuous stars, the ones which at first glance offer a grouping and a figure which is easy to grasp; these are the stars which astronomers call of the first, second and third magnitude, the other lesser ones are only joined by dotted lines, they are difficult to see at dusk or when the moon is bright.[57]

It is the multiplicity of choices the array of stars offers which makes it possible to differentiate the constellations from one another. A rule for simplicity (which geometry might suggest) would be counterproductive in a situation like this. Nonetheless, several of the configurations remain (topologically) similar and many of them inexplicably complicated.

The representation of the constellation of Taurus perhaps betrays the difficulty. The complexity of the shape lends it specificity, but the parts of which it is composed (irregular triangles, polygons and chains) are hard to distinguish (compared with nose, horns, hooves). This constellation, which appears in *Nouvelle Uranographie* on both the polar and equatorial maps, is configured differently on each. This is probably a mistake by the engraver, but it is impossible for us to decide which version is correct. Moreover, like all the figures, it is subject to distortion as it is translated from the polar map (azimuthal equidistant projection) to the equatorial map (cylindrical equidistant projection). Of course, neither may be regarded as the original. Nor is there an original on the sphere. The lines drawn on the map (which remain straight regardless of the projection) stand for the teacher who would accompany the student 'une belle nuit soit dans un jardin, soit sur une terrasse'[58] to point out the constellations (the pointing finger would trace an arc of a great circle on the celestial sphere). Exempt from projection, the lines therefore may be regarded as the 'symbolic' notation of an 'indexical' gesture. The configuration of lines for each constellation inscribed on the flat surface of the map tends towards a 'symbol' capable—arguably less robustly than the traditional figures—of surviving translation from one map to another. The utility of the scheme depends on each symbol's retaining sufficient self-identity to survive the distortions it might undergo and sufficient difference from the others to assure its meaning within the system.

The sense in which the figures are geometric is tenuous. They do not record any geometric structure or operation. They codify an act of pointing in a way which is analogous with the traditional constellation anatomies. However the new form has certain disadvantages compared with the older one. I have already touched on problem of internal articulation, which in the joining-the-dots figures is reduced to an assemblage of irregular polygons whose components or parts cannot be predicted from the sign as a whole, in contrast, say, with the figure of Orion, the hunter, which we expect to have a head, two arms, two legs and so on. The multiplicity of possible linear configurations which makes possible what internal articulation there is, furthermore, unleashes permutations which threaten the self-similarity of the sign —probably more than do the distortions produced by the different map projections, in

57 *Nouvelle Uranographie*, p. 2.
58 *Nouvelle Uranographie*, p. 4.

contrast, again, for example, with Orion, who can be got up in a variety of costumes or variously contorted without giving up his identity. The style of drawing also tends to reduce the associative potential of the graphic signs. The figurative associations which Ruelle recovers from his drawings (not from the stars, it should be emphasised)—parallelogram, cross, hourglass, kite, trapezium, lozenge, square, semi-oval—hardly lend themselves to the kind of mnemonic narrative that sustained traditional teaching. For example: the stories which explained why when Scorpius rises, Orion sets (and vice versa) because of their mythological enmity and how the hunter chases the Nymphs of the Pleiades in an eternal circuit around the sky.

These, perhaps, are some of the reasons why Ruelle's innovation did not win early acceptance.[59] At least from the semiotic point of view: Ruelle, a deserter from a dragoon regiment who had been harboured and trained by Cassini in the Observatoire Royale, was not a respected astronomer. The upheavals of the revolution which followed shortly on Ruelle's publication were doubtless not conducive either to the dissemination of his system. It was only in the second half of the nineteenth century that constellation figures like Ruelle's started to become commonplace. Before that, the trend was to omit the constellation figures if they were embarrassing and mark only constellation boundaries.

The Enlightenment preserved an ambivalence towards the constellations which is still evident, for example, in Louis-Benjamin Francœur's *Uranographie ou traité élémentaire d'astronomie à l'usage des personnes peu versées dans les mathématiques* (1812). Francœur, a professor of mathematics and amateur astronomer, made his name as an educator in the context of the post-revolutionary ethos of the École Polytechnique. The attitude of ambivalence later turned to impatience, as we have seen, with Herschel's comments in the 1830s, and later still despair. George Chambers's *Handbook of Descriptive Astronomy* (1877) added his own specific complaints to Herschel's irritation.[60]

> The present system of constellation, though on the whole useful, presents many anomalies, which require reform. Thus Aries should no longer have a horn in Pisces and a leg in Cetus; nor should 13 Argûs pass through the flank of Monocerus into Canis Major:

59 An apparently pirated version of the *Méthode facile* appeared in England in 1803 (under the title *Nova Uranographia or an easy method of knowing the constellations by the configurations of the principal stars between themselves*), but I have not discovered another map that I can link directly with Ruelle's. The English version of the map is essentially the same as Ruelle's except it has been redrawn on a Mercator projection. The author claims that, 'It cannot be contested that this map is new, original, and that I am the first who have drawn the whole sky on that projection.' Charles Grant, *Nova Uranographia; or, an easy method of knowing the constellations by the configurations of the principal stars between themselves* (London: [n. pub.], 1803) p. 1n. In fact, it is strictly not possible to show the whole sphere on this projection and the regions near the poles are extremely distorted. For this reason, the Mercator projection is unsuitable and seldom used for astronomical charts (just as it is also unsuitable, but all too often used for world maps). The accompanying explanation lacks the critical remarks that make Ruelle's something of a manifesto, but it translates the basic description of the constellations word for word. The copy does not appear to have had much impact in astronomical circles.

60 Quoting Herschel: '"The constellations seem to have been almost purposely named and delineated to cause as much confusion and inconvenience as possible. Innumerable snakes twine through long and contorted areas of the heavens, where no memory can follow them; bears, lions and fishes, small and large, northern and southern confuse all nomenclature," &c.' George F. Chambers, *A Handbook of Descriptive Astronomy* (Oxford: Clarendon Press, 1877), p. 557.

> 51 Camelopardi might with propriety be extracted from the eye of Auriga; and the ribs of Aquarius released from 46 Capricorni. But these are all matters as to which it is probably hopeless to expect extensive improvements in the present day.[61]

Francœur comments on the arbitrary character of the traditional constellation figures and explains that they have been omitted from the maps because one should not expect to find in the disposition of the stars any relation to the figure whose name the constellation bears.

> It is for this reason that we have preferred not to draw the figures on the maps, which would have made them more confused without any gain for instruction, and which would perhaps have made them awkward to use by presenting false images to the mind.[62]

The Zodiacal constellations alone are credited with enough interest from an historical point of view to be included in subdued form on an ecliptic chart. In offering some observations on the character and origin of the constellations, Francœur is anxious about venturing into the territory of historical speculation, where there is no hope of mathematical proof and much danger of repeating errors. He excuses himself with a somewhat rhetorical scruple.

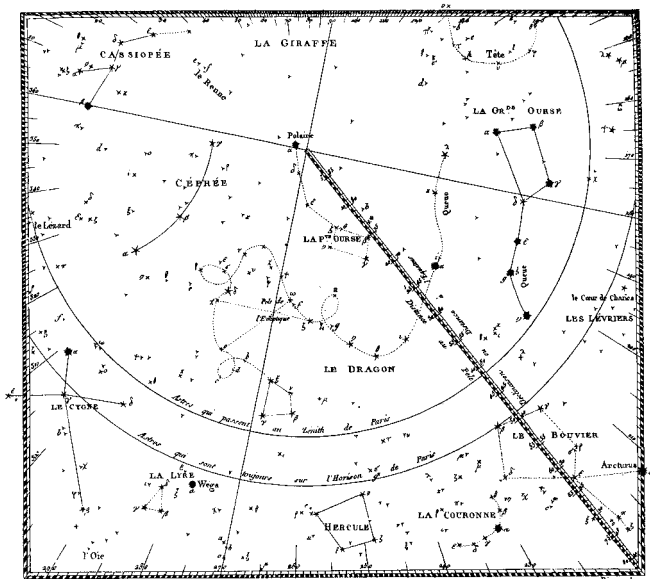
> It is very difficult to give the explanation of these figures the character of truth which would be its only merit and charm. It can only be by a unanimous accord between these [historical] interpretations, only by really coming to terms with the customs of the peoples who created such a kind of language, that one could be sure to protect oneself from error. How many respected men have been mistaken on this thorny subject! How many opinions have been taken up lightly then defended immoderately! Let us then take care not to substitute new mistakes for old. But if it is not possible to have mathematical demonstrations in suppositions of this nature, let us not give up on those which gather the highest degree of probability, the only proof which historical truths can offer.[63]

Nonetheless, Francœur's text is organised around the constellations and he does not scorn the use of poetic invention in the service of learning, offering the reader verses in Latin, 'Pour aider la mémoire.'[64]

Francœur's maps exhibit joining-the-dots figures describing the connections between the stars in accordance with the 'method of alignments' exercised in the text. But these *de facto* constellation figures do not represent a systematic attempt to reform the map of the sky **(41)**.

When changing circumstances encouraged the adoption of joining-the-dots figures, it seems that several map makers took their cue from Dien, who had exhibited his version of

61 *A Handbook of Descriptive Astronomy*, p. 483.
62 Louis-Benjamin Francœur, *Uranographie; ou, traité élémentaire d'astronomie à l'usage des personnes peu versées dans les mathématiques* (Paris: Béchet, 1812), p. 216.
63 Francœur *Uranographie*, p. 216.
64 Francœur *Uranographie*, p. 220.




**41**

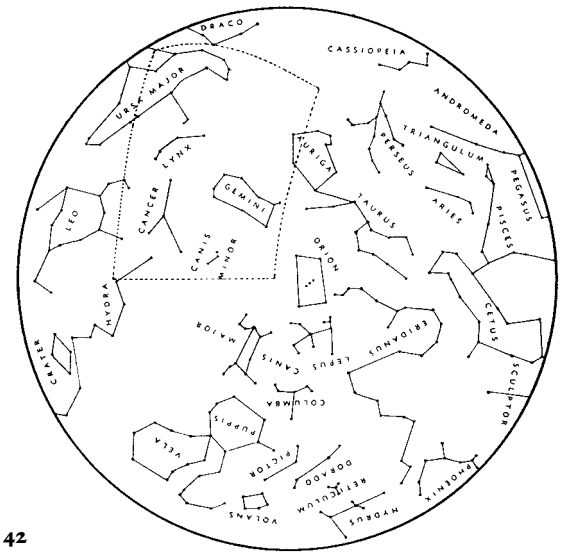
the form both on popular and on 'serious' charts.[65] But Dien was not alone in proposing this way of indicating the constellations and even his followers did not feel compelled by the claim that *his* was 'la manière la plus naturelle' of drawing the figures. What came to seem natural was that the constellations could be signified in this way, that is, by drawing lines between objects belonging to an already-defined set. But there was no agreement on the graphic sign so produced (**Appendix D**). The variations which emerged recorded 'symbolically' the 'indexical' gesture (pointing out the stars) as each author saw fit and inscribed it on the map, as if these connections actually existed. All the variations have their common denominator in the canon which can be traced to Ptolemy's catalogue. They are united in discarding the 'iconic' redundancy which had sustained the traditional figures. It is this gesture of disembodiment which perhaps gave rise to the notion that the joining-the-dots figure is somehow the 'skeleton' of its former embodiment, from which the flesh has been stripped to reveal an underlying structure. But the joining-the-dots figures are not reductions of the traditional ones,[66] they have simply resigned some of the functions that the traditional figures were called upon to perform. They 'form' only those stars they connect. The rest are left for constellation boundaries or catalogues to collect. They are content to label rather than stake out their 'territory' on the celestial sphere.

It is only under the 'iconic' aspect of the figures that a 'skeleton' appears to take the place of the body. In addition to the sense I suggested above, the joining-the-dots figures appear 'structural' because of the quasi-geometric character of the drawing, that is, because the

**41 North polar region from Louis-Benjamin Francœur, *Uranographie ou traité élémentaire d'astronomie à l'usage des personnes peu versées dans les mathématiques*, Paris, 1812**

65 The format and the configurations of Dien's *Uranographie* (1830) suggest it might have been derived from Ruelle's *Methode très facile* although Dien worked from revised base data. Dien could also have been influenced by Francœur's charts. These were signed by the engraver, 'Dien sculp.,' possibly the cartographic publisher Charles Dien of Paris, father of Charles the author of *Uranographie*.

66 The analogy with the type of iconic reduction associated, for example, with the 'development' of hieroglyphic characters, through the hieratic, towards the demotic script is false.



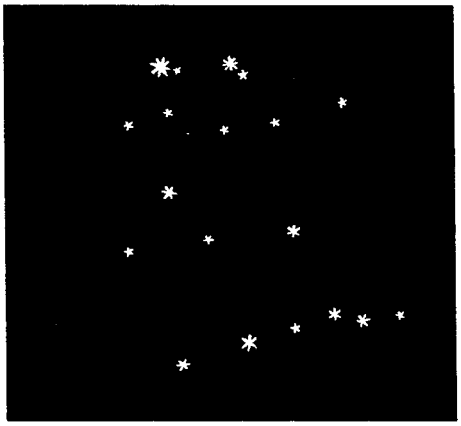

**42**

configuration of points and lines resembles a geometric drawing. Even though there is no geometry at work, the look of the drawing suffices to evoke the properties normally associated with geometric drawings. These properties derived by association from the 'sign vehicle', are then ascribed to the origin of the sign, for example, where it is suggested with words such as 'natural', 'logical', 'instinctive' or 'real', that the configurations are somehow a *necessary* result.

The number of permutations of the sign which have been published, each in the belief it is the most natural or logical configuration, clearly gives the lie to the suggestion that there is one which represents the essential structure of the constellation. Nonetheless, the hope seems to have coloured recent views not only of the practice of joining the dots, but also of the origin of the constellations. The explanation offered by the author of a mid-twentieth-century atlas illustrates quite well the kind of semiotic revisionism which can proceed from the 'sign-vehicle', that is, resulting from the practice of drawing.

> A few comments are necessary on the way in which the constellations have been drawn. About two thousand years ago, our ancestors divided up the dome of the sky into numerous, roughly defined sectors, which are called 'constellations' or 'asterisms'. In their fertile imaginations, they claimed to see in them, owing to the structure of the principal stars, mythological or allegorical figures, which artists endeavoured to draw more or less well, without, for that matter, taking much notice of the stars which ought normally to serve as points of reference. Today, it suffices to link together the brightest stars, but this method presents a considerable number of solutions, in fact, as many as there are authors of celestial charts. Unfortunately, this lack of standardisation is to be deplored. It does nothing to help lovers of astronomy who would find their task much easier if the

**42 Index chart from Vincent de Callataÿ, *Atlas du Ciel*, Brussels, 1955**



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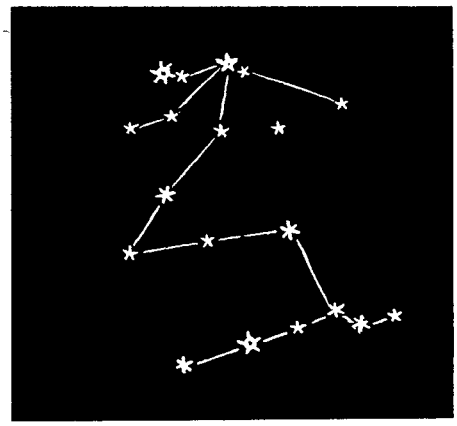

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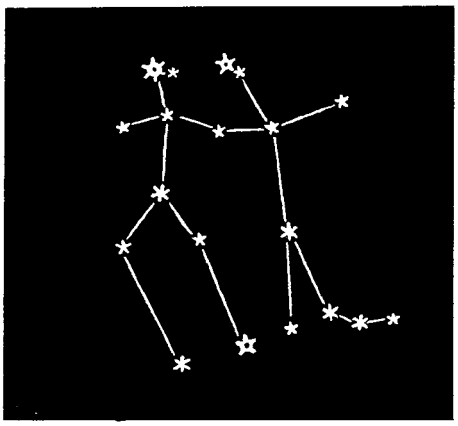

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drawings that figure in the atlases were the same as the ones which presented themselves logically and instinctively to their eyes in the midst of the starry sky. It is this point of view which has taken precedence in the present work and it is also the reason why some of the constellation figures are quite different from the ones found in other star maps **(42).**[67]

This tangled logic would have the drawings represent not a timely adaptation of the heritage of celestial cartography, but the overcoming of the entire history to which they owe their existence. It suggests a primordial vision in which the constellations actually possess the status which was attributed to them by associating the constellation signs with myth or with geometry.

**Memo 12: Return of the Repressed**

H. A. Rey's *The Stars: A New Way to See Them* (1952) is a proposal for the reform of the constellations which many ways parallels Ruelle's, being pitched at the elementary edu-

**43 The stars of Gemini from H. A. Rey, *The Stars: A New Way to See Them*, Boston, 1952**

**44 The 'allegorical' figure of Gemini from H. A. Rey, *The Stars: A New Way to See Them*, Boston, 1952**

**45 The 'geometrical' figure of Gemini from H. A. Rey, *The Stars: A New Way to See Them*, Boston, 1952**

**46 The 'graphic' figure of Gemini from H. A. Rey, *The Stars: A New Way to See Them*, Boston, 1952**

67 Vincent de Callataÿ, *Atlas du Ciel* (Brussels: Visscher, 1955), p. 14.

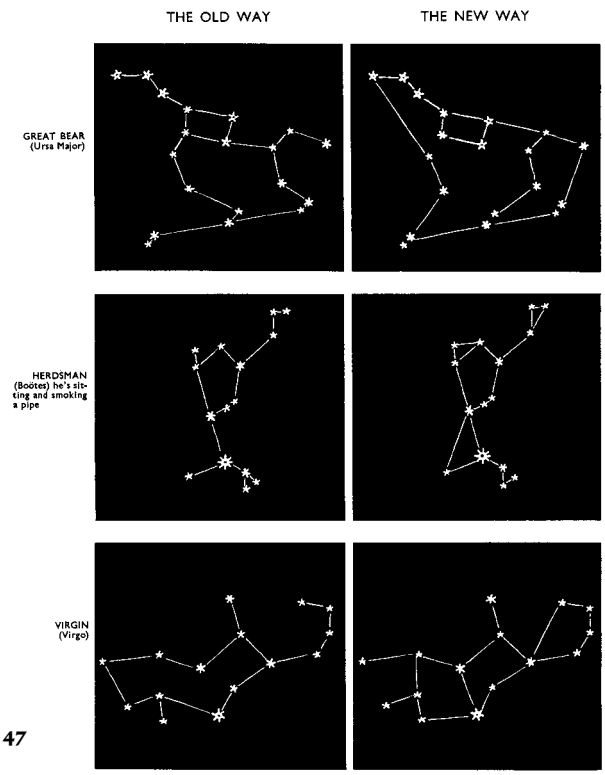


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Figure 5: Old and New
*The stars in both columns are identical; only the connecting lines are different.*

cational market and emphasising as its motivating complaint the lack of resemblance in the constellation figures. Whereas Ruelle deplored the lack of resemblance between the traditional constellation figures and the configurations the stars 'really' presented to the star gazer, Rey directed his complaint against joining-the-dots figures which lack any resemblance to the creatures and things for which they are named. He explained his purpose as follows:

> Some books show arbitrarily drawn around the stars, elaborate allegorical figures which we cannot trace in the sky. Others, most of the modern ones, show the constellations as involved geometric shapes which don't look like anything and have no relation to the names. Both ways are of little help if we want to find the constellations in the sky. [...] This book sets out to remedy the situation. It shows the constellations in a new graphic way, as shapes which suggest what the names imply [...] The connecting lines between the stars are drawn with a definite shape in mind, the shape which the name of the constellation suggests.[68]

Rey's 'new way' is illustrated by comparing different versions of the constellation of Gemini. One which Rey calls 'Allegorical' (a caricature of a traditional constellation picture, not based on any well-known model), another he calls 'Geometrical' (based on the Bartons' *Guide to the Constellations*, 1928), which may have been familiar to Rey and his

**47 The 'Old Way' and the 'New Way' from H. A. Rey, *The Stars: A New Way to See Them*, Boston, 1952**

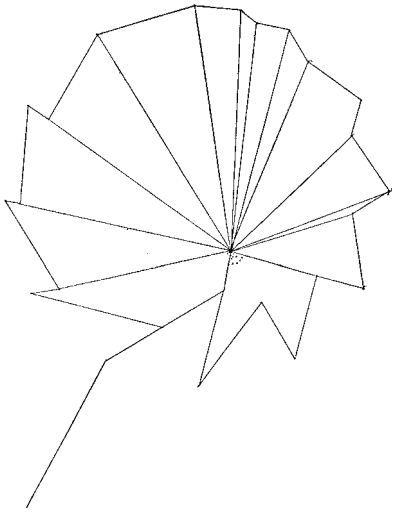
68 H. A. Rey, *The Stars: A New Way to See Them* (Boston: Houghton Mifflin, 1952), p. 10–13.

readers through its reproduction in popular newspaper supplements in the 1940s) and finally the one called 'Graphic' (his own idea) **(43–46)**. The constellation of Gemini yields one of Rey's best results in terms of his own intentions (it appeared on the cover of the book), but he admits that constellations with just a small number of bright stars 'could not be brought to a fitting shape.'[69] Further examples offered comparing 'The Old Way' and Rey's 'New Way' perhaps do more to betray the limitations of the technique than advertise its success **(47)**.

Celestial Products Inc.'s 'Painless Learning Placemat' (1997) puts the primordial vision associated with the 'infancy of astronomy, or the world itself'[70]and the 'puerile' origins of the constellations[71] – the vision also claimed for the drawings which purported to show the constellations as 'logically and instinctively' as they appeared in the sky – in front of the twentieth-century child. On the reverse of planispheres constellated and labelled in the normal way (not unlike Ruelle's maps), an unmarked chart is offered with the instruction:

> Draw Your Own Constellations
> Name Your Own Stars
> Use a watercolor marker. Wipe off with damp cloth.
> Connect stars with lines to make stick figures or draw your own imaginative objects to fit the patterns you see. Give each a name and then use your new map to find your constellations in the night sky.[72]

69 *The Stars*, p. 13.
70 Proctor, see above, p. 54.
71 Herschel, see above, p. 32.
72 *Stars and Constellations* ('Painless Learning Placemat') (New York: Celestial Procucts, 1997).



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*I believe nothing more convenient can be found than that veil which among my friends I call an intersection.*
(Leon Battista Alberti, *On Painting*, 1435)

## III On Structure and Representation: epistemological wish-images

That geometry could be both the guarantee and the abyss of representation calls for a historical as much as a structural explanation. In the following essay I consider drawing as the site of the entanglement of art and geometry. If I touch first on the role that drawing has played in geometry, it is to provide some grounds for assessing any specifically geometric claims made by or for drawing in the field of art. I will then examine what role geometry, mediated by drawing, has played in art and beyond that, what ideological claims, mediated by geometry, have been made by or for art.

I shall suggest that in drawing, a geometrical structure is not necessarily what it seems, and in art is not necessarily a structure either.

### 1

Euclid's geometry was revered for two thousand years as the model of deductive reasoning. The compilation of Greek geometry known as the *Elements* (c. 300 BCE) has been called the most successful textbook of all time, surpassing in its breadth and longevity of influence even his near-contemporary Ptolemy's *Almagest*. Euclid's results were founded on a set of axioms comprising twenty-three definitions, five postulates (i.e. specifically geometric notions) and five common notions. Although the tradition of Euclidean geometry celebrated the necessity of the results obtained by formal deduction, drawing nonetheless stood at the heart of the system. The first of Euclid's postulates being, 'To draw a straight line from any point to any point.'

**48 Paul Klee, *The Truth about a Palmleaf Fans*, pencil, 1923**

The developments through which such notions came to be regarded by mathematicians as 'obscure' belong squarely to the tradition of formalism that had always regarded Euclid as its founding father. The way Albert Einstein put it, referring to nineteenth-century investigations of the foundations of geometry, 'The progress entailed by axiomatics consists in the clean-cut separation of the logical form and realistic and intuitive contents.'[1] The 'discovery' of geometries other than Euclid's in the second half of the nineteenth century resulted from a immanent critique of geometry as a deductive system and, it should be emphasised, not from a 'scientific' investigation of space. In turn, the elaboration of what came to be known as non-Euclidean geometries made a thorough investigation of the fundamental assumptions and concepts of geometry an urgent matter.[2]

Perplexity about the status of Euclid's fifth, so-called 'parallel' postulate[3] can be traced even earlier than the *Elements*.[4] It aroused suspicion because it did not appear to possess the same self-evident quality as Euclid's other basic assumptions and, moreover, it required lines to be prolonged indefinitely and so denied any realistic check. Mathematicians tried to clarify the matter, preferably by showing how this awkward postulate might be derived from the other more readily acceptable axioms. The aim, as the title of an influential attempt had it, was to deliver Euclid vindicated from all fault.[5] The attempt was skewed by the extent to which Euclid's authority seemed unassailable, and by the extent to which his geometry was patently right.

The originators of non-Euclidean geometry proved, however, that Euclid's axiom about parallels was logically *independent* of (i.e. could not be derived from) the others by showing that the denial or substitution of this axiom did not lead to a contradiction. This is not to say that Euclidean geometry is wrong, only that non-Euclidean geometry is consistent provided Euclidean geometry is consistent.

Geometries of more than three dimensions (clearly not Euclidean, but usually classed separately from 'non-Euclidean' geometries) were also increasingly discussed in the nineteenth century. Such geometries have a different history. Equations with powers higher than three were known in antiquity, but because of the preference of Greek mathematics for geometrisation on a realistic model, they were dismissed as meaningless. Later, with the development of the algebraic approach to geometry, mathematicians were perhaps more ready to explore the possibly strange geometrical properties of higher power equations, although in the second half of the seventeenth century (after Descartes, that is), a mathe-

1 Albert Einstein, 'Geometry and Experience' (1921) reprinted in *Ideas and Opinions* (New York: Crown, 1954), p. 228.
2 This is the situation which prompted David Hilbert's classic work in axiomatics, *Die Grundlagen der Geometrie* (1899). Which, it has been claimed, had the greatest influence in that subject after Euclid. Hilbert's work prompted the application of the axiomatic approach to other branches of mathematics and logic.
3 That, if a straight line falling on two straight lines makes the interior angles on the same side less than two right angles, the two straight lines, if produced indefinitely, meet on that side on which are the angles less than the two right angles.
4 See Jeremy Gray, *Ideas of Space, Euclidean, Non-Euclidean and Relativistic* (Oxford: Clarendon Press, 1989), pp. 32–4.
5 Girolamo Saccheri, *Euclides ab omni naevo vindicatus* (Milan, 1733).

matical object of a power higher than three was still regarded as a 'Monster in Nature, less possible than a Chimaera or Centaure.'[6] The more abstract and generalised approach established in the nineteenth century did not inhibit thinking about a geometry of any number of dimensions. Such 'geometries' had clear applications where a system of $n$ variables could be interpreted as a 'space' of $n$ dimensions.

Non-Euclidean and $n$-dimensional geometries did not disclose anything new or previously hidden about the world. But the new geometries did force a re-assessment of geometry's status as a form knowledge of the world, a status which had until then rested on the presumption that Euclid's geometry was the *only* possible geometry. The special place Euclidean geometry had attained in mathematics and natural science—chiefly on the basis that it was true in fact—meant that there was a lot at stake in the epistemological implications of the new geometries.[7]

The traditional understanding of Euclidean geometry suggested an equivalence between its logical deductions and its graphic demonstrations. That is to say, the practical operations of drawing, its instruments and procedures, possessed an immediate and necessary correlation with the theorems of Euclidean plane geometry. Such graphic demonstrability was taken as proof that Euclidean geometry was really true. Thus geometry was regarded not only as the epitome of deductive reasoning but also as the true science of space. As later mathematicians showed, Euclidean proofs often contained implicit appeals to graphic constructions. Although mathematicians' sensitivity to such impurities in *a priori* reasoning, in time, became more acute, the idea that a certain class of drawing was to all intents and purposes synonymous with geometric argument was generally accepted and, no doubt, reinforced through generations of schoolbook geometry.

The mathematisation of natural philosophy associated with the 'scientific revolution' of the seventeenth century was in part motivated and in part justified by the compelling correlation of geometry with experience I have just described. Geometry was seen as the code in which nature was written and the means by which humans could know the divine order of the universe. The spectacular success of the new science did nothing to diminish this view. However, statements such as Galileo's often-quoted declaration to the effect that the 'absolute certainty' of geometry allowed humans a portion of divine knowledge masked a significant break with the classical tradition with which it was nonetheless aligned rhetorically.[8] The productivity of Galileo's approach was achieved by abandoning physical explana-

6 John Wallis (1616–1703), quoted in Henry Parker Manning, *Geometry of Four Dimensions* (New York: Macmillan, 1914), p. 3.

7 The role of non-Euclidean geometry in Einstein's General Theory of Relativity (1915) raised the stakes even more, and indeed fired the popular imagination, after astronomical observations made during the solar eclipse of 1919 succeeded in confirming a prediction based on the theory.

8 'I say that the human intellect does understand some propositions perfectly, and thus in these it has as much absolute certainty as has Nature herself. Those are of the mathematical sciences alone; that is geometry and arithmetic, in which the divine intellect indeed knows infinitely more propositions than we do, since it knows all. Yet with regard to those few which the human intellect does understand, I believe that its knowledge equals the divine in objective certainty—for here it succeeds in understanding necessity, than which there can be no greater certainty.' Galileo Galilei, *Dialogue Concerning the Two Chief World Systems (Dialogo sopra i due massimi sistemi del mondo)* (1632) trans. by Stillman Drake, (Berkeley: University of California Press, 1967), p.103. [continues]

tion and instead aiming for a descriptive science. The very suggestion that mathematics should be applicable to natural phenomena goes against the grain of the Platonic doctrine which reserved mathematics for the world of ideas. Furthermore, the practical use of mathematics entails approximation, which would have been intolerable for a purely philosophical outlook.[9] However, the traditional view of geometry certainly lent itself to the convincingness of the innovative descriptions elaborated by Galileo, Kepler and Newton and to some extent compelled their acceptance, along with their philosophical implications. Implications which, although in part inadvertent, ultimately overthrew the authority of Plato, Aristotle and Ptolemy. Euclid survived this revolution and, indeed, it increased his prestige. The new scientific method tended to re-inforce the perception of equivalence between the formal, symbolic system of mathematics and physical reality. Newton's view was that 'geometry is founded in mechanical practice, and is nothing but a part of universal mechanics which accurately proposes and *demonstrates* the art of measuring.'[10]

Subtle changes in the 'meaning' or the metaphysics of geometry stemming from Descartes, Newton and Leibniz were slow to be recognised and, one may suppose, the critique of Euclid was inhibited as long as geometry continued to offer accurate and ever deeper descriptions of natural phenomena.

The notion of geometry as the model of scientific knowledge was fundamental for Kant's project of establishing the basis for a metaphysics that could 'come forward as a science.' The use Kant's theory made of geometry went beyond, for example, Descartes's or Spinoza's (spurious) adoption of the pattern of deductive reasoning exemplified by geometry as the means of arriving at truth from first principles. For Kant, geometry provided the exemplar of how 'synthetic *a priori* judgements' were possible. This category of judgement—to which he assigned moral judgements—was distinguished by Kant from the 'analytic', which merely unpacks a concept, and the *a posteriori*, which is based on experience and cannot be accepted as 'necessary'. Kant asserted that mathematics proceeds by 'intuition, in which it considers

8 [continued] Earlier in *Il Saggiatore* (1623), Galileo expressed his idea of natural philosophy in terms of the language of mathematics and the script of geometry: 'Philosophy is written in this grand book, the universe, which stands continually open to our gaze. But the book cannot be understood unless one first learns to comprehend the language and read the letters in which it is composed. It is written in the language of mathematics, and its characters are triangles, circles, and other geometric figures without which it is humanly impossible to understand a single word of it.' (Galileo Galilei, 'The Assayer', trans. by Stillman Drake, in *Discoveries and Opinions of Galileo*, Garden City, NY: Doubleday, 1957, pp. 237–238) This amounts to, if not the identification of mathematics with geometry, then the notion of geometry as the cipher which mediates the knowledge of nature.

9 For Plato the world of ideas was real: in the Republic (c. 375–370 BCE) the study of mathematics is recommended (to the élite) 'to help in the conversion of the soul itself from the world of becoming to truth and reality [...] It has a great power of leading the mind upwards and forcing it to reason about pure numbers, refusing to discuss collections of material things which can be seen and touched. [...] Geometers constantly talk of 'operations' like 'squaring', 'applying', 'adding', and so on, as if the object were to *do* something, whereas the true purpose of the whole subject is knowledge—knowledge, moreover, of what eternally exists, not of anything that comes to be this or that at some time and ceases to be.' (as cited in François Lasserre, *The Birth of Mathematics in the Age of Plato*, London: Hutchinson, 1964, p. 23). Although Plato admits we may 'use the embroidered heavens as a model to illustrate our study of those realities,' he maintains that astronomers do not rise to the level which could lead to the knowledge of beauty and goodness. In the same way as music could hint at harmony, astronomy, dealing as it did with a special category of phenomena (heavenly rather than sub-lunar), could be a worthy illustration but a philosopher should not take it seriously.

10 Isaac Newton, *Mathematical Principles of Natural Philosophy*, trans. by Andrew Motte (1729), rev. by Florian Cajori (Cambridge: Cambridge University Press, 1934), p. xvii. My emphasis.

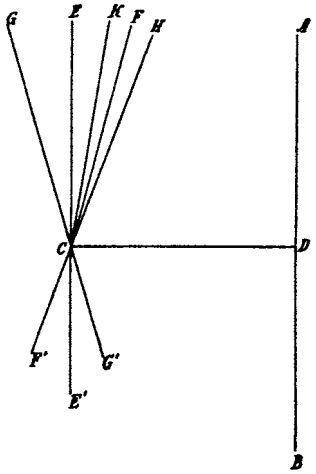


Fig. 89.

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the concept *in concreto*, though not empirically.'[11] Whereas a philosopher could proceed only analytically, by contrast, the geometer, 'at once begins by *constructing* [a triangle ... prolongs this side, divides this angle and so on]. In this fashion, through a chain of inferences guided throughout by intuition, he arrives at a fully evident and universally valid solution of the problem.'[12] The explicit appeal to graphic construction echoes the faith Euclid (mainly) tacitly placed in the construction of figures, but above all it provides Kant with the image of certainty he sought for his metaphysical judgements. It has been remarked that 'The paradigm of construction pervades and beguiles Kant's thinking even when he seems to be at the greatest remove from mathematics.'[13] The idea of construction continued to shape modern thought despite the fact that Kant's arguments from geometry failed.

The mathematical scruples of Kant's immediate successors demanded rigorous deduction founded ultimately on arbitrary notions and in the end, the elaboration of non-Euclidean geometries was fatal for Kant's metaphysics. The question that concerns us now is what effect did those developments have on the role of drawing in geometry?

There are several kinds of drawing associated with non-Euclidean and *n*-dimensional geometries. All have a purely didactic function alongside verbal explanations and analogies. Mathematics textbooks do not usually explain the modes of representation that have been used. In the following examples I shall not attempt to explain the mathematics.

A diagram used to help explain how the parallel postulate is modified in non-Euclidean

**49 The notion of parallelism in hyperbolic geometry from Nikolaj Iwanowitsch, Lobatschefskij, *Zwei Geometrische Abhandlungen*, 1898**

11 Immanuel Kant, *Critique of Pure Reason* (1787), trans. by Norman Kemp Smith (London: MacMillan St. Martin's, 1933), p. 578.
12 *Critique of Pure Reason*, p. 579 (my emphasis).
13 David R. Lachterman, *The Ethics of Geometry: A Genealogy of Modernity* (New York and London: Routledge, 1989), p. xii.

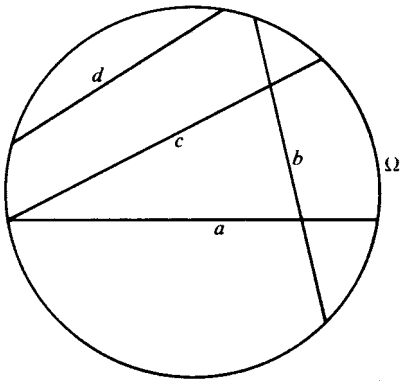


Fig. 13.1.

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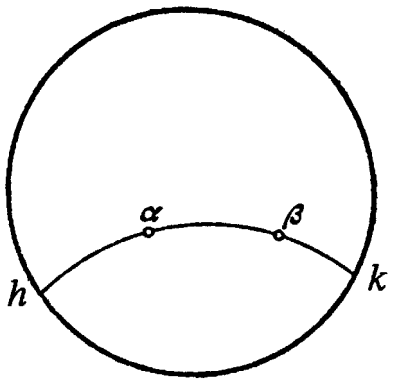



Figure 93

51

hyperbolic geometry **(49)** posits two 'parallel' lines at the *limits* separating the lines through a given point that *cut* another line, from the lines through the same point that *do not cut* it (in Euclidean geometry there can be *only one* line through a point which does not cut a given line if they are produced indefinitely). In the drawing, we are being asked to accept something which does not *look* as if it is the case as long as we continue to regard it as a Euclidean figure. The implication is that in hyperbolic geometry lines cannot be prolonged arbitrarily and/or that they are not really straight.

A drawing like this has to be interpreted conceptually in accordance with the text. Such drawings are, as it were, non-intuitive by definition. There is nothing in them which 'demonstrates' the proposition in the manner that is expected of Euclidean figures (although, as we have seen, Euclid's parallel postulate also defied graphic demonstration). Nor is there any *system* of representation involved which might permit more to be deduced from the figure than is posited in the text. The intended meaning of the graph is provided by the mathematical argument and/or verbal discussion and cannot be obtained from a general appeal to experience. Unlike a Euclidean figure, in which the geometry in question is effectively consistent with the experience of the surface on which the graph is inscribed, this kind of diagram is subject to an intentional meaning that would tend to conflict with a 'normal' Euclidean interpretation. This drawing is no longer a demonstration of what it is about in the way Kant celebrated. Nor is it a picture. Interrogation of the drawing alone would not yield any information about the geometry.

Similarly, when we are asked to consider the radius of a circle drawn on the page as being imaginary (that is, in connection with $i$, $\sqrt{-1}$) or infinite, we are being asked to suspend our

**50 Beltrami's model of hyperbolic geometry from Jeremy Gray, *Ideas of Space, Euclidean, Non-Euclidean and Relativistic*, Oxford, 1989**

**51 Poincaré's model of hyperbolic geometry from B.A. Rosenfeld, *A History of Non-Euclidean Geometry: Evolution of the Concept of a Geometric Space*, New York, 1988**

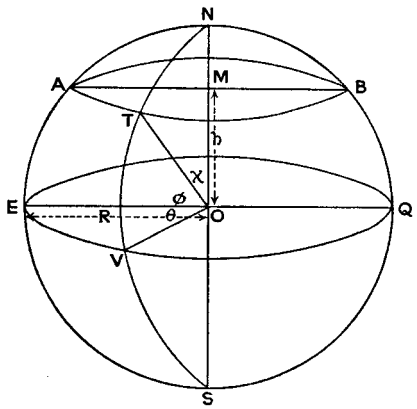



*Fig. 1. Diagram illustrating Latitude and Longitude*

52

Euclidean perception of the graph **(50, 51)**. Beltrami's and Poincaré's models of hyperbolic geometry suggest different methods of projecting a non-Euclidean surface onto a Euclidean plane just as maps display the projection of the terrestrial or celestial sphere on a flat surface. Spherical geometry was, in fact, the first non-Euclidean geometry.

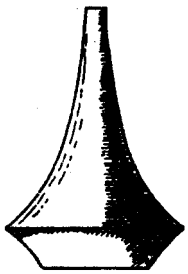
As in textbooks on map projections **(52)**, in teaching non-Euclidean geometry, drawings are offered to show some of the properties of (parts of) non-Euclidean surfaces. The pseudosphere, for example, is a surface of constant negative curvature on which Lobachevskian hyperbolic geometry applies **(53)**. Drawings are also used to exhibit the relationship between a non-Euclidean surface and the plane of projection **(54, 55)**. These kinds of drawing suggest analogies with more familiar geometries. In the case of 'three-dimensional' drawings, they appear more 'transparent' and make direct appeal, if not to intuition in the Kantian sense, then at least to the habit of looking at pictures. Where some kind of projection is involved, the point is to suggest that rigorous projective models can be explored in a purely mathematical way. There is no practical sense in mapping non-Euclidean surfaces.

Pictures can also be used to make clear what is meant by the idea of intrinsic and extrinsic descriptions of a surface. (The co-ordinate pairs—latitude and longitude—which suffice to navigate the curved surface of the earth are an example of an intrinsic description. A space traveller on the other hand would require an extrinsic description of our planet to land safely.) In this illustration **(56)** a surface of variable curvature (with co-ordinates $u, v$) is shown embedded in a three-dimensional space (with co-ordinates $x, y, z$).

Pictures like this might also be used to suggest how, analogously, a three-dimensional non-Euclidean space could be conceived of as 'curved' in a four-dimensional space, and so on. But here the image functions only as a hint towards a purely mathematical concept.

The pictures frequently used to help suggest how one might conceive of four-dimen-

**52 Diagram illustrating latitude and longitude from J. A. Steers, *An Introduction to the Study of Map Projections*, London, 1927**



Pseudosphere.
Fig. 54.

Tractrix.
Fig. 55.

53

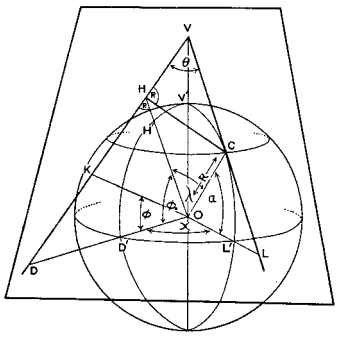



*Fig. 14. The Construction of the Oblique Case of the Gnomonic Projection*

54

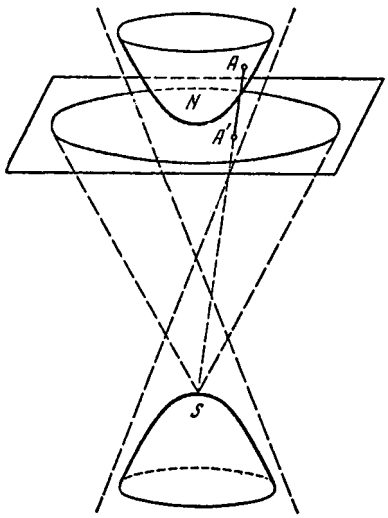



Figure 94

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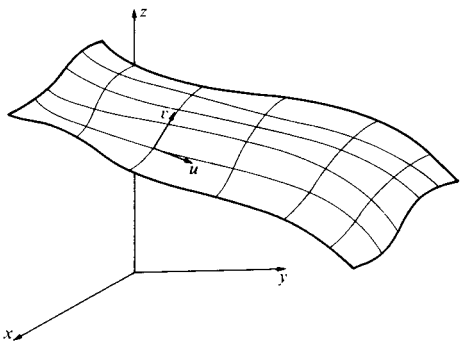



Fig. 11.6. Intrinsic and extrinsic descriptions of a surface.

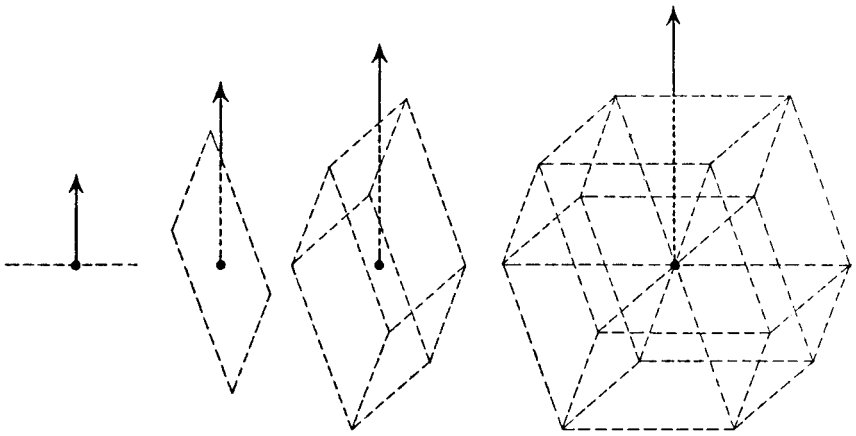
56

**53 The Psuedosphere from Roberto Bonola, *Non-Euclidean Geometry*, Chicago, 1912**

**54 The construction of the oblique case of the gnomonic projection from J.A. Steers, *An Introduction to the Study of Map Projections*, London, 1927**

**55 Diagram illustrating Poincaré's projection of the hyperbolic plane from B. A. Rosenfeld, *A History of Non-Euclidean Geometry: Evolution of the Concept of a Geometric Space*, New York, 1988**

**56 Intrinsic and extrinsic descriptions of a surface from Jeremy Gray, *Ideas of Space, Euclidean, Non-Euclidean and Relativistic*, Oxford, 1989**

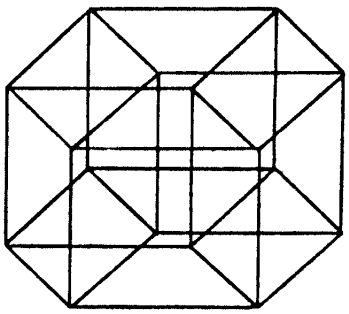


**57**

sional 'Euclidean' (i.e. 'flat') space also make use of a projective concept, although the projection is seldom executed in a way that would give more than a vague idea of what is at stake. For example, this illustration **(57)** is intended to suggest how we could continue to conceive of 'perpendiculars' even when we run out of our familiar Euclidean dimensions and how they might be notated in a drawing. Take a point (no dimensions), move it in any direction: it describes a line (one dimension); take the line and move it at ninety degrees to the first shift: it describes a plane (two dimensions); take the rectangle and move it at ninety degrees to the first two shifts: it describes a solid (three dimensions, so far, so intuitive). Let this shift be drawn on the page, as in an oblique projection, at some arbitrary angle. Now, take the volume and move it 'at ninety degrees' to the last *three* shifts (don't ask how). Let this shift be drawn as before at some arbitrary angle. If the shifts are supposed to be equal in length, then you have a representation of a 'hypercube' (regular figure in four dimensions). The process could, in theory, be continued indefinitely, through any number of dimensions, although the drawing would soon exhaust its power to convey the concept very clearly.

Jouffret's graphic result after four displacements is similar to the drawing of the hypercube first proposed by William Stringham **(58)**. The drawing is sometimes explained as a picture in two dimensions of the three-dimensional projection or 'shadow' of a four-dimensional object: an analogy which lends the four-dimensional figure a concreteness not provided by the mathematical concept. It does, however suggest that the three-dimensional projection will display innumerable aspects as the object is 'rotated' in four-dimensional space. A stereoscopic animated hypercube produced recently **(59)** exhibits what earlier illustrations only hinted at. Incidentally, the limitations of the earlier illustrations tended to lend the two-dimensional figure an unwarranted concreteness, as if it were just a slightly over-complicated crystal. Such an impression was reinforced by the resemblance to ordinary crystallographic

**57 The first four fields and their perpendiculars from E. Jouffret, *Triaté elementaire de géométrie à quartre dimensions*, Paris, 1903**



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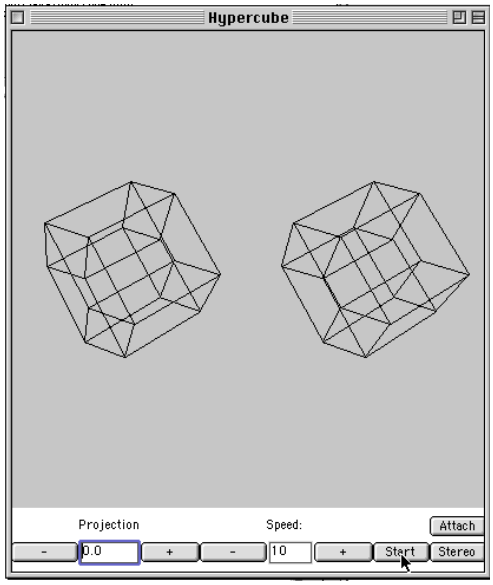


59

illustrations[14] and by the tendency for only one or two aspects of the hypercube to be copied from one book on the subject to another **(60)**. Jouffret's attempts to present more 'exact' representations of four-dimensional objects using technical drawing methods produced results which were difficult to interpret visually. They were not repeated **(61, 62)**.

Another analogy which is illustrated graphically suggests how, as a cube can be produced by folding a net of six squares in three dimensions, or developed into a flat arrangement of squares **(63)**, so a hypercube could be developed as a three dimensional arrangement of eight cubes **(64)**. It is easy to draw such an arrangement conventionally, but it is difficult to show how it should be 'folded' in four dimensions.

In the first example I gave (redefining parallels in hyperbolic geometry), where a concept connected with an exotic geometry is illustrated in a manner determined by a text, any associations suggested by the drawing alone would be misleading. The figure has lost its 'indexical' quality and its meaning relies entirely on intention. In other words, a figure like this always and only says too much, because it cannot really show what it is supposed to say.

The projective models restore what I called in Part II an 'indexical process', albeit problematised by the status of the object of representation, but like any map, the correct interpretation depends on how the process is specified.

In the context of my study of star maps what was important for me, following Peirce, was to restore a wider range of application to the term 'index'; specifically, to not to restrict it to the category of 'reagents' (physical connections or causes), but to notice the relationship between 'reagents' and 'designations' (pointing signs, pronouns etc.). It helped me to establish a framework for the semiotic interpretation of maps, or at least to help identify graphic

**58 Represenation of a hypercube by William Stringham from *American Journal of Mathematics*, 1880**

**59 Mark Newbold, Stereoscopic projection of a hypercube, Java Applet, 1996**

14 See below, p. 129.

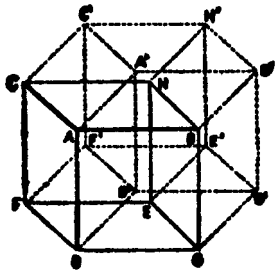

Fig. 1.

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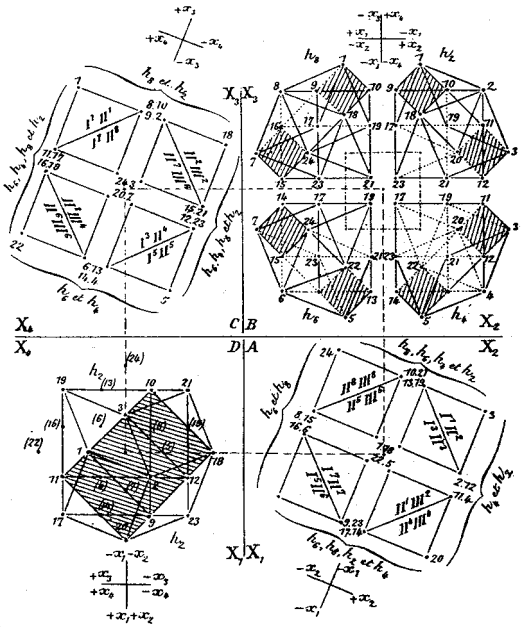

Fig. 40. — Projections planes des seize octaèdres fondamentaux.

61

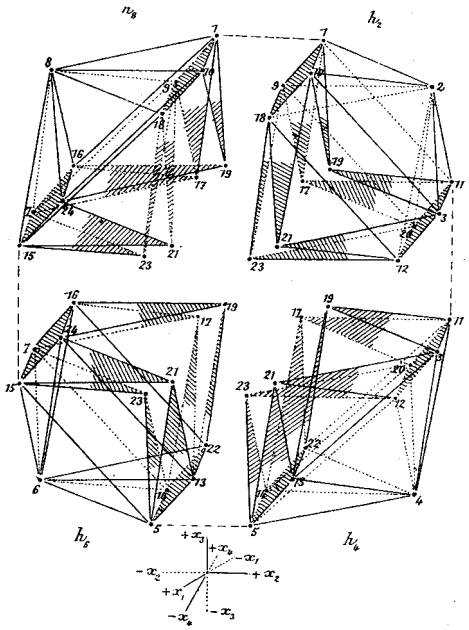

Fig. 41. — Perspective cavalière des seize octaèdres fondamentaux.

62

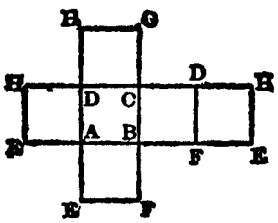

Fig. 3.

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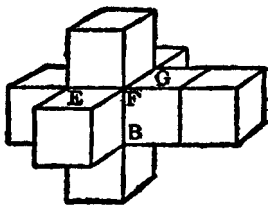


Fig. 4.

64

**60** **Hypercube from Henry Parker Manning (ed.),** ***The Fourth Dimension Simply Explained,*** **New York, 1910**

**61** **Plane projection of sixteen fundamental octahedra from E. Jouffret,** ***Triaté elementaire de géométrie à quartre dimensions,*** **Paris, 1903**

**62** **Cavalier perspective of sixteen fundamental octahedra from E. Jouffret,** ***Triaté elementaire de géométrie à quartre dimensions,*** **Paris, 1903**

**63** **Two-dimensional development of a cube from Henry Parker Manning (ed.),** ***The Fourth Dimension Simply Explained,*** **New York, 1910**

**64** **Three-dimensional development of a hypercube from Henry Parker Manning (ed.),** ***The Fourth Dimension Simply Explained,*** **New York, 1910**

components of a map that seemed to escape the categories provided by traditional analysis of drawings. The notion of graphic 'demonstration' in Euclidean geometry presupposes or implies an indexical relationship between the drawing and the geometrical idea and/or a really existing space.

The picture-like diagrams introduce other more familiar kinds of projection. The allusion made to the three-dimensional 'shadow' of a four-dimensional object is certainly provocative in this respect. But in this kind of diagram the projective process is not usually specified at all. Nor do we have any experience, for example, of a four-dimensional object which would help us guess at the correct interpretation of the drawing. An image such as Stringham's hypercube tends to exacerbate the ambiguity which haunts this kind of drawing even when it does not try to go beyond familiar objects and everyday geometry. The impression given, on the one hand of familiarity and on the other hand of strangeness, might account for a large part of the drawing's didactic message. If it appears to introduce a paradox, it is not a paradox of non-Euclidean or four-dimensional geometry. It is a paradox of representation. As such, the explanation calls for a historical approach and will have to deal with another geometry and its entanglement with visual representation.

Before retracing some historical steps in order to approach the geometry of projection and its implications, it might be worth inserting a comment on geometric objects. The Greeks accepted material objects—drawings, that is—as part of their mathematical reasoning. Indeed, the predominance of geometry in Greek mathematics was in part a result of its practical appeal. Geometry had the advantage over arithmetic of offering a way of avoiding awkward things like irrational quantities ($\sqrt{2}$, for example). We have seen how the intuitive self-evidence of the axioms of geometry was expected to be demonstrated by drawing and how Euclid's parallel postulate caused anxiety because it was impracticable. Euclidean geometry was primarily the geometry of the figures it described.[15] According to Greek doctrine, the abstract propositions of geometry referred to 'objects' existing in the realm of ideas. Any material triangle, say, was only an imperfect copy of the ideal triangle. The correlation that geometry provided between the ideal and material worlds, was taken as a sign of divine grace. The notion of a description of 'space', probably only became important later through developments such as Descartes's analytic geometry[16] or Newton's *Principia* which asserted that space exists prior to objects and that the properties of objects follow from the nature of space. Kant's notion of intuition affirmed both actually existing space and the idealisation of geometry. The century after Kant saw an immanent development of geometry as an abstract discipline which resulted in geometry resigning its claim to represent the real world in order to maintain its *a priori* status. Its objects now had to radically disown their origins as empirical abstractions over which idealism had merely thrown a veil. From then on, as it were,

15 Euclid's fourth postulate, That all right angles equal one another, amounts to a statement about space. But it is also just a definition of a right angle if you already accept the space as natural.
16 Descartes shows signs of struggling with the classical legacy and resists the idea of empty space.

geometry refused to mediate between the material and ideal worlds. It created a class of objects of whose existence it is meaningless to enquire. The most important philosophical implication was that the objectivity—real or ideal—attributed to geometric 'truths' became untenable. What had been virtually deified in the ideal, now had to be thought of as a subjective and arbitrary creation. The application of geometry to the objective world would be a matter of carrying an arbitrary system of co-ordinates into the world rather than the world revealing its (hidden) structure. The notion of geometric objects thus appears to fade, at least from the point of view of mathematics.

It is characteristic of mathematics that it legislates retrospectively. The tradition that makes it possible to speak of 'development' is continually updated and restructured in accordance with more general or logically transparent conceptualisations. I have described a process by which geometry has been emptied of its contents, even though those contents—material, practical or ideological—might have represented important motivations for earlier mathematicians. Mathematics is certainly revisionist even if it is not altogether ahistorical. However, an assessment of the role of geometry in art (or indeed any application) must account for historical objects. Modern mathematics teaches circumspection when it comes to attributing meaning to geometry itself and points instead to a system of symbolic transformations. It is preoccupied with investigating the rules for these transformations but is not concerned with any real object or referent. This is not to say that mathematics has ceased to be applied. Indeed, in the era when the idea of 'pure' mathematics became self-consciously defined in relation to its counterpart, applied mathematics continued to expand its range and depth of description in the fields of science, technology and economics and found ways of incorporating non-Euclidean geometry, statistics and other mathematical techniques beyond classical geometry and algebra. The modern epistemological outlook, however, puts the emphasis on the autonomous structure of mathematical models instead of the 'truth' that had impressed earlier scientists. It has its counterpart in the theory of signs where the emphasis falls on the arbitrary relation between the signifier and signified and the unlimited possible transformations of the sign.

Although the modern mathematics denies the objectivity of the truths held by the old view to be timeless, it still retains something of the idealism that motivated earlier geometers—but at a price. Einstein summed up the bargain when he wrote, 'As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality.'[17]

It is perhaps this vestigial idealism, or this sacrifice, which secures for mathematics its historical credentials, that is, its authority to legislate retrospectively. This is how the attributes of supposedly eternal truth tend, paradoxically, to be applied to historical revisionism. It could explain why the lure of a timeless mathematical truth continues to have a distorting influence on historiography. The challenge for a historical approach is to salvage historical

17 'Geometry and Experience', p. 228.

objects from geometry's junk-yard; to recognise the transformations of the sign as historical facts.[18]

**2**

Geometry in the form of linear perspective has beguiled art historians, on one hand, with its promise of certainty and on the other hand, with its suggestion of a ruling metaphor for art history itself. The result of allowing an a(nti)historical criterion to short-circuit historical analysis has been voluminous erudite controversy.[19]

The foregoing exposition was intended to suggest how the rigours of geometrical thought are potentially corrosive of an interrogation of art works. The assessment of the role of geometry in art should be prepared to question not only what kind of geometry might have been used in the production of a picture, but also how far geometric figures or procedures might have been deployed emblematically. A sense of what meaning geometry or technique might have held for the producer would counterbalance an anachronistic (and, as we shall see, unreliable) reading of the apparent structure of the picture. As James Elkins points out, perhaps more often than not, we find perspective *in pictures* rather than pictures *in perspective.*[20]

As I proceed with the discussion of concrete historical objects, I will bear in mind two distinctions that I hope will help avoid some of the conceptual tangles that have beleaguered earlier studies.

J. V. Field makes clear a distinction between the practical tradition of mathematics as it was used by craftspeople or merchants and the learned tradition that was the subject of scholarly work but without immediate application.[21] Her historical study is to a large extent construed as an analysis of the transactions between those traditions. For example, she shows how Piero della Francesca's mathematical treatises have antecedents in both traditions; that on one hand he develops geometrical results that were unlikely to be applied in practical

18 Thomas S. Kuhn (*The Structure of Scientific Revolutions*, Chicago: Chicago University Press, 1970) notes how science, teaching its own history, tends to make it look like progress leading inevitably towards whatever is accepted by the science of the day, which in turn is regarded as a law of nature. He points out that this confidence in the current world view, justifiably inspired by the rigours of science, does not necessarily provide the basis for a reliable historiography.

19 Much of the debate flows from Erwin Panofsky's pioneering study, *Perspective as Symbolic Form* (1927). 'The practice or tactic of the essay,' says Christopher S. Wood, 'is to juxtapose an art-historical narrative and a characterisation of *Weltanschauung* (which is often achieved by a narrative about intellectual history), and then marry them in a brief and dramatic ceremony.' Translator's introduction in *Perspective as Symbolic Form* (1927) (New York: Zone Books, 1991). Panofsky can manage this because he borrows the trans-historical authority of mathematics even as he makes it historically relative. Thus he is not embarrassed to claim that a painting is 'the concrete expression' of an idea that was not articulated as such until much later. He ascribes 'laws' to art as scientific and mathematical laws were ascribed to nature. Panofsky was followed by many authors in this method of historical 'back projection.' Nonetheless, *Perspective as Symbolic Form*, signalled the ambition of art history towards a broader field of interpretation that included philosophical consideration of the theory of representation.

20 '... by and large perspective is taken to be a thing which governs pictures, rather than an ornament in some preexisting fictive space. The phrase "pictures in perspective" sounds as natural as the phrase, "perspective in pictures" sounds awkward.' James Elkins, *The Poetics of Perspective* (Ithaca and London: Cornell University Press, 1994), p. 45.

21 J. V. Field, 'Mathematics and the craft of painting: Piero della Francesca and perspective' in *Renaissance and Revolution: Humanists, Scholars, Craftsmen and Natural Philosophers in Early Modern Europe* ed. by J. V. Field and Frank A. L. J. James (Cambridge: Cambridge University Press, 1993).

65

work while, on the other hand, his paintings contain elements that show evidence of being worked out by formal procedures described in his treatises.

P. J. Booker, in *A History of Engineering Drawing*, underlines the importance for a historical assessment of drawing methods of acknowledging the difference and the relationship between what he calls 'primary' and 'secondary' geometries, especially in cases where the 'primary' geometry is not prior historically. 'Primary' geometry is the projective basis of a drawing system understood in three dimensions. 'Secondary' geometry is a method of constructing drawings in two dimensions. The latter might be the result of involved geometric reasoning, but could also be just a mechanical procedure learned by rote.[22]

This picture **(65)**, drawn and engraved by Albrecht Dürer for his book *Underweysung der Messung* ... (Instruction in Measurement ...) depicts a man seated at a table by a window about to start work on a drawing of a nude woman who is lying on the table in front of him. A screen standing in the middle of the table separates the man from the woman. The screen and the drawing paper are apparently both marked with a square grid. A small obelisk stands on the table close in front of the man's face and an inkwell just beyond the drawing paper. The window gives out on a lake shore landscape in which some buildings and ships are roughly indicated. The view is partly obscured by the woman's body, the profile of the man, a pot plant and a jug standing on the windowsill.

The room and the furniture appear to be drawn in perspective in such a way that the lines supposedly at right angles to the wall are made to converge towards a point lying close to the horizontal line indicating the lake horizon, just to the left of the pot plant. The edge of the picture is marked with a single line with no ornament.

The image is frequently cited as an illustration of a device mentioned by Leon Battista Alberti. I shall discuss below to what extent this association is justified, but first I would like to describe the context in which Dürer's picture appeared.[23]

**65 Albrecht Dürer, 'Yet another method' from *Underweysung der Messung*, 2nd edition, 1538**

22 P. J. Booker, *A History of Engineering Drawing* (London: Chatto and Windus, 1963).
23 Elkins in *The Poetics of Perspective* associates Dürer's apparatus with Alberti's 'window figure', the metaphor that Alberti uses in Book I of *On Painting*, and notes how Dürer separates the presentation of the [continues]

The full title of Dürer's book is *Underweysung der Messung mit dem Zirckel und Richtscheyt in Linien ebenen und gantzen Corporen, durch Albrecht Dürer zusammen gezogen und zu Nutz allen Kunstliebhabenden mit zugehörigen Figuren in Truck gebracht im jar MDXXV* (Instruction in measurement with compass and straight edge in straight lines and solid bodies, compiled and brought to the press with accompanying figures by Albrecht Dürer in the year 1525 for the benefit of all who have a love of art).

Published in Nuremberg, *Underweysung der Messung* was the first publication stemming from Dürer's project for a comprehensive treatise on the art of painting. A draft table of contents (before 1512)[24] lays out consideration of the aptitude of the painter's apprentice (including his star sign and physique), the child's education, his literary and religious upbringing, 'the great usefulness, joy and delight which spring from painting' and the artist's career prospects as well as topics dealing with the theory of painting itself: proportions of men, horses and buildings, perspective, light and shade, colours and subject matter. Dürer had actually almost completed work on his treatise on human proportion by 1523, but decided to issue first a preliminary treatise dealing with the elements of his art. The dedication of *Underweysung der Messung* (to his friend, the scholar Willibald Pirckheimer, 1470–1530) declares that 'the art of measurement' (*Die Kunst der Messung*)[25] is the true foundation of all painting (*recht Grundt aller Malleren*), and it is therefore the author's intention to 'propound the elements for the use of all eager students of art, and to instruct them how they may employ a system of *Measurement with Rule and Compass*, and thereby learn to recognise the real Truth, seeing it before their eyes.'[26]

Dürer locates the book firmly—and, in contrast, as we shall see, to Alberti's *On Painting*—in the practical tradition, although in doing so his aim is the reform of that tradition, not least through the very act of publishing, which was an attack on the proprietary knowledge of the guilds. For Dürer, setting out its theoretical foundations brought painting out from the world of the 'ignorant', albeit skilled and imaginative craftsman, into that of the liberal professions. His own ambition and desire for knowledge had earlier led him to Italy where, as he acknowledges in the dedication of *Underweysung der Messung*, the revival of classical learning was more advanced than in Germany. There he had been able to supplement what was available in his own milieu. As his biographers note, in 1506 Dürer travelled to Bologna specially to meet someone who would teach him the 'secret' art of perspective—

23 [continued] 'perspective machine' from the geometric treatment. Hubert Damisch, in *The Origin of Perspective* trans. by John Goodman (Cambridge MA, London: MIT Press, 1994), says Dürer's engraving represents an apparatus, 'to obtain a rendering that is perspectivally correct by purely mechanical means in conformity with the principle of the *velum* posited by Alberti.' (p. 36) Damisch contrasts this instrument with the one in Dürer's picture of two men drawing a lute, which he claims demonstrates 'in geometrical terms, the point-by-point correspondence, in relation to a common "origin," between the object and its projection onto an intersecting plane.' The fact is, in geometrical terms all the devices illustrated by Dürer are equivalent, although the variations suggest different metaphors. See also Erwin Panofsky, *Albrecht Dürer* (Princeton: Princeton University Press, 1945), pp. 252–3.

24 See Wiliam Conway, *Literary Remains of Albrecht Dürer* (Cambridge: Clay, 1889), pp. 170–71.

25 Albrecht Dürer, *The Painter's Manual: Underweysung der Messung* trans. by Walter L. Strauss, (New York: Abaris, 1977 (1525), p. 37. Further page references in brackets in the text. The English translator of Dürer's treatise remarks that Dürer coined the German term *Messung* for *geometria* (p. 10). Panofsky (*Albrecht Dürer*, p. 254) renders it in English 'geometry'. Cf. *Literary Remains of Albrecht Dürer*, p. 212.

26 *Literary Remains of Albrecht Dürer*, p. 212.

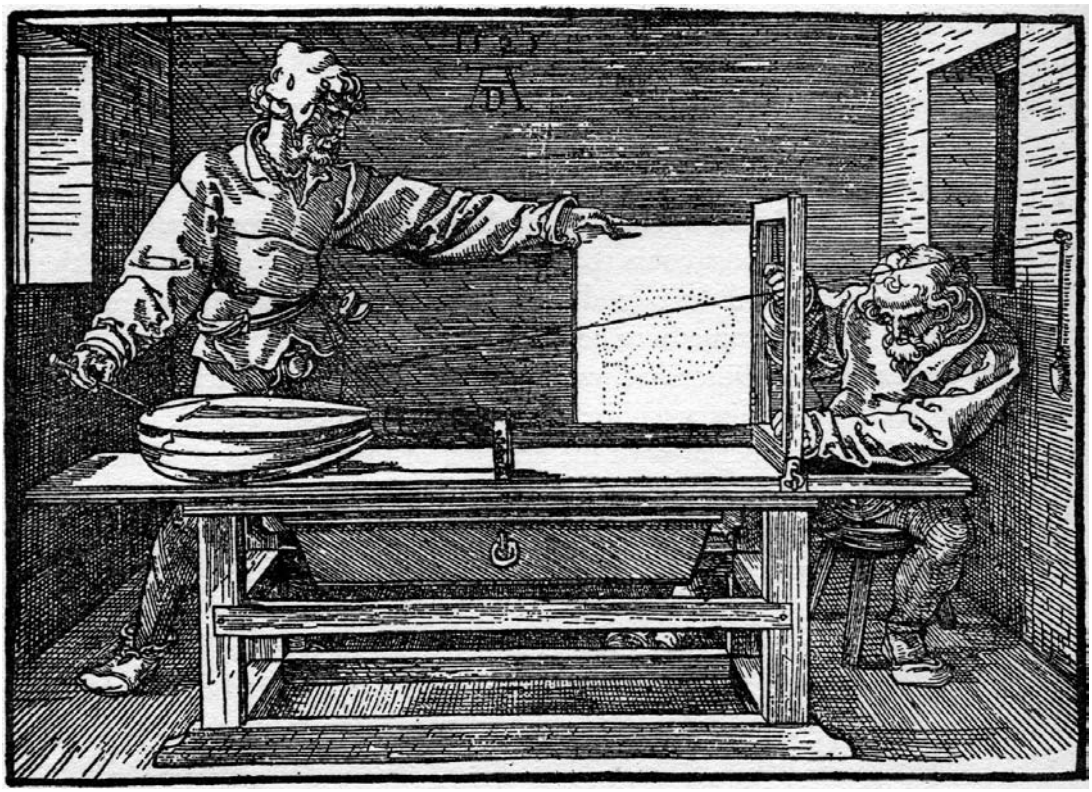
possibly Luca Pacioli, the pupil of Piero della Francesa and associate of Leonardo da Vinci—and in 1507 in Venice he acquired his own copy of Euclid's *Elements*.

Euclid stands before the beginning of Dürer's treatise in a note to the reader: 'The most sagacious of men, Euclid, has assembled the foundations of geometry. Those who understand him well can dispense with what follows here, because it is written for the young and for those who lack a devoted instructor' (41). What follows, however, is not 'Euclid Made Simple'. It is, as Conway remarks, 'rather a course of Geometrical Drawing than a treatise on Geometry.'[27] It follows the pattern established by Euclid's logic in so far as for the most part it proceeds from simple things to more complex things: through lines, planes and solids, but with digressions on complex methods,[28] instruments and applications such as the design of alphabets and monuments. In Dürer's pedagogy, geometry is synonymous with construction and little attention is paid to deductive reasoning. Nonetheless, *Underweysung der Messung*, contains items of notable mathematical interest.

Dürer introduces his theory of perspective towards the end of the treatise neatly by announcing that, 'Having demonstrated how to construct various types of solids, I also wish to teach you how to render them in a painting' (365). His optical preliminaries are extremely concise. He achieves this by introducing shadows to the perspective demonstration. For something to be seen it must be in the light, light travels in straight lines and this is why solid objects cast shadows. He includes in his drawing of the specimen cube in plan and elevation a point source of light and the shadow, and thus demonstrates an example of what we would call central projection even before he has explained it in terms of perspective. Likewise, the diagram he offers in order to explain how things appear bigger or smaller depending on their distance from the eye anticipates the 'transparent pane [...] which will slice off all the lines of sight' (371). The procedures of perspective construction he goes on to describe appear to be derived from the methods first put forward in writing by Alberti[29] and later elaborated by Piero della Francesca,[30] both of whose works it is likely Dürer knew in manuscript.

Finally, Dürer offers two different methods of tracing an object in correct perspective, each involving a three-dimensional apparatus. The first is the literal construction of the transparent pane that cuts the lines of sight. This is a special table upon which are erected a frame containing a flat pane of glass and a device for fixing the eye point. The artist should position himself so, looking through the viewfinder, he can trace the outlines of what he sees directly on the pane of glass. Although Dürer gives detailed instructions for making such a device and adds an equally detailed picture of a man using it to draw a portrait, this device has been regarded somewhat more as an elaboration of the metaphor, than as a practical device—given, on the one hand, the scarcity of large flat panes of transparent glass in Dürer's day and, on the other hand, the limitations imposed by the restriction of the viewing distance

27 *Literary Remains of Albrecht Dürer*, p. 213.
28 For example, Dürer introduces a projective method of drawing conic sections in the context of dealing with plane curves.
29 *De Pictura*,1435, *Della Pittura*, 1436.
30 *De Prospectiva Pingendi*, 1460.



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to the arm's reach. The second apparatus, apparently of Dürer's own invention, overcomes these shortcomings by constructing, as it were, an automatic device that, although it takes two men to operate, does not involve their bodies in the drawing process. Nor does it involve any expensive materials. With the first device, as Dürer says, you can 'trace what you see before you,' with the second you can 'render anything within reach in correct perspective by means of three threads' (391). The famous drawing of two men drawing a lute shows how it works **(66)**. Whereas the first apparatus seemed to take a metaphor literally, here Dürer has constructed a three-dimensional model, or mechanical analogue, of the notion of projection he had earlier expounded according to abstract principles and graphic construction. The metal 'eye' hammered into the wall takes the place of the human eye, the taut thread stands for the line of sight, the intersection of the threads stretched across the frame that intervenes between the 'eye' and the object locates a point on the plane described by the frame. There ends the original edition of *Underweysung der Messung*.

For the 1538 edition of the book, among a few other alterations and revisions, Dürer added two more devices to this appendix of 'drawing machines'. One is a hybrid of the earlier two (complete with practical instructions) and the other is the apparatus in the picture I described above **(65)**. This time, Dürer does not give detailed instructions on how to make it, but he notes in his commentary that this method is also useful for rendering an object 'larger or smaller according to one's wish' (435).

To call the set of drawing devices an appendix is not to suggest that it is merely an after-

**66 Albrecht Dürer, 'Another method' from *Underweysung der Messung*, 1525**

thought, although it stands apart from the rest of the text and accompanying figures, most obviously because of the elaboration of the pictures. None of the other figures in the book is rendered in perspective except when this is the result of teaching a perspective construction. The perspective machines could have been added for the sake of amusement—perhaps not as blithe as the 'monument to a drunkard' included in the section on columns—but indulging Dürer's personal interest in 'philosophical' machines and practical technology. The most important difference, however, seems to be the relationship between the figures and the text. For the rest, Dürer's drawings closely parallel, illustrate or work out what is described in the text. Here, the image carries a more complicated demonstrative burden. I would like to explain this by looking more closely at the image of the man drawing the woman, although it will entail a digression on Alberti's treatise, *On Painting*.

Dürer's picture seems straight-forward in so far as it clearly shows a device for drawing. The depiction is transparent enough, as I showed above, to yield a satisfactory verbal description and indeed enough information to construct something similar for oneself. Obscure parts of the drawing (What is the thing hanging from the man's belt? What is happening with the woman's feet?) are not essential. The complications of the drawing do not detract from this instructive aspect, although, in my investigation, attention will be divided between the object of representation and the means by which it is represented. I will discuss the demonstrative aspects of both.

Perhaps 'divided' is the wrong word, because—apart from the fact the 'object of representation' is also a device for representation—the existence of the object also comes into question. In searching as it were 'behind' the picture for the object it represents, we are, in this case, more likely to find a text than a room with a man sitting at a table, or any similar apparatus preserved from fifteenth or sixteenth century. Art historians find little evidence that such apparatus was actually used by painters. The object exists chiefly in our capacity to construct it.

The canonical text 'behind' the picture, Alberti's *On Painting*, was not equipped with any pictures or diagrams. Nonetheless Alberti's means of representation are also important for a discussion of demonstration, not least in so far as Dürer's aim might have been, in part, to demonstrate how well-versed he was in Italian art theory.

Alberti writes:

> No composition and no reception of light can be praised where there is not also a good circumscription—that is, a good drawing—which is most pleasant in itself.
>
> Here is a good aid for whoever wishes to make use of it. Nothing can be found, so I think, which is more useful than that veil which among my friends I call an intersection. It is a thin veil, finely woven, dyed whatever colour pleases you and with larger threads in the parallels as you prefer. This veil I place between the eye and the thing seen, so the visual pyramid penetrates through the thinness of the veil. This veil can be of great use to you. Firstly, it always presents to you the same unchanged plane. Where you have

> placed certain limits, you quickly find the true cuspid of the pyramid. This would certainly be difficult without the intersection. You know how impossible it is to imitate a thing which does not continue to present the same appearance, for it is easier to copy painting than sculpture. You know that as the distance and the position of the centre are changed, the thing you see seems greatly altered. Therefore the veil will be, as I said, very useful to you, since it is always the same thing in the process of seeing. Secondly, you will easily be able to constitute the limits of the outline and of the planes. Here in this parallel you will see the forehead, in that the nose, in another the cheeks, in this lower one the chin and all outstanding features in their place. On panels or on walls, divided into similar parallels, you will be able to put everything in its place. Finally, the veil will greatly aid you in learning how to paint when you see in it round objects and objects in relief. By these things you will be able to test with experience and judgement how very useful our veil can be to you.[31]

The apparatus called a 'window' or 'veil'[32] can be regarded—the way Alberti introduces it—as an aid to drawing. It can also be regarded—as might appeal more to a modern viewer—as a model of perspective in its primary geometry.

Alberti's treatise does not give a general account of the connection between these two aspects of the veil nor a full explanation of its relationship with a secondary geometry he also describes. Extracting the 'geometric essentials' from Alberti's text (as the history books often do) suppresses the specific demonstrative modalities of his discourse. *On Painting* contains a mixture of quasi-geometrical argument (starting with definitions and proceeding from simple to more complex propositions in the Euclidean manner), a 'phenomenology' of sight, an aesthetic doctrine and practical instruction as well as subtle propaganda for the innovative art of early fifteenth century Florence—all interspersed with edifying quotations and examples from classical literature. Its coherence stems more from its proselytising zeal than from its logical structure.

Alberti emphasises in the concluding book, 'It would please me if the painter were as learned as possible in all the liberal arts, but first of all I desire that he know geometry' (90). The priority accorded to geometry echoes the motto of Plato's academy, and is carried through by Alberti in placing his geometrical discourse at the head of the treatise. Nonetheless, he maintains, 'The greatest work of the painter is the *istoria*' (70). The education of the painter should therefore extend beyond the formal arts (the revered *Trivium* of grammar, rhetoric and logic and *Quadrivium* of geometry, arithmetic, music and astronomy) to include knowledge of classical literature, good taste and a suitable social milieu. Above all,

31 Leon Battista Alberti, *On Painting*, trans. by John R. Spencer (London: Routledge & Kegan Paul, 1956), pp. 68–69. Further page references in brackets in the text.

32 Elkins suggests, 'Alberti might have borrowed the image of a window [i.e. the metaphor] from his own *velo*.' (*The Poetics of Perspective*, p. 49.)

Alberti's aim is to promote painting and with it the status of the artist from a craft activity connected with the mediaeval guild system to the status of a liberal art, like music or astronomy, under the aegis of geometry.

However, it is not actually by teaching geometry that Alberti seeks to establish this claim. The quasi-geometric form of argument I referred to is deployed rhetorically in order to lend convincingness to a thesis that is mainly content to quote geometry rather than develop theorems that would be recognisable to mathematicians. Alberti's efforts to make himself understood by his readers are divided between those directed towards promoting the reception of the new art he envisages—the art heralded by the achievements of Brunelleschi, Ghiberti, Masaccio and Donatello—and those directed towards encouraging the production of that art.

Alberti indulges in a kind of geometric doublespeak. The references he makes to geometric principles and mathematical reasoning are pointed, even manipulative, but are not substantiated. The qualifications, apologies and elisions within which Book I of *On Painting* is bracketed serve Alberti's geometrising rhetoric while excusing him from elaborating a rigorous geometric argument. At the beginning, he begs the reader while taking 'from the mathematicians those things with which my subject is concerned,' to consider him 'not as a mathematician but as a painter' (43). At the end, while apologising for his lack of eloquence, he reassures his readers that the 'prolix geometric demonstrations' (59) with which he usually explains these things to his friends have been omitted only for the sake of brevity.

As much as Alberti is committed to elevating the discussion of painting by associating it with classical mathematics and literature, he seems well enough aware that geometry itself will not yield a theory of painting. He insists we should climb down from the abstractions of the mathematicians and make use of a 'more sensate wisdom' (43). Thus his introductory definitions are translations of some of Euclid's terms back into empirical entities, in fact, into components of drawing. The preliminaries proceed by introducing a theory of vision which focuses attention on its geometrical aspects in so far as Alberti explicitly excludes discussion of the physics of visual rays and the physiology of the eye. The idea of visual angles (derived from Euclid's optics) is made concrete and figuratively restored to the field of drawing with a metaphor: 'The eye measures these quantities with the visual rays as with a pair of compasses' (46).

It is a measure of Alberti's success as a polemicist that his name has come to stand for a mathematically rationalised and constructed space in pictures. The way Panofsky has it, Alberti gets the credit for 'bringing an abstract and logical method into harmony with traditional usage [...] In this way the Renaissance succeeded in mathematically fully rationalising an image of space [...] it was now possible to construct an unambiguous and consistent spatial structure of infinite extension.'[33] This is an exaggeration which would make reading Alberti's treatise rather puzzling if one were expecting to find there a modern-seeming

33 *Perspective as Symbolic Form*, p. 63.

geometric logic as the art-historical cliché suggests. By recognising the broader scope of the conception of painting Alberti proposes and by putting aside anachronistic expectations, *On Painting* will not seem so disappointing. Some of the peculiarities of Alberti's argument can be explained by the fact that the notion of the 'visual pyramid' he develops in Book I seems to *presuppose* the model he introduces only in Book II (i.e. the 'veil' later illustrated by Dürer). For example, in Alberti's analysis of the visual pyramid, the hierarchy of 'extrinsic', 'median' and 'centric' rays seems to make more sense in relation to the frame of a picture than in the general case of vision.

Alberti's innovation, the *intersection* of the visual pyramid, is a radical definition of painting, but in Book I of *On Painting* it is introduced abruptly as if it were some kind of (geometric) truth that followed from the idea of the visual pyramid or from one of the doctrines of 'the philosophers' Alberti saw fit to adopt. It is noteworthy that the concept of painting as the intersection of the visual pyramid, or in Alberti's analogy, 'a quadrangle of right angles [...] which is considered to be an open window through which I see what I want to paint,' (56) is a three-dimensional idea, whereas the formal geometry he refers to is two dimensional. Alberti passes from one to the other without explanation. What he aims to show is the relationship between the cross-section of the visual pyramid (i.e. the image), and its base (the object of vision). By taking a longitudinal section of the pyramid, Alberti demonstrates how the quantity at the base and the quantity at the cross-section are related as the corresponding sides of similar triangles, and so are proportional—a proof of which was already provided by Euclid. There is therefore a rational law for determining the relative sizes of images on a picture surface depending on the actual sizes and positions of objects. The notion of proportionality Alberti introduces in this way immediately prompts a literary-aesthetic-philosophical digression leading Alberti to the maxim 'man is the mode and measure of all things' (55).

In the flow of Alberti's discourse, the notion of how things are known through comparison serves to set up the next part of his exposition and to mask another change of tack. There follows a description of what we would call a secondary geometry: this is a method for constructing in two dimensions the image of a pavement of square tiles, scaled roughly according to how big we want the images of the people to be relative to the size of the picture. This, as Alberti puts it, is 'What I do when I paint. First of all about where I draw' (55–56). The instructions and commentary do little to elucidate the foregoing theory except in as much as they suggest a practical meaning for some of the obscure terms introduced earlier (centric ray, for example). The procedure is literally setting the scene for the new painting.

The pavement is a simple enough object to serve as a specimen, though not as general as the cube Dürer takes as his example. However, its functions and meanings in Alberti's context extend beyond the quasi-geometric demonstration of how to draw the lines that stand for a grid of squares on a plane at right angles to the intersection in correct perspective. Before returning to Dürer's apparatus, it will be useful, I think, to consider the grid motif in connection with Alberti's veil, recalling the semiotic treatment of the graticule I developed in

Part II. There I argued that the 'indexical' function of the graticule on a map acts as the guarantor of the 'iconic' aspect of the graph.

The widely adopted notion which says that Alberti's perspective constructs 'an unambiguous and consistent spatial structure of infinite extension,' (as Panofsky expressed it) seems to have been prompted by the pavement figure and, I would suggest, not a little by Alberti's pretentious style. In my view, it is wrong, as I hope will become clear. The consideration of *why* such a notion became so widely accepted probably belongs to a discussion of twentieth century criticism, rather than to the present context. What I want to discuss now is the grid.

At least as much as a novel geometric construction, Alberti's teaching of perspective suggests the convergence, from one side, of the graticule used for copying—a technique well established in workshop practice—and, from the other side, the tiled floor motif already popular in painting—common enough in Alberti's day for him to deplore 'incorrect' methods of constructing it.

The method of 'squaring up' has probably been in continuous use since the time of the ancient Egyptians[34] for copying images and, as Dürer reminds us, for enlarging and reducing them. Alberti's veil applies the method for the first time to copying the appearance of reality, that is, how reality presents itself to vision. Neither the 'translation' of images mediated by the grid, nor the tracing of appearances is usually considered a 'geometric' operation in the view of art history, but the construction of the tiled pavement is often considered the very crux of the geometry of perspective in painting and extravagant claims have been made for it.[35] In the context of Renaissance practice, however, the pavement is geometric principally in

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34 If not before. The method remains at the heart of digital raster images.

35 The revival of interest towards the end of the eighteenth century in Pliny's story of the invention of drawing (by tracing the outline of a shadow on a wall) does align drawing with the geometrical idea of projection, but this is already a kind of historical back-projection. See for example *The Origin of Painting ('The Maid of Corinth')* by David Allan **(67**), *The Invention of the Art of Drawing* by the neo-classical painter Joseph-Benoit Suvée **(68)** or the picture of the same title by Karl Friedrich Schinkel **(69)**. Interestingly, the two painters' works both show a woman inscribing her boyfriend's profile by tracing the shadow thrown by a lamp (equivalent to central projection) while Schinkel, best known as an architect, has a man tracing the shadow of a woman outdoors in an Arcadian setting, by sunlight (equivalent to orthographic projection). François Boucher (1703-1770) has another variant.

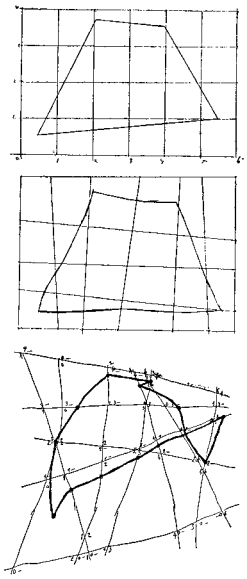
so far as it belongs to a class of straight-edge graphic constructions. As we have seen, this was certainly a more important part of geometry in the fifteenth or sixteenth century than it is today, but that doesn't justify some of the 'geometric' interpretations one reads.

The pedagogic and practical function of the pavement construction seems to be Alberti's suggestion, as it were, of tipping the familiar copying grid into the picture, letting it down ninety degrees like a draw-bridge so it can function as a guide to the painter to keep things in proportion. Alberti has a lot to say about how paintings should look and what they should be about, but he does not suggest the kind of unified image of a scene that would later be associated with the *camera obscura* and as it were back-projected on Alberti. Nor does he suggest an image of space itself. One could say that Alberti is very satisfied with the geometric basis for his idea of painting as the intersection of the visual pyramid, but he does not require of paintings more than that they should seem about right. When he recommends 'That veil which among my friends I call an intersection' as an aid to drawing—circumscription, as he called it—he does not suggest how this could be integrated with the pavement schema or that such integration would be desirable. Alberti also offers 'squaring up' as a useful means of obtaining the perspective image of a circle and in doing so advocates reasonable approximation over laborious construction.[36] Alberti does not mention the perspective constructions for complex objects such as were elaborated by Piero della Francesca or demonstrated by Paolo Uccello.[37]

For all that Alberti requires of painting that it should look learned and the painter should be well educated, the practice he is talking about is still rough and ready compared with the mathematical rigour that some accounts of *On Painting* could lead us to expect. If one is going to regard the perspective pavement as kind of Cartesian co-ordinate geometry *avant la lettre,* then one must be prepared to say the same for the grid which mediates the translation of images from one surface to another. Despite the thrill of the presence in Alberti's construction of lines drawn 'as if looking into infinity' (56) the pavement is offered only for mapping definite things in a definite place—indeed a rather narrow space[38]—in accord with the method transferring images. To be sure, Alberti adds to the tradition by suggesting three-dimensional possibilities but, as I have already noted, the geometry he uses is restricted to two dimensions.

But perhaps more to the point than the geometric status of the grid is its semiotic status. What is interesting about the grid and what makes it different from other picture elements is that it makes its appearance (at first, at least) without positing any specific meaning. It is there to mediate the translation of other signs that hang together independently. Its function, as far as the technique goes, is to create an identity between two surfaces, and in this respect it has the role of an 'indexical designator'. It has what I described as an indexical

36 A small number of points obtained from the circle inscribed in a square can be mapped on to the perspective grid and the curve interpolated. This does not yield a true ellipse however, which the perspective image of a circle must be, as a conic section.
37 Dürer included a description of a method like Piero's in the 1538 edition of *Underweysung der Messung*.
38 The pavement grid quickly becomes quite useless as it recedes and the squares become increasingly foreshortened.



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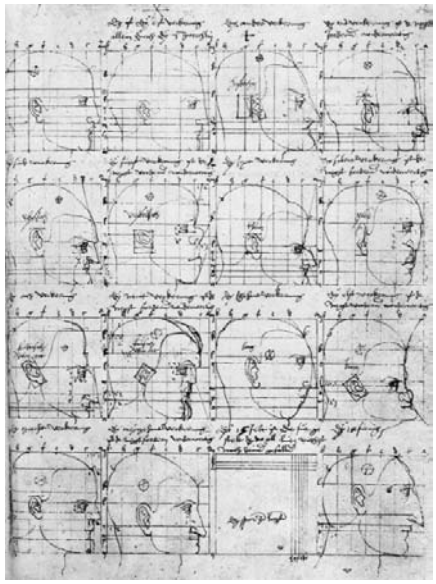

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*function*, but it does not immediately satisfy other expectations we might have of the graphic signs that make up a drawing. This function does not change if the grid which so to speak 'receives' the image is distorted compared with the one which 'captured' it.[39] Primordially, the regular grid does not represent anything but its own self-identity. When used for copying or translating an image, the grid compels the identity of two surfaces, just as it compels the identity of two parts of its own surface. When one grid is distorted, the identity-function is not destroyed, but instead it gets meaning. The distortion of the grid signifies a transformation while identity is nonetheless asserted. A systematically distorted grid displays characteristics that can help to identify the indexical *process* it designates: in this way, for example, we can identify map projections by their characteristic graticules. It should be emphasised, however, that by itself, the distorted grid cannot do this unambiguously. When the process is not actually demonstrated before our eyes, there must be some kind of convention, or some other sign, or set of signs which informs us.

An album of map projections could consist *only* of graticules because each is a distortion of the same spherical grid of meridians and parallels.[40] Thus the shape of the grid (or graticule) takes on a symbolic aspect in so far as its visual specificity serves to differentiate it from other patterns resulting from other processes. A constellation of contextual signifiers can amount to an univocal assertion of a particular indexical process (and so resist the ambiguity to which the grid alone is always vulnerable) to the extent that the grid pattern comes to *stand for* this process, even when no such process has actually taken place.

**70 Paul Klee, 'Rythmic Structuring with flexible base' (1922) from *Das Bildnerische Denken*, Basle, 1956**

**71 Albrecht Dürer, 'Fiteen constructed heads, studies in physiognomy' ink, undated study for *Four Books on Human Proportion***

39 See, for example, Paul Klee's exploration of the grid in his Bauhaus lecture notes **(70)** or Dürer's anamorphic caricatures **(71)**.

40 See John P. Snyder and Philip M. Voxland, *An Album of Map Projections,* US Geological Survey Professional Paper 1453 (Washington DC: United States Government Printing Office, 1989).

This, I think, is the tendency of Alberti's doctrine of painting. The pavement figure—subject to a simple structural discipline—is deployed as the symbol of the new painting defined as the intersection of the visual pyramid, demonstrated by models such as the veil and described by metaphors such as the window.

Unlike the traditional copying grid, which is usually made to disappear,[41] the pavement figure is often ostentatiously developed in the final picture, not so much, it seems, to display how the picture was made, but as if to say, 'This is a picture in perspective,' and to declare its allegiance to the principle of intersection of the visual pyramid. In so far as the pavement is properly constructed, it makes a display of the artist's learning, but it also makes a new truth-claim: not really a claim to a metaphysical truth due to geometry (seductive though that possibility might be) but rather, it is a claim on the authenticity associated with the indexical sign: the claim that the image on the picture surface is the *trace* of the appearance of reality.[42] The pavement figure also serves as a signal to the viewer: that we may look *through* the paradoxical surface on which the image is inscribed. To pursue the metaphor I used earlier: letting down the draw-bridge is thus also a gesture towards the viewer.

One could say that the pavement figure invites the kind of spatial analyses that were popular in twentieth-century studies, where the attempt was made to recover three-dimensional information from pictures. However, the results of these analyses tend to suggest the pavement figure was, in fact, more of a decoy than the guarantor of an consistent approach to the representation of space. As often as not, the analyses reveal the inconsistencies and lacunae in the perspective construction. Moreover, of necessity, they underline the kind of assumptions that must be made in order to banish the ambiguity that would threaten to set adrift what the pavement aimed to fasten down by signalling a particular indexical process. From our point of view, the reconstruction of three-dimensional forms from pictures has little value as historical research. It appears more as an exercise designed to underscore the basic claim of the 'perspective paradigm'—as the set of expectations flowing from Alberti's definition of painting has been called. The triviality of the results tends to show how little it takes to establish this paradigm and frequently what a small part of painting perspective is.

We have seen how an indexical process requires some conventional interpretation to be a sign—that the phenomenon itself is not sufficient without some kind of significative apparatus or 'designator'. What we need to ask is how the indexicality (implicitly)[43] ascribed to pictures is made to stick, especially where there is no evidence of an indexical *process* actually taking place, either by means of an optical-mechanical device or by means of formal mapping.

For a long time, the geometrical arguments based on Euclidean optics such as Alberti

41 The grids used to transfer or enlarge images are almost invariably suppressed in the finishing of the picture. It is only in the twentieth century that it is asserted (a great example is the painting *In the Hold*, 1913–14 by David Bomberg), or is allowed to leave its mark (as in the late work of Walter Sickert). This was also the era during which the grid came to be asserted autonomously as a generator rather than as a mediator.

42 A claim which would later be made *a fortiori* for photography.

43 Of course, this term is not used, but, in my assessment, this appears to be the import of terms such as naturalism, verisimilitude and the like.

hinted at in *On Painting* lent support to the perspective paradigm, as did the legend of Brunelleschi's original demonstrations in which his picture was explicitly offered up for comparison with reality. Such support was mediated symbolically by the presence in paintings of motifs embodying the grid and the pride of place given to architectural configurations and set-pieces of foreshortening. The scholarly tradition that expounded the geometry of representation helped to secure the emphasis on the objective foundation of perspective, even though this theory became remote from artistic practice.

The theory of picture-making based on the geometry of light rays excluded—correctly, it should be said—any account of the subjective apparatus of vision and the physiology of the eye. The pre-eminence which was ascribed to geometry in the general theory of painting and its ideological claims had a considerable influence on the subsequent reception of Renaissance art and has perhaps been allowed to overshadow other aspects of Renaissance art theory such as have been highlighted, for instance, by Michael Baxandall. The estimation of geometry expressed by theorists was, however, not necessarily reflected in the practice of painting. Painters continued to rely on a repertoire of effects inherited from earlier practice and their innovations were not all justifiable in terms of mathematical reasoning or objective criteria. In fact, it was not until the twentieth century that aspects of image production and reception excluded from the customary account of perspective—which were formerly placed in the category of 'painter's tips and tricks'—were subjected to rigorous analysis. Such investigations, however, were sometimes hampered, for example, in J. J. Gibson's work in psychology, by excessive adherence to the perspective paradigm. Within art history, the critical recognition that the geometry of light rays is far from the whole story about pictures, despite being preoccupied with attempts at discrediting or relativising geometry, failed to dislodge the perspective paradigm from its own thinking.

Perspective is a tricky case in semiotic terms, because it presents the image as the *trace* of appearance. Hence it cannot be separated from resemblance. This index, it seems, must also be the perfect icon. Now it might be a problem with Peirce's analysis that one category is defined in terms of sign production and another is defined in terms of sign reception, although there is no suggestion that his categories are exclusive. However, the analysis does serve to point out that resemblance can be independent of any indexical process and, moreover, that an index does not necessarily involve resemblance between the sign and its sense.[44] This can be clearly understood in terms of picture-making where resemblance by no means depends on projection and strictly geometric methods can certainly make things look strange. The rules of picture-making are not identical with the rules of perspective. So much is clear already from Alberti's treatise, or, one might also argue, from the practice of anamorphosis which can be viewed as the systematic infraction of the rules of picture-making, yet in conformity with the rules of projection. I think it is worth pointing out that anamorphosis depends for its drama on the precariousness and elusiveness of the precise position of the

44 Resemblance to other signs of the type is, however, necessary for anything to be a sign.

viewing subject where he/she will get the iconic payoff. Why this is not the case for 'ordinary' pictures can seem puzzling the deeper one goes into the projective schemes that are supposed to structure them. How come paintings are so tolerant of deviations from the supposed ideal viewing position? My view, and this is the suggestion which I hope justifies the use of semiotic analysis, is that the aimed-for iconicity is seldom entrusted entirely to an indexical process, even though the latter holds out the promise of perfection. Instead, a notion of indexicality, mediated symbolically, is established to underline the (wished-for) relationship to reality of the image inscribed on the picture surface: *under the sign of the index*, resemblance is not just likeness, but points to a 'truth to reality' that will hold in spite of the ambiguity inherent in projection. Subjective resemblance is still the criterion by which the picture is judged, but it is not necessary to force an illusion on the viewer.

My attempt to describe this overlapping of icon and index is perhaps sufficient to suggest how, in an image such as Dürer's picture of the man drawing a woman through a screen, the picture's complications might be masked by its very legibility. The rhetoric of Dürer's demonstration configures a complex theory of representation with remarkable economy. I have already discussed how the veil as shown in Dürer's picture can be regarded as a model of perspective in its primary geometry and in this sense has a clear role in Dürer's teaching. We can regard the apparatus as a demonstration of an indexical process. But I have questioned whether and how such an apparatus might have actually been used by painters. It is extremely unlikely it was used by Dürer to make this image. I have pointed out that, though it advocates naturalism and is readily accepted as naturalistic, the image is artificial. It was hard enough to think of a room 'behind' this picture (as the woman reclines behind the veil) containing this table and screen, this draughtsman and model at work. To imagine in the room two such set-ups with a man and woman posing as draughtsman and model behind another veil starts to seem absurd.[45] Yet the notion of 'seeing through'—as the man appears to look through the reticulated screen, opaque though it seems to us—is addressed to the viewer of the picture by the open windows—the interior elevation pierced by its windows faces us as the screen faces the draughtsman—and importantly by the enframing of the drawing itself, which echoes the frame that supports the draughtsman's net. *For* this image, the grids which *in* the image mediate the man's transcription of what appears before his eyes—from the veil to the surface of the paper—take the place of the pavement figure, *signifying* another indexical process. The juxtaposition of the vertical and horizontal grids in Dürer's picture furthermore establishes a measure in three dimensions. Even though there is hardly anything else in the picture that conforms with this (secondary geometric) construction, it succeeds in establishing, perhaps not the illusion, but the notion of a real space sufficient for the viewer to be instructed clearly about the spatial relationship between the drawing subject, the veil and the object and to be convinced of the idea of projection this apparatus demonstrates.

45 On a different register, this image has often been read as an allegory of gender relations.

My digression on Dürer's and Alberti's demonstrative apparatus was, I hope, a useful way of investigating the role of geometry in the constitution of the 'perspective paradigm' and bringing to light some general problems of projection. My analysis was somewhat in the style of ideological critique. From that approach it was clear how little the success of the Albertian campaign depended on geometric content, despite the prominence of geometry in books such as *De Pictura* and *Underweysung der Messung*. Indeed, the persuasiveness of the role of geometry in art theory appeared to depend on dissimulating or diverting aspects of projection that could not support the aims of the new painting and avoiding other aspects of a rigorous geometrical approach to picture-making that would be simply too tiresome and longwinded for a practitioner to be bothered with. My comments suggested how the artist's semiotic economy could establish what is needed from geometry without getting roped into pointless labour. Perspective thus appeared as a kind of epistemological wish-image. The metaphysical 'truth' of geometry, it seemed, was advertised, on the one hand, to establish the credentials of projection as an indexical process—what might be called the logic of the trace—and on the other hand, to distract attention from the ambiguity that is no less a part of that logic.[46]

I have already mentioned how the scholarly legacy of the promotion of perspective in pictures seems to have become remote from artists' practice in the centuries following Alberti's manifesto. Given the vicissitudes of fashion in painting, there are moments when it can seem as if Alberti had succeeded better in putting the problems of representation on the mathematicians' agenda than he had in building geometry into the practice of painting. The works that are recognised today as contributing to the mathematical interpretation of perspective or the theory of projection are unlikely to have had a direct influence on the practice of painting. For instance, the work of Girard Desargues (1591–1661),[47] which includes novel treatments of perspective, stereotomy, sun dialling and conic sections reflects a theoretical convergence of the first three practical concerns (classically associated with architecture) and the last abstract mathematical subject. Desargues is hailed today as the precursor, if not actually inventor, of modern projective geometry, but his work was not widely circulated in his time and did not have much influence. Apart from its small circulation, Desargues's research—or to use his own tentative title from the work on conic sections, *Brouillon projet d'une Atteinte ...*—is notorious for its obscure terminology and extreme mathematical concision. The reception of Desargues's work by the academy, through the mediation of Abraham Bosse (1602–1676) was controversial.[48] To be sure, the geometry and techniques of perspec-

46 It could be further argued that geometry had another role in the Albertian campaign in helping to dissimulate the 'secrets' of its success in a secular market economy. I am referring to the establishment of a monadic individual subjectivity and of the framed picture as the vehicle for the image-commodity and basic unit of exchange for the freelance artist. The perspective model ostensibly based on geometry helped to make these things seem inevitable.

47 Sixteenth-century works such as Frederico Commandino's commentary on the *Planesphaerium* of Claudius Ptolemy (1558), Daniele Barbaro's *La Practica della Prospettiva* (1569), Giacomo Barozzi da Vignola's *Le due Regole della Prospettiva Practica* (1583), Giovani Battista Benedetti's *De rationibus operatioinum perspectivae* (1585), Guidobaldo del Monte's *Perspectivae libri sex* (1600) could also be mentioned.

48 See Field et al, *The Geometrical Work of Girard Desargues* (New York and Berlin: Springer, 1987), pp. 29–30 and Martin Kemp, *The Science of Art: optical themes in western art from Brunelleschi to Seurat* (New Haven and London: Yale University Press, 1990), pp. 122–128.

tive were propagated through the academies of art, although it could be argued that the presence of geometry on the curriculum had as much, maybe more, to do with the justification of the existence of the academy as such than it had to do with the practical needs of painters.

**3**

The rediscovery of Desargues's work occurred in the context of the independent development of projective geometry in the wake of the work of Gaspard Monge (1746–1818). Monge did not produce the kind of mathematical novelty which assures the reputations today of some of his contemporaries and pupils. He is nonetheless credited with prompting the revival and productivity of geometrical research in the nineteenth century. Both the theoretical and historical backgrounds of Monge's *Géométrie descriptive* are interesting. On the geometric side, Monge adopted the analytical (algebraic) approach pioneered by Descartes. On the descriptive side, the kind of drawings with which he is concerned formed a part of a more ancient practical tradition that had been codified by Vitruvius in the first century BCE. The system Monge developed and later taught had its origins in his approach to the tasks he had to undertake as a young draftsman at the École Royale du Génie (the military engineering school) at Mézières in the mid-1760s. The geometric method Monge devised allowed him to finish his assignment much quicker than expected. This at first aroused the suspicion of his superiors, but his mathematical talents were soon recognised and he was given promotion. The method was considered valuable enough to have been classified as a military secret, and as a result it did not appear in print until his lectures were published in the *Séances des écoles normales* in 1795. These papers were collected in book-form in 1799.

I want to look at Monge's *Géométrie descriptive* because its principal subject is representation, and specifically the inter-relationship of drawing and mathematics. Moreover, his work had a profound influence not only on mathematical geometrical research, but also on the teaching and practice of drawing in the nineteenth century in the context of engineering, design and manufacture, or as they were often called at the time, the 'useful arts'. *Géométrie descriptive* is a statement of a modernising agenda, clearly understood in technological, economic and military terms.

Tracing the influence, in Deforge's nice phrase, of 'Monge et les avatars de géométrie descriptive'[49] will be vital for my assessment of the 'meaning' of geometry in the twentieth century, the time when geometry achieved a prominence in art theory and criticism that it had not enjoyed since the Renaissance.

As well as meeting an identifiable practical need, descriptive geometry emerged in a situation from which its dissemination was assured. In 1769, Monge was appointed professor of mathematics at the École du Génie succeeding the man whom he had first encountered when he was admitted to the school as a draftsman only a few years earlier. At Mézières,

49 Yves Deforge, *Le Graphisme technique: son histoire et son enseignement* (Seyssel: Champ Villon, 1981), p. 189.

Monge also became involved in teaching and research in experimental physics and chemistry as well as becoming known in scientific circles in Paris through his papers read at the Académie des Sciences. Monge was a strong supporter of the revolution and after 1789 was involved with the reorganisation of technical education at a national level, in particular, he was instrumental in the establishment of the École de Travaux Publics (the future École Polytechnique) and the École Normale. The courses in descriptive geometry that Monge taught at these new schools were aimed at teaching teachers, a circumstance which had an influence on his style of presentation.

Monge brought to the practical tradition a mathematical generality and rigour that it had earlier lacked, but the motivation, as we have seen in connection with its early application, was not only mathematical speculation, but the provision of general and effective tools for practical problem-solving. It is possible to read *Géométrie descriptive* as a concise statement of Monge's revolutionary pedagogy, or perhaps to avoid exaggeration one should say, pedagogy in the service of the Revolution. This amounts to a philosophy which echoes the classical and Renaissance models we have already touched on to the extent that it foregrounds geometry as a deductive system. It also expresses Enlightenment and bourgeois values associated with education, intellect, the nobility of the mind and suchlike. It should be remembered that because of his own humble social background, Monge would not ordinarily have been admitted to the École du Génie and one could say without exaggeration that Monge owed his career and his position of high esteem (indeed, later he was an intimate of Napoleon) to studying geometry in his spare time. Nonetheless, the 'Programme' of *Géométrie descriptive* opens by placing the objective squarely in the context of the national economy (and implicitly in the context of competition with Britain in terms of industrial production and military capability): 'To free the French nation from the dependency it has had until now on foreign industry.'[50]

However, Monge's comments on the needs and justifications for the place of descriptive geometry on the national curriculum are confined to his introductory remarks and he is generally eager to discuss the principles of descriptive geometry instead of its applications. Monge makes a point of the suggestion that, 'Among the different applications in which one can make use of the method of projection, there are two which stand out for their generality and their ingeniousness: these are perspective construction and the rigorous determination of shadows in drawings' (3) but he does not develop these in his École Normale course. Indeed, in the worked examples that form the lectures, practical engineering problems are hardly mentioned either, and when they are, are used to refer back to more abstract matters. For example, a short digression on the engineering of stone vaults concludes, 'Thus the analysis of a vault into voussoirs absolutely requires the consideration of planes tangent and normal to the curved surface of the vault' (31). The abstract tone is certainly a distinguishing

50 Gaspard Monge, *Géométrie descriptive* (Paris: Baudouin, 1799), p. 1. Further page references in brackets in the text. See **Appendix E** for original texts of my translations from the French cited in Part III.

feature of Monge's text and is consistent with its educational milieu where those destined to teach were expected to gain a deeper grasp of the basic principles of the subject than they necessarily might impart to their own students in the context of secondary-school or technical education. There is nothing new about the appeal to the general principles of geometry as a kind of higher truth. What is outstanding about *Géométrie descriptive* is its restrained mathematical seriousness and in this respect it set new standards. Monge's method is distinguished from earlier treatments of drawing in that it is based on a thoroughly three-dimensional geometry, and perhaps above all, because of the emphasis Monge placed on the reciprocity between the geometrical properties of objects and of drawings mediated by projection, and between such drawings and mathematics. When Deforge remarks that, 'Monge insists on the character at once rational and practical of descriptive geometry more than on its novelty,' [51] we should remember that the practical matter at the heart of *Géométrie descriptive* is drawing.

> Descriptive geometry has two objectives: the first is to give the methods of representing on a sheet of drawing paper which has only two dimensions, [...], any three dimensional object [...] provided this body is capable of rigorous definition.
>
> The second objective is to give the means of obtaining the form of a body from an exact description, and to derive from it all the facts which result from its form and position in space. (5)

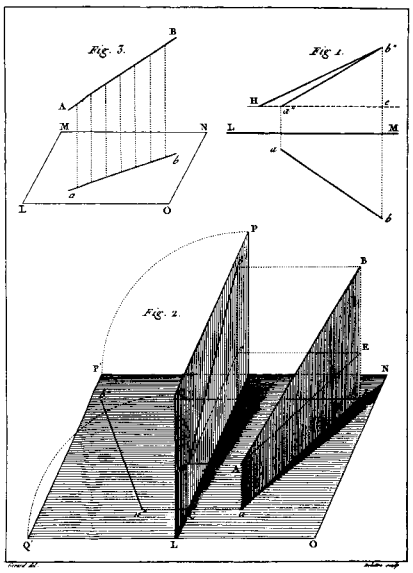
In mathematical (and pedagogical) terms this translates into a statement of the reciprocity between geometry (associated with drawing) and algebra:

> It is not without a point that we make the comparison here between descriptive geometry and algebra; these two sciences have the most intimate relationship. There is no construction in descriptive geometry which cannot be translated into analysis; and if the problems have no more than three unknowns, then every analytic operation can be regarded as the script [*écriture*] for a play [*spectacle*] in geometry. It is desirable that these two sciences should be cultivated together: descriptive geometry brings its own kind of transparency to the most complicated analytic operations, and in turn, analysis brings its own kind of generality to geometry. (16)

The language Monge uses in this statement and elsewhere[52] is suggestive for the kind of

51 *Le Graphisme technique*, p. 198.

52 'The correspondence between the operations of analysis and the methods of descriptive geometry is not limited to what we have just mentioned, it is everywhere. If one generates forms by moving points, curves or surfaces in space, these movements and the new objects can always be dictated by analytic operations; and the new objects to which they give rise are expressed by the results of the equations. Reciprocally, any three-dimensional equation is the script [*écriture*] which dictates a movement in space. Therefore to learn mathematics in the most advantageous way, the student should get the feeling at an early stage for the correspondence between the operations of analysis and those of geometry; he should, on the one hand, be able to write in algebra any movement he could conceive of in space, and on the other hand, represent the moving spectacle in space of which every equation is the script [*écriture*].' (62)

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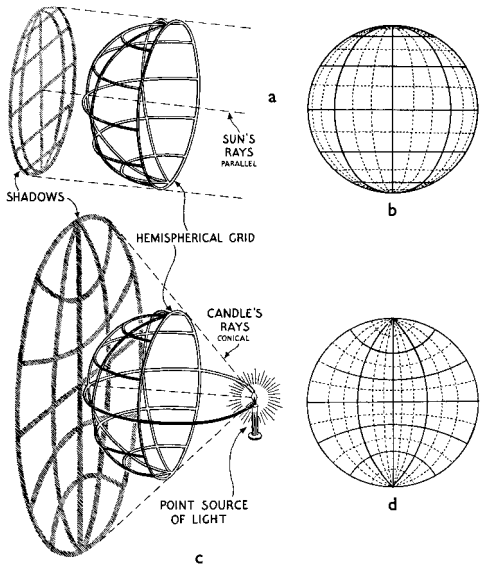
semiotic analysis I have explored. The notion of projection developed in *Géométrie descriptive* is fundamentally different from what we have encountered before because it is now a two-way street as far as algebra and geometry—respectively *l'écriture* and *la trace*—are concerned. This is Monge's justification of how drawing may effectively be used as an analogue computer for analytical problems. Monge does not distinguish between objects given analytically, that is by mathematical equations, and objects given materially in three dimensions (except for his proviso, 'provided this body is capable of vigorous definition'). The process of projection, obscure though it may be, is not mediated by vision. The reciprocity between the three-dimensional 'world' and the two-dimensional page—underlined by Monge's notion of demonstration or *évidence*—is guaranteed by the co-ordination of two planes of projection. It is no longer the one-way process we observed in astronomy and painting. Astronomy had forced the issue of reciprocity by hypostatising as 'celestial mechanics' whatever geometric constructions (cycles and epicycles, for instance) it conjectured to save the phenomena, starting with its own epistemic regime of projection (the celestial sphere).[53] Painting had frankly emphasised the deformation of perspective image in relation to the object. *Degradata* is the word Piero della Francesca used to distinguish the image from the object of representation. Painters were advised to avoid 'unnatural' distortions, or if fashion swung the other way, to display extravagant effects of foreshortening.

Monge, it seems, avoids any metaphorical explanations in his presentation of projection. By that I mean only that there is no 'as if' in his explanation, for the terms he uses, 'projection' and 'trace', cannot help carrying some metaphorical weight. He does provide, however, a diagrammatic picture to support the basic principle of how any point in space can be specified

**72 Planes of projection from Gaspard Monge, *Géométrie descriptive*, Paris, 1799**

53 Newton restored a physical explanation to the celestial mechanics that Kepler had apparently abandoned along with the Ptolemaic clockwork. But it should be noted that Kepler's confidence was founded in a realistic notion of geometry and that Newton's explanation was achieved by postulating gravitation (the mysterious action at distance that prompted early objections) and hypostatising (absolute) space.




**73**

by its projections on two planes (the projectors being perpendicular to the planes) and how these may be co-ordinated for convenience **(72)**. Putting an angle of ninety degrees between the planes of projection brings descriptive geometry into conformity with what is called orthographic drawing, that is, plans and elevations. Such drawings are the archetypes of technical drawing. Orthographic drawing certainly cannot be attributed to Monge. However, Monge's work is fundamental to *modern* drawing, despite the abridgement and simplification, not to say corruption, of his theory that went with its dissemination. This is because, following *Géométrie descriptive*, orthographic drawing came to be firmly associated with *projection*. As one of the supposedly eternal truths we have inherited from the nineteenth century, expressing it in terms of *becoming* instead of in terms of essence is bound to sound odd.

Although *Géométrie descriptive* is concerned with graphic representation, construction and computation, it would be wrong to assume that descriptive geometry has to do directly with picture making of the kind I explored earlier. Monge foresaw its adaptation to perspective and shadow projection (the stock-in-trade of architectural drawing), but left it to his followers to demonstrate these applications. In any case, perfectly adequate methods already existed in architects' offices and artists' studios. Monge was apparently of the opinion that shadows helped people to 'read' drawings in three dimensions.[54] This, along with the recommendation of planes of projection perpendicular to one another, may be Monge's only concessions to 'visualisation' (in so far as vertical and horizontal planes of projection corresponded with the customary ways of representing familiar visual objects). So, for my argument to proceed, I will have to show, at least by some representative instances, what intervened between Monge's austere teaching, later drawing practice and, eventually, the art of the twentieth century.

Before going on, however, it is perhaps worth pausing to reflect again on the index. It would

**73 Parallel and central projection from P. J. Booker, *A History of Engineering Drawing*, London, 1963**

54 See *Le Graphisme technique*, p. 199.

be tempting to assign descriptive geometry to this category merely on the strength of Monge's terminology or its associations with perspective and sciagraphy. It is easy to see how these things connect up. A nice example is Booker's diagram explaining orthographic (parallel) and stereographic (central) map projections by means of shadows cast by a hemispherical grid **(73)**. But what does descriptive geometry add to the idea of index that I have been elaborating?

In my discussion of maps I focused on the role of the grid as a component of what I called the significative apparatus of the index. With perspective, we saw how indexical signification can obtain independently of any physical referent, and that it can be established on the side of sign production by means of graphic construction and on the side of sign reception by the deployment of symbolic designators such as the perspective pavement, framing devices etc. Descriptive geometry also insists on the compelling relationship between any possible figure in three dimensions and its two dimensional traces. The difference is that descriptive geometry is not mediated by vision or the Euclidean geometrical optics that stood in for vision, but by Cartesian geometry. Hence, descriptive geometry extends the notion of index to include processes such as algebra. Such abstraction—beyond even geometry, which at least was a satisfying analogue of reality—would be perturbing if our concept of index were restricted to what Peirce called reagents. Descriptive geometry suggests a notion of algebra as a kind of machine (and indeed, the possibility of a continuity between symbolic codes and indices which could explain some of Peirce's bizarre-seeming suggestions that we came across earlier).[55] For Monge, the vivid correspondence between geometry and algebra is underpinned by a realistic notion of geometry. Though he is keen to demonstrate the mathematical generality of his ideas, he restricts his statement of the 'most intimate relations' between the 'moving spectacle' of points, lines and curves in space and the analytic 'operations' which prescribe or dictate them to problems of no more than three dimensions. Methodologically, descriptive geometry is dedicated to maintaining a complement of three-dimensional information while working in two dimensions. But, although visualisation may be virtually synonymous with the perception of objects in three dimensional space, descriptive geometry and visualisation face different pragmatic criteria and are not, so to speak, congruent.

## 4

For all that descriptive geometry might have been made to seem as if it were the key to technical and hence economic advancement not just for the student but for the nation, it is clear that the lack of a fully rationalised system of technical drawing had not inhibited British engineering and industry. It should also be remembered that descriptive geometry is not the whole of technical drawing. Impressive though geometry might be as a 'universal method'

55 See Part II, p. 47. The workings of a digital computer also suggests this kind of continuity. Examining the layered programming languages and 'machine codes' behind the user interface and pursuing them ultimately to the movement of electrons on an integrated circuit, it is difficult to draw a line between symbolic codes and physical effects.

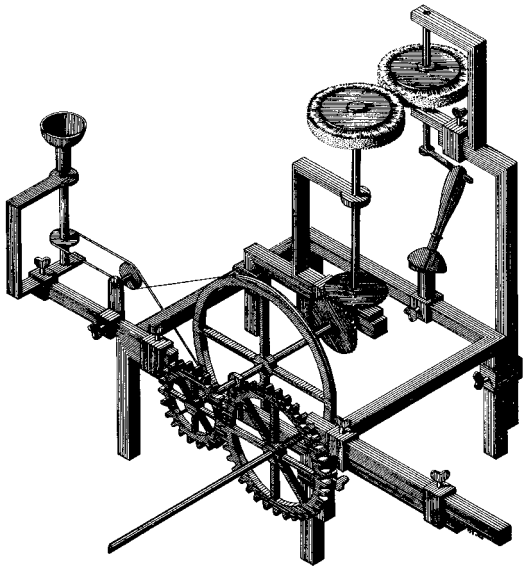
this does not necessarily constitute a universal language. Descriptive geometry had nothing to say about drawing conventions, symbolisation, scales, dimensioning and the like which give meaning to a drawing for a designer or a manufacturer.[56] As we shall see, this distinction is not always made clear in nineteenth-century teaching of drawing.

William Farish's 'On Isometrical Perspective', published in 1822, arose from the lecture-demonstrations on mechanics the author delivered as Jacksonian Professor of Natural and Experimental Philosophy at the University of Cambridge. The text itself comes from his inaugural lecture as president of the newly-formed Cambridge Philosophical Society and was printed in the Society's first *Transactions*.

'On Isometrical Perspective' is perhaps an unusual example of the amalgam of practical and scholarly traditions in that it is situated in such an elevated academic environment while being predominantly practical in its approach. It is interesting for several reasons. Descriptive geometry was accepted as the basis of technical drawing education in France and was quickly adopted in continental Europe, but in Britain and the emerging industrial economy of the United States, it was taken up much more slowly. Farish therefore represents a position that is by no means anti-Mongean, but is certainly non-Mongean. His interpretation of orthographic drawing reflects a lineage that was repressed by Monge but which, despite the dominance of descriptive geometry in Europe, can still be traced in what has been called 'la réduction didactique de la géométrie descriptive.' My point is not to identify the influence of rival schools in the various textbooks that appeared in the nineteenth century, but to note that Mongean descriptive geometry was not handed down in its pure form. Farish's text offers a way of acknowledging a set of ideas about drawing (not necessarily original to Farish) that were never actually eclipsed by descriptive geometry.

The most conspicuous difference, if we compare Farish with Monge, is the former's pragmatic approach, whereas we might have described Monge's as syntactic. The drawing system Farish expounds is the method he had found useful in helping his assistants to assemble models of machines from a kit of parts he had had made for his lectures. Incidentally, this kit of parts—apart from sparing Farish the trouble and expense of making and storing a large number of models—represents an analysis of the principles of machinery and this is where we find Farish's syntactics **(74)**. To put one of these models together one needed a clear grasp of how the various components connected up in three dimensions. The usual system of plans and elevations might have sufficed formally, but was felt to be 'unintuitive' except perhaps for an expert. Adding shadows, albeit well-adapted for representations of architecture, was hardly much help with generic machine parts. Making perspective pictures would be too time-consuming and complicated and could introduce confusing distortions. So the 'isometrical perspective' Farish advocated and exposed to discussion had the advantage of picture-like properties, but without the disadvantage of perspectival distortion. In isometrical 'per-

56 As Deforge puts it, 'Technical drawing is not the offspring of descriptive geometry.' (*Le Graphisme technique*, p. 214).



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spective', parallel lines were not subject to convergence towards a 'vanishing point' and so remained parallel in the drawing. Moreover, Farish claimed, it was relatively easy to draw:

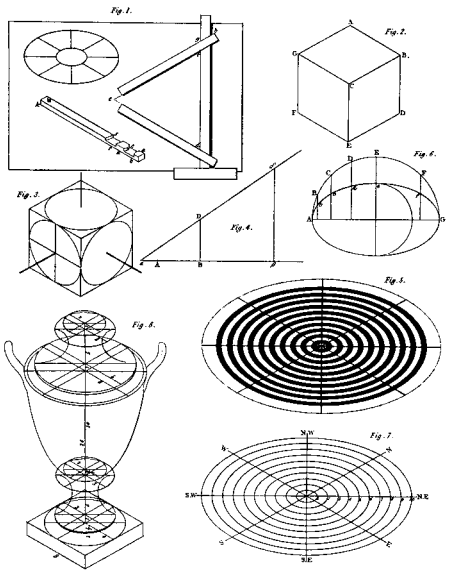
> There is no difficulty in giving an almost perfectly correct representation of any object adapted to this perspective, to which the artist has access, if he has a very simple knowledge of its principles, and a little practice.[57]

For the user of the drawing—that is, the one who had to interpret it by assembling a model correctly—the chief advantage of the system was that it showed a 'three-dimensional view' with each of the three principal planes it displayed foreshortened by the same amount. It worked because, as Farish points out, 'In models, and machines, most of the lines are actually in the three directions parallel to the sides of a cube, properly placed on the object' (6). This did not stop Farish from recommending his 'isometrical perspective' for a very wide range of other applications, as we shall see.

A modern writer would not call this kind of drawing a 'perspective' although in Farish's day this term would have covered any drawing where the emphasis was on picture-like qualities. These would have included so-called *cavalier* perspective (basically, a plan with the perpendiculars attached at an angle drawn at the same scale; 'cavalier' because it suggested a high 'view point', as if from horseback, and was associated with military engineering) and *cabinet* perspective (usually an elevation with perpendiculars attached at an angle, drawn at half the scale of the elevation, associated with furniture design). The modern catch-all term 'projection' might be just as inappropriate as 'perspective' for isometric drawing, but Farish had reasons for invoking both.

**74 Drawing of machine parts from William Farish, 'On Isometrical Perspective', Cambridge, 1822**

57 William Farish, 'On Isometrical Perspective', in *Transactions of the Cambridge Philosophical Society* (Cambridge: Cambridge University Press, 1822), p. 4. Further page references in brackets in the text.



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Farish's rationale amounts to the reconciliation of perspective and orthography. It entails a double operation of establishing a view point (in relation to a specimen cube) and removing it. The explanation seems to presuppose the concept it wants to demonstrate, namely that of orthography as a representation obtained by means of projection. By contrast, the way Monge had established this idea for orthography was by the arbitrary adaptation of an abstract system to customary modes of drawing. It is worth emphasising that however convincing Monge's theory, the idea of projection is not essential to plans and elevations, which can be and certainly were regarded simply as true shape drawings analogous to a plan one might have inscribed on the ground in preparation for building work.

This is what Farish says:

> Suppose a cube to be the object represented. The eye placed in the diagonal of the cube produced. The paper, on which the drawing is to be made to be perpendicular to that diagonal, between the eye and the object, at a due proportional distance from each, according to the scale required. Let the distance of the eye, and consequently that of the paper, be indefinitely increased, so that the size of the object may be inconsiderable in respect of it.
>
> It is manifest, that all the lines drawn from any points of the object to the eye, may be considered as perpendicular, which becomes therefore a species of orthographic projection. It is manifest, the projection will have for its outline an equiangular and equilateral hexagon, with two vertical sides, and an angle at the top and the bottom (5).[58] **(75)**

**75 Isometric drawing from William Farish, 'On Isometrical Perspective', Cambridge, 1822**

58 This passage continues with an explanation of how, by the symmetry of this figure, the measures of any lines in the picture corresponding to lines lying on the object in any these planes would match the proportions of those lines on the object.

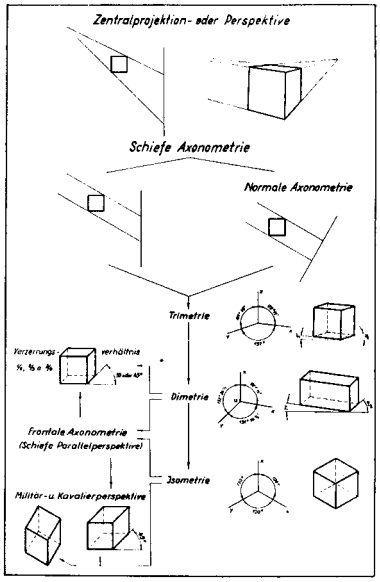
The projective justification Farish here supplies is a kind of pseudo-sophistication. It begins following the Albertian model with the 'paper on which the drawing is to be made' standing in a surprisingly literal way for that intersection of the visual pyramid that had earlier suggested the metaphors of an open window or a pane of transparent glass. The business about the proportional distances between the eye, paper and object 'according to the scale required' is peculiar in view of the fact that perspective does not offer a uniform scale. It would only seem to matter if one had in mind a particular size of object and a particular piece of paper on which one had to fit the image. In any case, Farish's next step makes it entirely irrelevant.

Increasing the distance between the eye and the object 'indefinitely' is a euphemism for removing the eye to infinity. It makes a certain kind of mathematical sense as a way of expressing a continuity between central and parallel projection (the further the eye recedes, the more nearly parallel the rays from the eye to parts of the object will become). But it violates the 'more sensate wisdom' Alberti had insisted on (when the rays become parallel, the object will subtend an infinitely small angle at the eye; and so, for that matter, would the paper, being held at some fraction of an infinite distance from the eye). Farish's logic is paradoxical because if we look at the other end of this infinitely long visual pyramid, we *could* imagine rays leaving different parts of the object and travelling parallel to one another towards a remote eye. Then it does not matter where one puts one's paper, because the scale of the image will not change.

The association Farish makes between his 'perspective' and 'orthographic projection' is made only on the strength of the parallelism of the rays. He seems therefore to presuppose a concept of orthographic drawing in which it is understood like the projection of visual rays, but with objects 'seen' as if from an infinite distance. Such a notion had been in circulation at least since the mid-seventeenth century,[59] but I am not sure where the idea originates. For Farish, the practice (if not the theory) of orthography saves the day, for it is difficult to see how his projection would be 'manifest' at all on his perspectival model. The difference that emerges between isometric 'projection' and standard orthography is that in isometric, the projectors are aligned with a diagonal of the specimen cube instead of perpendicular to one of its faces. This kind of interpretation was later applied to other kinds of drawing that preserve parallelism in picture-like representations and led to a classification of drawings on the basis of primary geometry, according to the orientation of a specimen in relation to the plane of projection and/or the angle of projection. Thus isometric came to be understood as a member of the axonometric group classed under orthographic projections. Cavalier and cabinet perspectives were classed under oblique projections **(76)**.[60]

59 See for example, Abraham Bosse, *Traité des practiques géométrales et perspectives: enseignées dans l'Academie Royale de la peinture et sculpture* (Paris: [published by the author], 1665), p. 70.

60 The terms are, however, often used very loosely. The kind of 'cavalier perspective' often used by architects is commonly called axonometric. Yve-Alain Bois's insistence on calling anything that resembles a parallel projection 'axonometry' severely hampers his attempt to sketch a genealogy of the form. See Yve-Alain Bois 'Metamorphosis of Axonometry' in *Daidalos* 1 (1981), reworked as 'From - ∞ to 0 to + ∞ Axonometry, or Lissitzky's mathematical paradigm', in *El Lissitzky: architect, painter, photographer, typographer* (Eindhoven: Municipal Van Abbemuseum, 1990) See below, p. 197.




**76**

I have gone to the trouble of examining this in some detail, because Farish expresses a rationale that echoes throughout nineteenth century teaching, both in the European tradition that broadly speaking derived its idea of orthography from Mongean geometry and in the British tradition that broadly speaking derived its idea of orthography from perspective and Euclidean geometry. In short, it is the notion of orthographic drawings as 'views', if not from an infinite distance as we have seen here, then from a roving eye that scans an object, keeping its line of sight perpendicular to the plane of projection.[61]

**76 Classification of drawing systems from Alois Nedoluha, *Kulturgeschichte des technischen Zeichens*, Vienna, 1957**

61 The following examples may be regarded as typical of the rationalisations of orthography offered in drawing manuals. This is the version in Thomas Bradley, *Practical Geometry, Linear Perspective and Projection: including isometrical perspective, projection of the sphere and the projection of shadows* (London: Baldwin & Cradock, 1834), pp. 230–231:

'If the distance of the vertex from the original object, instead of being at a finite distance, as it is always supposed to be in perspective projection, be assumed to be at an infinite distance; the rays from the object, instead of forming a pyramid, will form a prism, or will be parallel to one another; and the projection becomes what is called orthographic [...] no vanishing points or lines can be produced; or these vanishing points and lines may be also considered at an infinite distance, and the projections of original parallel straight lines will be parallel, or may be conceived as converging to an infinitely distant vanishing point.

'Orthographic projection, theoretically considered, is only a modification of linear perspective, yet the practical geometrical constructions in its application are sufficiently different to require explanation and examples.'

This is the version in F. Arcadius, *Cours de dessin linéaire industriel* (Paris: Carles, 1853), plate 17:

In the arts, one represents objects in two ways: perspectivally or geometrically.

In perspective, objects are represented as they appear to the eye. This kind of drawing renders only the apparent forms of objects, everything is foreshortened and none of the dimensions is exact: consequently, it cannot be used in industry, where it is necessary to make the dimensions of objects known down to the last detail so they can be manufactured. Geometric drawing, known more generally as projection, is intended to represent the outlines of objects capable of being defined exactly on surfaces of given form and position.

Because space has no limits, one can only determine the position of an object by referring it to two planes perpendicular to one another which are called Planes of Projection: one is horizontal, the other is vertical and the line of intersection where they meet is called the Ground Line. [...]

To make the operations of projection easy to do, we suppose that the lines emanating from a body are all straight, parallel to each other and perpendicular to each of the planes of projection.

To make it easier to understand, let us determine the projections of a point A [...]

Let us suppose that the spectator looks at this point from above, in such a way that the visual ray which emanates from his eye passes through the point A and is perpendicular to the horizontal plane [...] by moving oneself around one comes to look at point A face-on, in such a way as the visual ray, still passing through A, is perpendicular to the vertical plane.

Deforge notes how in the early twentieth century, 'a spectator, observer or "observer-projector" crops up in most accounts of the principles of projection, not without a certain fantasy or incoherence.'[62]

Farish's lecture is not typical in that his audience at the Cambridge Philosophical Society was not actually being taught either engineering or drawing. Farish's attempt to establish a primary geometry for his drawing system, might have been appropriate for his academic audience, but he was, in fact, mainly preoccupied with secondary geometry, that is, graphic constructions and their applications. The lecture even describes in some detail a set of special attachments for the T-square to facilitate isometric drawing **(75)**. So, Farish must have felt that even these issues were of fitting scientific interest for a man in his position.

What this suggests in my context is the kind of intellectual weight that could be attached to geometry at a time when the academic status of technology was, let us say, under negotiation. It also gives a sense of the need for a rationale that, on one hand, would confirm the status of the teacher and suggest to the pupil the possibility of a higher knowledge, and on the other hand could act as a substitute for theory in the context of practical education.

Farish was an enthusiastic advocate of his system and recommended it for, among other things, mining engineering and drawing minerals and crystals. He says:

> It would not be difficult to devise rules for the representation of many other forms which might occur in objects to be represented. But the above cases are sufficient to include almost everything which occurs in the representation of models, of machines, of philosophical instruments, and, indeed, of almost any regular production of art. (11–12)

Historically, it seems isometric perspective was not as widely adopted as Farish anticipated although it was widely taught and competed among the variety of drawing systems that recommended themselves to practitioners in a rapidly expanding range of applications. Progress in industry, technology, discovery and communications during the nineteenth century saw the application of graphic representation to new subjects, new methodologies applied in traditional industries and, perhaps most importantly, a large expansion of the class of people for whom drawing was a necessary part of professional life. The concomitant spread of technical drawing education was the vehicle for the dissemination of ideas connected with geometry and projection like Farish's, which served more to inculcate notions of pedagogic hierarchy—or intellectual community, as the case may be—than to explain very much to students.

Booker remarks that, 'primary geometry was invented to account for a secondary geometry which had been in use for ages. True as this projectional system is, it has never yet proved to be of any use. An oblique view of an object can be drawn without any idea of the nature of projection—and even if its form is explained in terms of projection, one will still continue to

62 *Le Graphisme technique*, p. 212.

draw it the same way.'[63]

Perhaps it really did not matter to the student of technical drawing what paraphrase or variation on the rationale of drawing served to flatter the intellectual vanity of the instructor or to lend unity to the various methods that had to be learned. After all, the meaning of his (we are still speaking of the nineteenth century) drawings would be strictly circumscribed and the codes and conventions that made them communicative artifacts would be learned on the job.

However, it is in marginal situations, where the pragmatic context is less coherent, that we can expect to come across appeals to supposed founding discourses of drawing or the questioning of the resulting graphic signifiers. These situations might be connected with investigations of unfamiliar natural or mathematical objects, with explorations of unfamiliar aspects of known objects or with the investigation of the conditions of signification itself.

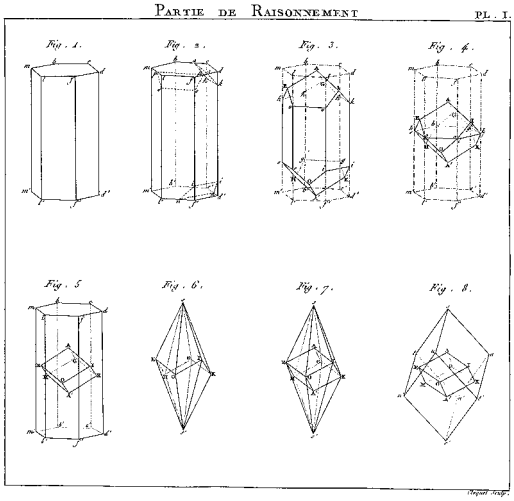
**5**

At the beginning of the nineteenth century crystallography was a relatively new science. Its disciplinary foundations are largely due to René Just Haüy (1743–1822), a contemporary of Monge's and colleague at the École Normale, whose *Traité de la Minéralogie* appeared in 1801. Haüy's work brought the taxonomic motives of the eighteenth-century naturalists into contact with physics, chemistry and mathematics. However, mineralogy seemed to him a poor science compared with zoology or botany whose objects seemed to have such a hold on the human imagination.

> But most minerals, hidden in the cavities of the globe, are only extracted along with a whole lot of debris, and scarred by the destructive tools which have torn them from their hiding places: they are, for the common man, only brute masses, without physiognomy and without language, made only to be appropriated to our needs: one hardly imagines they could become the object of a separate science, and that there could be a place for the naturalist in between the miner who extracts them and the artist who works them.[64]

In the absence of the investigative techniques and structural theories which would later transform his topic, Haüy's classification of minerals was concentrated on an analysis of the external morphology of crystals on the basis that this offered clues to the internal composition and microscopic structure of the materials. Although based to some extent on physical properties such as cleavage, Haüy's notion of structure was almost completely hypothetical and geometric. Thus the *Traité* consists, not of a collection of specimens for identification—of *objets trouvés*—but of a geometric analysis organised as a commentary on an exten-

63 *A History of Engineering Drawing*, pp. 211–212.
64 René Just Haüy, *Traité de la Minéralogie* (Paris: Louis, 1801), p. ii. Further page references in brackets in the text.

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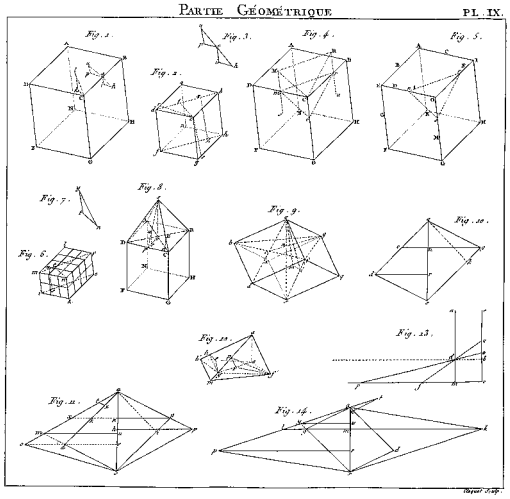



78

sive set of illustrative diagrams **(77–80)**. The 'physiognomy' and 'language' of mineralogy would be established on the double foundation of drawing and mathematics, 'the one by simple reasoning aided by drawings which make visible the mechanism of this structure, the other, in a separate text, with the aid of mathematical analysis, giving the results all the generality the subject entails' (xlix).

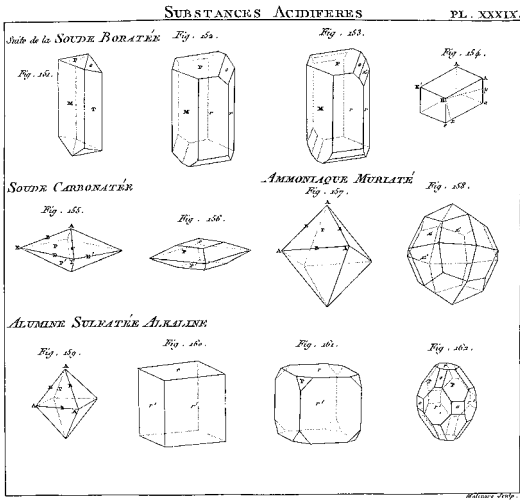
Although, in tribute to his collaborators who prepared the plates for the *Traité*, Haüy referred to the drawings as 'a kind of graphic treatise on the laws of structure,' (li) it will be clear from my comments that on their own, the drawings would not constitute a science. Or to put it another way, the potential autonomy of the drawings would threaten to undermine the reasoning they were intended to support. Haüy's separation of the mathematical analysis can be seen as a precaution against this.

In presenting the subject in a new way, there appears to be a trade-off between the didactic value of the drawing and its demonstrative capacity in the geometric sense we discussed earlier. Haüy informs his readers, 'The figures have been drawn according to the method of projection, supposing a point of view removed to infinity' (lv).[65] That means parallel projection and it assures an important property for drawings made for the study of crystals in that we know that any parallels in the drawings represent parallels in three dimensions. However, Haüy does not use co-ordinated planes of projection, as in descriptive geometry, which would provide a complement of three-dimensional information. Instead, with very few exceptions, the drawings are pictorial 'views' designed apparently *ad hoc*, employing different variations on axonometric or oblique projections, sometimes on the same plate. Without any datum provided in the drawing, the reader must refer to the text for basic information

**77 René Just Haüy, 'Partie de Raisonnement', plate I from *Traité de la Minéralogie*, Paris, 1801**

**78 René Just Haüy, 'Partie Géométrique', plate IX from *Traité de la Minéralogie*, Paris, 1801**

65 A set of wooden three-dimensional models was made for the École des Mines.

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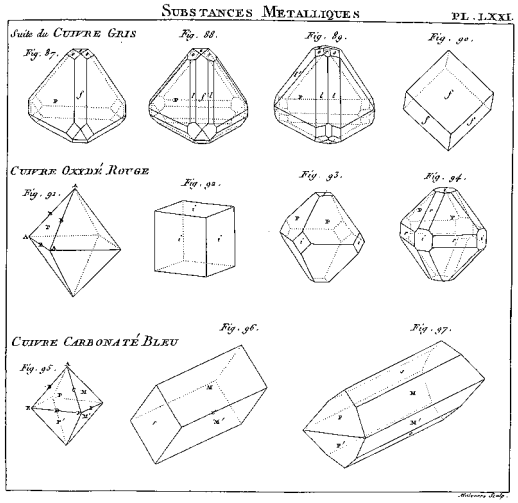


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about the shape of the object. For example, similar-looking configurations on the page, might be specified variously as cuboids or rhomb(ohedr)oids. Sometimes it doesn't matter, as for instance when the diagram is there to make a general point about the regular accretion of cells (Haüy's hypothetical *molécules intégrantes*), the cell is given in the text simply as some kind of parallelepiped. Although labels are applied to signify the relationship between a series of drawings, it is not possible to ascertain the 'actual' shape merely by looking at the drawing. A guess prompted by the drawing may not be in agreement with the text, although it might be no less plausible.

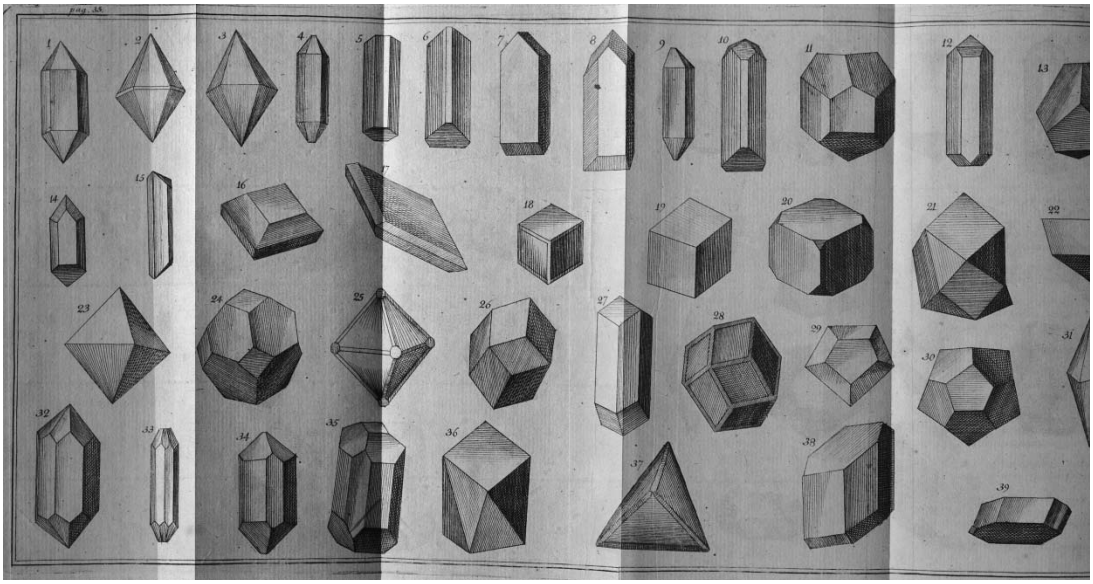
This is no surprise. Indeed, the idea of a 'view point' at infinity—which logically assimilates parallel and central projection—should have warned us that these projections would be subject to the same kind of spatial ambiguity as perspective, anamorphosis or the projections on the celestial sphere.

Usually, the tacit conventions of the pragmatic context of the drawing suffice to suppress or compensate for the ambiguity that comes with projection. The generalised outlines presented by the drawings for Haüy's *Traité* suggest a compromise between geometry and pictures which offers constancy of parallels and a general idea of the three-dimensional arrangement of the solid, but requires the student to pay close attention to the text.

Arguably, the method used by earlier mineralogists such as Linneaus (1768) or Romé de l'Isle (1772) of showing a rough sketch of the crystal accompanied by a developed surface (from which, conceivably, one could make a paper model) was more directly informative about a particular shape **(81, 82)**, but it did not make it so easy to show the relationships between the various three-dimensional developments of the crystal form which was one of Haüy's principal objectives. Farish's recommendation of isometric drawing was, it seems,

**79 René Just Haüy, 'Substances Acidiferes', plate XXXIX from *Traité de la Minéralogie*, Paris, 1801**

**80 René Just Haüy, 'Substances Metalliques', plate LXXI from *Traité de la Minéralogie*, Paris, 1801**



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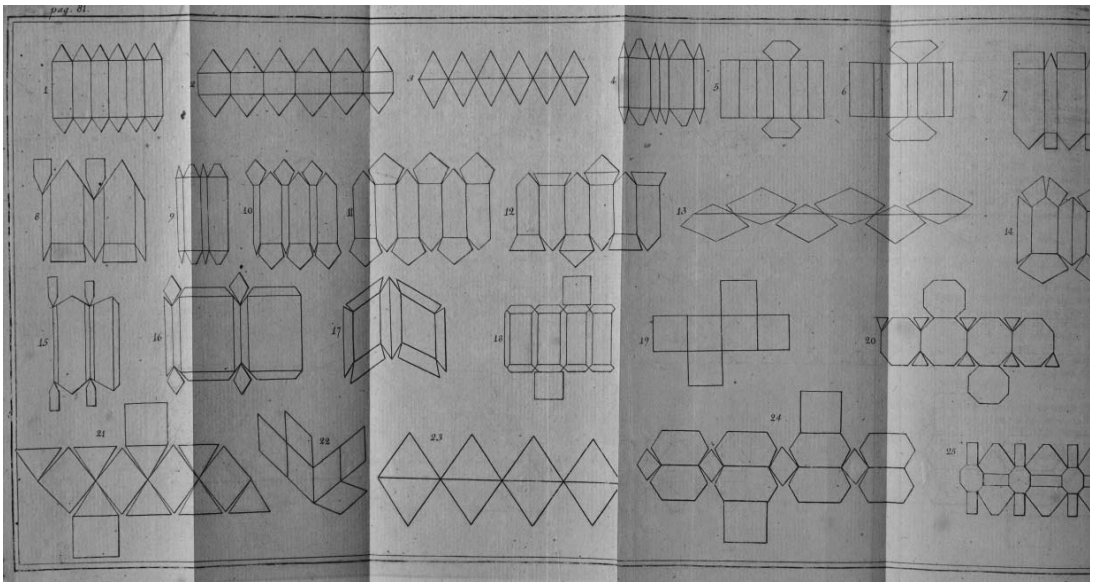
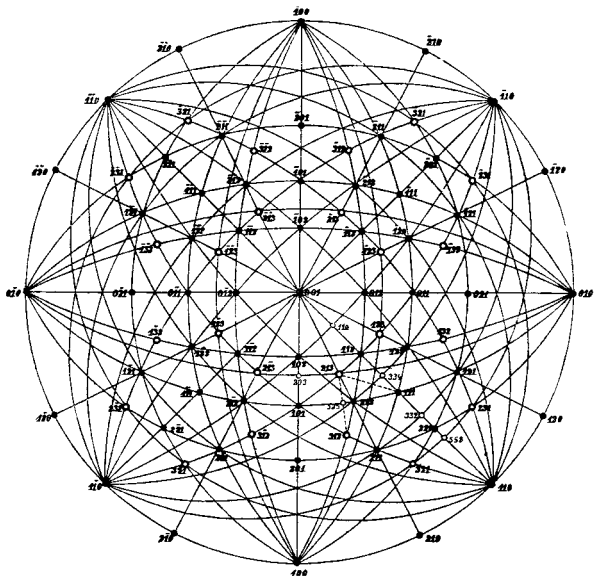


82

never taken up by crystallographers and is, in fact, not really any better suited to crystallography than the conventions that Haüy adopted and helped to establish as the standard practice for crystallographic illustration. Nor for that matter would descriptive geometry have offered any advantages for pedagogic purposes. As crystallographic theory after Haüy placed more emphasis on the angles between crystal faces and symmetry properties, the shortcomings of the Haüy-type diagrams were felt more acutely. Later notation of crystal forms eliminated the representation of crystal faces by means of a method akin to celestial cartography. This consisted of projecting the perpendiculars to the crystal faces passing through the centre of an imaginary sphere on to the surface of the sphere, then plotting those points on a flat surface by stereographic or gnomonic projection. Thus the distribution of points indicates

**81 Crystals (sketches) from Linneaus, *Systema Naturae*, Stockholm, 1768**

**82 Crystals (nets) from Linneaus, *Systema Naturae*, Stockholm, 1768**



**83**

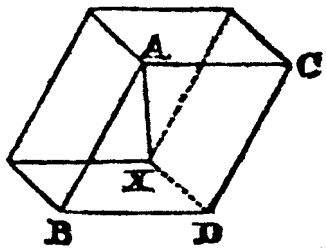
the symmetry properties of the crystal and the interfacial angles in a kind of crystallographic constellation, regardless of the shapes of the faces **(83)**. But this ingenious method takes us a little beyond the present discussion of visual representation of three-dimensional form. There were particular qualities of crystallographic illustrations of the Haüy type that brought to light another issue of their interpretation which, however, is independent of the kind of ambiguity I described above and could not be resolved by the supplementary information that would specify the actual shape of the crystal.

## 6

It is more than likely that it was Haüy's illustrations that L. A. Necker had in mind when he published his 'Observations on some Remarkable Phænomena seen in Switzerland; and an Optical Phænomenon which Occurs on Viewing a Figure of a Crystal or Geometrical Solid' in the *London and Edinburgh Philosophical Magazine and Journal of Science* (1832). As Professor of Mineralogy at Geneva, we can expect Necker to have been particularly attentive to the relevant text and to have easily overcome the shape-ambiguity of the drawings. The phenomenon he remarked, 'which has often occurred to me while examining figures and engraved plates of crystalline forms,' is the 'apparently accidental and involuntary'[66] reversal in depth of the figure such that a part seemingly nearest can suddenly seem furthest away, resulting in a change of the supposed orientation of the solid in space. Necker illustrated it with a drawing **(84)**. The 'Remarkable Phænomena seen in Switzerland' were some kind of atmospheric effect.

**83 Stereographic projection of a crystal from B. Gossner, *Kristallberechnung und Kristallzeichnung*, Leipzig and Berlin, 1914**

66 L. A. Necker, 'Observations on some Remarkable Phænomena seen in Switzerland; and an Optical Phænomenon which Occurs on Viewing a Figure of a Crystal or Geometrical Solid', in *London and Edinburgh Philosophical Magazine and Journal of Science*, 1/5 (1832), p. 336.




**84**

The Necker Cube (as it is usually called in honour of the author, if not of his example) is recognised as the first description by a scientist of a *perceptual* illusion. Leaving aside the fact that *all* pictures are perceptual paradoxes in that they are simultaneously understood as flat patterns of marks *and* as objects, suffice it to say for the moment that the ambiguity is not an optical or ophthalmologic phenomenon as Necker himself had speculated. Nor—it's worth saying again—is it a property of geometry or of projection.

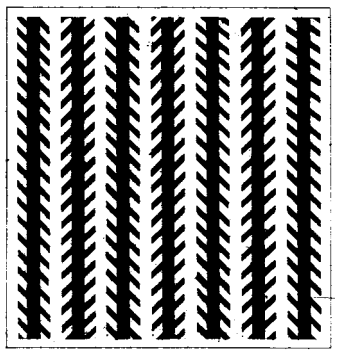
In the nineteenth century, interest in such phenomena may have been motivated by concern over how both the subjective and the objective conditions of seeing could affect the use of scientific instruments. In an era when measuring instruments usually required data to be read visually and when the scientist often needed to make drawings, a wide range of visual effects was described. Optical distortions and aberrations, that is, physical effects of lenses and other media, were studied in detail and, before photography, the interpretation of visual data mediated by drawing was much discussed and sometimes controversial, for example, in the disputes over nebulosity that engulfed the Herschels[67] or over the topography of the Moon.[68]

The reversible cube drawing gained a place in a repertoire of exemplary figures demonstrating various kinds of visual 'illusion'. The subjective phenomena such as were exemplified, for example, by the so-called Zöllner (1860), Poggendorff (1860), Hering (1861), Müller-

**84 'The rhomboid AX is drawn so the solid angle A should be seen the nearest to the spectator, and the solid angle X furthest from him, and that the face ACBD should be the foremost, while the face XDC is behind. But in looking repeatedly at the same figure, you will perceive that at times the apparent position of the rhomboid is so changed that the solid angle X will appear the nearest, and the solid angle A the furthest; and that the face ACBD will recede behind the face XDC, which will come forward; which effect gives the whole solid a quite contrary apparent inclination.' From L. A. Necker, 'Observations on some Remarkable Phænomena seen in Switzerland; and an Optical Phænomenon which Occurs on Viewing a Figure of a Crystal or Geometrical Solid', in *London and Edinburgh Philosophical Magazine and Journal of Science* 1832**

67 This is recounted in detail by Simon Schaffer in 'On Astronomical Drawing', in *Picturing Science, Producing Art*, ed. by Caroline A. Jones and Peter Galison (London and New York: Routledge, 1998).

68 See Ewen A. Whitaker, *Mapping and naming the Moon: a history of lunar cartography and nomenclature* (Cambridge: Cambridge University Press, 1999).



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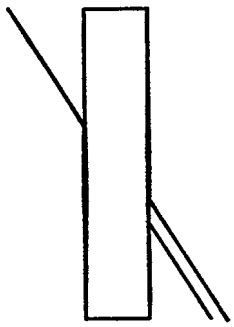

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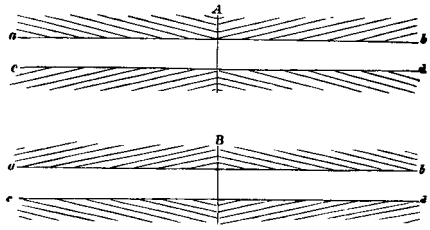



87

Lyer (1889) and Thiéry (1896) illusions were the topics of psychological and epistemological speculation and experiment in the nineteenth century, notably by Mach and Helmholtz **(85–89)**. In the early twentieth century, the psychology of perception came to assume the role, so to speak, of curator of this collection and many more specimens were added. These unusual cases, where the normally so marvellously efficient visual system seems to break down, suggested a way of studying how the mind and/or the brain works. More recently, such figures have found applications theoretically and experimentally in the fields of artificial intelligence and robotics.

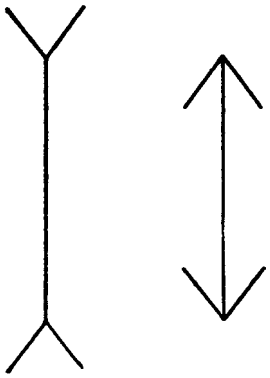
In the present context, what interests me about such figures is not only the context in which they were first described, but how they came to be codified. Although these figures came to be seen as the property of psychology, in the mid-nineteenth century, experimental psychology did not yet exist as an independent academic discipline. Johann Carl Friedrich Zöllner (1834–1882)[69] was an astrophysicist, Karl Ewald Konstantin Hering (1834–1918) a physiologist, Johann Christian Poggendorff (1796–1877) a physicist and the editor of *Annalen der Physik und Chemie*, where he published several discussions of puzzling visual phenomena. Towards the end of the nineteenth century, a group of exemplary figures was classed, possibly misleadingly, as 'geometrical' or 'geometrical-optical' illusions. There is some justification for the label (in so far as these illusions have to do with judgements of

**85 Zöllner's illusion from Hermann von Helmholtz, *Handbuch der Physiologischen Optik*, Hamburg and Leipzig, 1910**

**86 Poggendorff's illusion from M. Luckiesh, *Visual Illusions: Their Causes, Characteristics and Applications*, London, 1922**

**87 Hering's illusion from Hermann von Helmholtz, *Handbuch der Physiologischen Optik*, Hamburg and Leipzig, 1910**

69 The brilliant instrument maker and pioneer of astronomical photometry, Johann Carl Friedrich Zöllner will cross the orbit of this essay again later as the author of *Die Transcendentale Physik und die sogenannte Philosophie* (1878) a book which contributed to the popularisation of ideas connected with the 'fourth dimension'. Zöllner was convinced, much to the alarm of his scientific colleagues, that the feats produced by the Spiritualists should be explained by the real existence of a fourth dimension of space.



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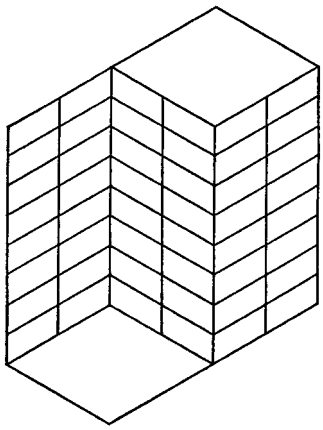

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sizes, shapes and angles), but there was at the time little agreement among researchers, or amateurs, on the nature of the perceptual phenomena.

The canonical figures are in many respects very unusual objects of perception. Not least for being formulated in such a way as to deliberately eliminate any pragmatic context, that is, not just the tacit or explicit conventions of a drawing system, but the signs or qualities that normally help make vision a reliable means of obtaining non-visual information (such as spatial relationships, object-qualities etc.) about the world in which we live—the world to which the human visual system is adapted. The pragmatic context which nonetheless clings to these artifacts is that of the scientific demonstration and experiment. This stems in part from the drawings (such as Necker's crystal figures) which might originally have prompted reflection on their surprising aspects and in part from the effort, on reflection, to isolate an effect in a quasi-geometric drawing. It seems, however, that the geometric connotations of the processes of simplification, reduction and generalisation that these drawings appear to have undergone emerge more strongly when they are taken out of the scientific context.

Up to now, I have laid out drawing, geometry, projection, representation, not so much as independent systems that could provide me with reliable hermeneutics, but more like a trade network in which surreptitious and underhand deals can be observed along with above-the-board transactions. However, semiotics teaches that it is only within a particular code that any transaction can be declared illegal. In the realm of signs, everything is permitted and the rule of Humpty-Dumpty is challenged only by that ubiquitous foreigner, the index, a model of autonomy, who nonetheless cannot operate without a licence. It is clear that the codes are

**88 Müller-lyer's illusion from Hermann von Helmholtz, *Handbuch der Physiologischen Optik*, Hamburg and Leipzig, 1910**

**89 Thiery's illusion from M. Luckiesh, *Visual Illusions: Their Causes, Characteristics and Applications*, London, 1922**

not fixed historically. Nor are the codes at any particular time overhauled systematically. Hence they always retain archaic components alongside innovations. Even Hilbert's thoroughgoing revision of the axiomatic basis of geometry made do with terms like point, line and plane even though he insisted it made no difference logically if he said tables, chairs and beer mugs.

My account has skipped from the mid-sixteenth century to the mid-eighteenth century with only a few passing references and in my discussion of nineteenth century topics I have let art history fade from view. As I turn now to twentieth century topics, I shall return to the question of what ideological claims, mediated by geometry, have been made by or for art.

So strongly would Cubism be felt in the following discussion, as it were, as its centre of gravity, that it makes sense to explain why. There is little doubt that the impact of Cubism is largely responsible for the revival of interest in geometry in art theory and criticism in the early part of the twentieth century. There is considerable doubt, however, about how geometry is supposed to have informed Cubist painting or how it is supposed influence our understanding of the works. The widely held, perhaps predominant view, that geometry or the representation of space is somehow the key to Cubist aesthetics has increasingly been challenged by what one could call the semiotic view. Rosalind Krauss underlines that this is a minority view and aims to give the impression of a small group of scholars capable of resisting art historical orthodoxy with the insights of structural linguistics.[70] Since Krauss and her colleagues are loyal as far as possible to Saussure, one might aptly call theirs the semiological view.

For my purposes, it is worth reviewing the literature on Cubism, because I think it would show how the 'geometric' and the 'semiotic' versions of Cubism are entwined. Indeed, even for recent scholars who have no commitment to geometrical ideas, geometry provides a pseud's jargon that can be used apparently without irony.

*7*

Cubist theory is really the *gossip* about Cubism. In its early phase at least, it was a highly localised discourse, confined to the circle of a small number of artists and writers, among them journalists who knew their readers very well. In this environment, ideas such as that Cubism has to do with geometry were propagated by means of a kind of Chinese whispers. The famous story of how Cubism got its name is a case in point. The critic Louis Vauxcelles's disparaging comment (possibly echoing a remark of Henri Matisse's) on Georges Braque's exhibition at Kahnweiler's gallery in 1908 in a sense rivals, perhaps even outstrips, Braque's painting in its influence. Vauxcelles wrote,

> [Braque] constructs deformed metallic men, terribly simplified. He despises form,

70 Rosalind Krauss, 'The Motivation of the Sign', in *Picasso and Braque: a symposium*, ed. by Lynn Zelevansky (New York: Museum of Modern Art, 1992). See also Yve-Alain Bois, 'The Semiology of Cubism' in the same volume.

> reduces everything, places, figures and houses, to geometrical schemes, to cubes.[71]

This and the 'bizarreries cubiques' (as he called Braque's paintings the following year) from which Cubism was coined, seemed to Vauxcelles an abuse of 'l'esprit géométrique'[72]. Nonetheless the label 'Cubism' was an important means by which the association with geometry stuck to the new painting. But that does not explain how it became a doctrine. Gossip is not a disinterested discourse. It is concerned with positioning within a specific social milieu, with reputations, influence, allegiances and rivalries. It is not particularly concerned with coherent theoretical statements, unless these could be expected to be recognised in such a way as to bring advantage to the writer or his friends. Cubist and post-Cubist literature contains a variety of highly suggestive theoretical apologies, aspirations and philosophical allegiances. It also plays out more or less coded personal disputes and prejudices and one should not be surprised when it is used as a vehicle for various kinds of bigotry or chauvinism. Many of the allusions in which contemporaneous readers would have grasped specific intentions are probably lost on us after nearly a hundred years. Alongside the construction of the archive and the retailing of gossip, modern scholarship has attempted to recover something of this context, but there is also a tendency to generalise. In order to avoid generalisations, I shall confine myself to some superficial observations.

Another early critic of Braque, Charles Morice's 1908 review was hardly more sympathetic in tone than Vauxcelles's. He was also struck by a geometric aspect of the paintings he saw.

> [Braque] proceeds from a genetic *a priori* to which he submits the whole field of vision and thinks he can translate the whole of nature by means of combinations of a small number of absolute forms. Cries of horror were heard in front of his female figures: 'Hideous! Monstrous!' Where we thought to find a feminine figure [face?] [...], the artist has seen only geometrical harmonies. [...] He has a personal alphabet in which each character has a universal meaning.[73]

Morice's view is quite the opposite of Vauxcelles's. Whereas the latter had associated geometry with reduction, by implication an inductive, *a posteriori* process of abstraction, for Morice's interpretation of Braque's work, geometry is the *generator* of a system of signs purportedly of unlimited scope and universal meaning. The paradox in the last sentence I have quoted perhaps expresses Morice's scepticism. Morice no doubt expected his readers to

71 *Gil Blas*, 14 November 1908, trans. by Jonathan Griffin in Edward F. Fry, *Cubism* (London: Thames & Hudson, 1966), p. 50.

72 '[...] jusqu'aux bizarreries cubiques et, je l'avoue, malaisément intelligibles de Bracke [sic] (en voilà, eût dit Pascal, qui abuse l'esprit géométrique!) confère à cette salle touffue un intérêt passionnant.' *Gil Blas*, 25 March 1909, reprinted in Guillaume Apollinaire, *Les peintres cubistes: méditations esthétiques* (1913), ed. by Leroy C. Breunig and J.-Cl. Chevalier, (Paris: Hermann, 1965), p. 149. (Dated 25 May 1909 according to Daniel Henry Kahnweiler, *Juan Gris: his life and work* trans. by Douglas Cooper, (London: Lund Humphries, 1947), p. 69n.

73 *Mercure de France*, 16 December 1908, reprinted in *Les peintres cubistes: méditations esthétiques* (1965), pp. 147–8; cf. trans. in *Cubism* (1966), p. 52.

understand a reference to the late work of Cézanne and perhaps to the Provençal painter's reputed exhortation to treat nature by means of the cylinder, the sphere and the cone which had been discussed in the press.[74] In another article a few months later, Morice accused Braque of an admiration for Cézanne which was excessive and in his words, 'mal réfléchie,'[75] thus criticising Braque and the Cubists alike while simultaneously defending Cézanne. This statement is in a sense the complement of the first one in so far as here the reference to Cézanne suffices to imply a notion of geometry.

What these remarks suggest is that these ideas were not new in art criticism and the writer could draw on an existing vocabulary and a variety of rival associations with geometry. One can also discern here the emergence of an autonomous and increasingly freewheeling debate stimulated by the connection of Cubist painting with geometry. Morice seems to adumbrate themes which were actively pursued in avant-garde theory through the 1920s.

Jean Metzinger (1883–1956), the painter who along with Albert Gleizes (1881–1953) became one of the chief organisers and promoters of Cubism—with a capital C[76]—as a 'movement', responded in the terms the critics had set, configuring Cézanne, Picasso, perspective, geometry, Braque and signs according to his own idea of the importance of the new painting. In a magazine article published in 1910, he wrote:

> Picasso brings us a material account of the real life in the mind, he establishes a free, mobile perspective, such that the sagacious mathematician Maurice Princet deduces from it an entire geometry.
>
> [...] Braque who cheerfully fashions new signs, commits no error of taste.[77]

Here, apart from putting a positive spin on the words of hostile critics, it seems Metzinger saw no contradiction between the geometric and the semiotic (as we would call them). But this is not to say that he articulated any convincing theoretical connection between them. The main aim of Metzinger's defence of Cubism at this time is to place the new painting simultaneously at the forefront of the avant-garde, with its connotations of a break with the past and a unique ability to express the modern age, and at the pinnacle of the tradition of western art where it should stand alongside the sublime achievements of the past. Ideas connected with geometry would be very useful for this campaign, and were developed in parallel with a revisionist art history which he and his friends articulated more and more elaborately. Geometry—or to be exact, the way geometry was understood in the art world—would lend authority, a sense of necessity, truth, certainty and indeed eternity to the

74 In his letter to Emile Bernard (15 April 1904) Cézanne adds, 'everything brought into proper perspective.' But this is not often mentioned. Meanwhile Cézanne is often invoked as a hero in the fight against perspective.
75 *Mercure de France*, 16 April 1909, reprinted in *Les peintres cubistes: méditations esthétiques* (1965), p. 151.
76 The 1912 publication *Du 'cubisme'* still had cubism in inverted commas, but was the decisive step in shedding them.
77 *Pan*, October–November 1910, reprinted in *Les peintres cubistes: méditations esthétiques* (1965), p. 155; cf. trans. in *Cubism* (1966), p. 60.

'fundamental laws' of painting that Cubism was supposed to articulate in as pure and autonomous a way as possible. It would mobilise a well-worn vocabulary in the polemic against the decadent styles of the recent past. The invocation of geometry in Cubism's self-justifications (I am not speaking here of how Cubist paintings might have evoked thinking about geometry) signalled both the trans-historical fundamentalism embraced by the movement and its modernity. I should say, however, that at this stage, Metzinger's idea of modernity is vague and one should not read later modernisms into it. He made a point of rejecting perspectival realism, ornamental, anecdotal and symbolic intentions, but the Cubism he is speaking about did not challenge the normal genres of bourgeois painting: nude, portrait, landscape, still life (and even allegory).

The reference in the passage quoted above to the mathematician Princet hinted (for those in the know) at notions connected with geometry which emerged in the polemic against perspective. Princet was an actuary who was friendly with some of the Cubist painters at this time and is said to have introduced them to the 'fourth dimension' and non-Euclidean geometry. Doubtless he would have been able to bring some mathematical knowledge to the then current debates about painting and geometry. It is not hard to imagine how his education might have earned him the nickname 'mathematician' in the circle of the Bateau Lavoir. (Kahnweiler denies he ever had any influence on Picasso or Braque.)

In *Du 'cubisme'*, a tract written by Metzinger and Gleizes, published in 1912, the painters declare, almost as cryptically, 'If one wanted to connect the painters' space with some kind of geometry, it would be necessary to refer to the non-Euclidean scholars and to meditate at length on certain theorems of Riemann.'[78] Despite the fact that these authors reject mystification and Metzinger had earlier praised the precision, clarity and logic associated with geometry, their treatment of the subject is obscure. In fact, in this in many ways remarkably conservative text, the authors deny they are geometers. They aim instead to configure the unique calling of the artist and advise:

> Anytime [the artist] ventures into metaphysics, cosmogony or mathematics, he should be content to extract their flavours and refrain from asking from them certainties they do not possess.[79]

*Du 'cubisme'* seems to be an exercise in radical moderation aimed at redirecting the already prevailing interpretation of the aims of Cubism that Metzinger himself had helped to establish. In an effort to regain the initiative, the reference to non-Euclidean geometry was put there perhaps only to confuse or annoy those critics who put forward a set of Cubist 'principles'—among them Cézannism, essentialism, geometry and representation of time—as if it represented a doctrine on which the critic could then freely express his support or dissent.[80]

78 Albert Gleizes and Jean Metzinger, *Du 'cubisme'* (Paris: Figuière, 1912), p. 17.
79 *Du 'cubisme'*, p. 43.
80 E.g. the articles by Léon Werth (1910) and Michel Puy (1911) in *Cubism* (1966), pp. 57–58 and 65–66.

In a statement that seems to offer mitigation to writers and at the same time reasserts the practice of painting pictures, Gleizes and Metzinger wrote:

> Just as much as synchronic and simplistic images, we reproach the facile fantasies of occultism. If we condemn the exclusive use of common signs it is not that we imagine replacing them with Cabalistic ones. Even we readily confess that is impossible to write without clichés, or to paint by disregarding known signs.[81]

Apollinaire was not so circumspect:

> The new painters do not claim to be geometers any more than their elders. But one could say that geometry is for the plastic arts what grammar is for the writer. Now, today, scholars no longer hold to the three dimensions of Euclidean geometry. The painters have been led quite naturally, and, so to speak, by intuition, to preoccupy themselves with new possible measures of space which in the language of the modern studios are designated by the shorthand term the *fourth dimension*.[82]

Poet and painter's friend, Guillaume Apollinaire's thoughts on the 'fourth dimension' in connection with Cubism were first expressed publicly in a lecture towards the end of 1911. He wrote an article, 'La nouvelle peinture'. which was published in April 1912 and later reworked it as part of *Les peintres cubistes: méditations esthétiques* (1913), from which I have just quoted.[83] I am going to come to the 'fourth dimension' shortly. Now, I want to remark on how Apollinaire also aims to recover the notion of geometry from Cubism's attackers.

Apollinaire's text is an excellent example of the kind of erudite sophistry that seems to have been expected from modern art critics. In this passage, he manages to put his opponents who deplored the 'geometric preoccupations' of the new art on the back foot by declaring that the modern painters do not claim to be geometers *any more* than did painters of the past. He thus appropriates for his argument the traditional teaching of geometry going back as far as you like. The analogy he makes between geometry (for painters) and grammar (for writers) is interesting as an alteration of the semiotic interpretation of Cubism, but Apollinaire's main point is to reinforce his fundamentalist agenda: it is only that the new painters' method has been purified. Furthermore, the new painters' geometry surpasses that of the ancients, as it must if the artist is true to his gift. This Hegelian idea that the true artist is in harmony with the 'spirit of the age' and inevitably expresses the highest knowledge of the era is neatly put in a Kantian phrase, whereby the painters are led towards this knowledge by intuition. The catch phrase 'fourth dimension' is Apollinaire's cue for a rhapsodic discourse which of

81 *Du 'cubisme'*, p. 35.
82 Guillaume Apollinaire, *Les peintres cubistes: méditations esthétiques* (Paris: Eugène Figuière, 1913), pp. 15–16.
83 Linda Dalrymple Henderson provides a chronological table of 'specific references to the new geometries by artists and critics in pre-World War I Paris' in *The Fourth Dimension and Non-Euclidean Geometry in Modern Art* (Princeton: Princeton University Press, 1983), pp. 59–63.

course has nothing to do with mathematics. The 'fourth dimension' seems to signify for him whatever it is that makes great art great, 'it represents the immensity of space eternalising itself in all directions at a given moment. It is space itself, the dimension of the infinite; it is that which endows objects with form.' It represents the 'infinite universe' as a new measure of perfection and raises the new painting to the level of great art, which is, in Apollinaire's view, religious art.[84]

Although Gleizes and Metzinger to some extent played down geometry, the idealist, cosmic and quasi-religious aspirations they associated with Cubism continued to be an important motivation in their text and elsewhere. It is difficult to assess what influence Apollinaire had, or whether he should be seen more as a reporter than an interpreter of the 'langage des ateliers modernes.' Nonetheless, Gleizes seems to echo Apollinaire's notion of the 'fourth dimension' almost verbatim in an interview (published after 'La nouvelle peinture' and before *Du 'cubisme'*).[85] Metzinger exhibited a painting in 1913 entitled *Nature morte (4$^{me}$ dimension)*. But it seems no one was going to quote Apollinaire if they could quote Plato instead.

In 1912, one of Cubism's early supporters, Roger Allard (1885–1961), wrote an article for the readers of *Der Blaue Reiter* (edited in Munich by Wassily Kandinsky and Franz Marc), in which he reviewed Cubism and its supposed aims as a movement that had already run its course. In his effort to counter 'the trivial and misleading accounts' of Cubism prevalent in the press, Allard resorts, without actually mentioning geometry by name, to an unusual set of metaphors tinged with not a little irony. He wrote:

> In the place of the impressionist illusion of space which is founded on aerial perspective and naturalistic colour, Cubism gives us plain, abstract forms in precise relation and proportion to each other. Thus the first postulate of Cubism is the ordering of things—and this means not naturalistic things but abstract forms. Cubism feels space as a complex of lines, units of space, quadratic and cubic equations and ratios.
>
> The artist's problem is to bring some order into this mathematical chaos by bringing out its latent rhythm.
>
> In this way of looking at things, every image of the world is the point of convergence of many conflicting forces. The subject of the picture, the external object, is merely a pretext: the subject of the equation. This has always been true; but for many centuries this basic truth lay in a deep obscurity from which modern art is today seeking to rescue it.[86]

In the context I have developed here, it is hardly necessary to underline how Allard has acknowledged and inflected the terms of the then current discussion of Cubism. He sees the much-advertised war against perspective as really the rejection of impressionism, as it were

84 *Les peintres cubistes: méditations esthétiques* (1913), p. 53.
85 See *The Fourth Dimension and Non-Euclidean Geometry in Modern Art*, p. 61.
86 'The Signs of Renewal in Painting' ('Die Kennzeichen der Erneuerung in der Malerei', originally in *Der Blaue Reiter*, Munich 1912), trans. in *Cubism* (1966), p. 70–71.

the style of the fathers. He refuses to declare Cubism's abstract forms, ordered in proportion and relation, a new geometry, though his invocation of postulates, equations and ratios strongly suggests the temptation to do so.

Allard's point is to convince his readers that the Cubists are 'justified in transmuting the vision of nature into an exact and abstract world of forms,'[87] but the article is more concerned with the Cubists' place in history than with their paintings. 'Transmuting' seems to suggest a notion of the occult or divine powers that have traditionally been attributed to the artist as creative individual, and could be seen as Allard's way of emphasising the abstract qualities of painting as a kind of 'super'-naturalism or metaphysical speculation. 'World of forms' here hints at the Platonic connotations of the essentialism that appears to have been prevalent and was expressed more directly by others.[88] There is also an evocation of Platonic *anamnesis* in the idea of the 'truth' recovered by modern art from 'deep obscurity'.

'World of forms' might guide us towards a kind of idealism, but the analogy Allard draws between abstraction in painting and abstraction in music or poetry suggests a world of signs. Allard points out how, in music or poetry abstraction was taken for granted, while in painting it met with hostility and derision. The way Allard (who was after all a poet) writes—his metaphorical imagination, his puns and his ability to turn a phrase in such a way as to reveal surprising aspects of a word—could be read as an attempt at a literary analogue of Cubist painting. This might seem to run counter to the 'epistemology' he seems to attribute to Cubism, but it is possible that Allard was more interested in literary demonstration than serious philosophical justifications.

The essentialist view also got support and philosophical orientation from Daniel Henry Kahnweiler (1884–1979) writing during the war years. For many scholars, 1914 marks the demise of Cubism as a coherent movement, with the departure from Paris of many of the protagonists on military service and the exile of one of their most important advocates (and their chief commercial backer), Kahnweiler. As Picasso's and Braque's dealer, he had given these 'pioneers' of Cubism the chance to avoid the salons and in his gallery he had given the public almost its only opportunity of seeing their works. Reflecting on Cubism from Switzerland, Kahnweiler writes both as an insider and as an outsider. His close association with and privileged access to Picasso and Braque may have given his opinions extra weight, but his *Der Weg zum Kubismus* was not published until 1920, in German. It seems to have been motivated in part by a desire to 'set the record straight' as a key witness, but he is also concerned to establish Cubism's place in history on a grander scale and presents his assessment of Cubism mainly in terms of philosophical generalisations.

87 'Signs of Renewal', p. 71.

88 For example Michel Puy wrote in a review of the 1911 Salon des Indépendants, making his idea of the link with mathematics and geometry clear, '[The cubists] aspire to the essence, to the pure idea, to a speculative delerium comparable with that which springs from the study of mathematics. [...] In restoring the beauty of a landscape or the grace of a woman to definite geometrical forms, one is brought more vigorously to clarify the planes [blueprints?], better to establish the structure, more sharply to study the constructive aspect of the world, more profoundly to penetrate the relationships between form and colour.' Reprinted in *Les peintres cubistes: méditations esthétiques* (1965).

Kahnweiler's later writing, such as his monograph on Juan Gris (1946) and the article, 'L'art nègre et le cubisme' (1948) in which he elaborated a 'semiotic' theory, is hailed by Yve-Alain Bois as the key lesson for his own 'semiology' of Cubism.[89] Around 1915, however, when he wrote *Der Weg zum Kubismus*, Kahnweiler responded within the terms of the debate we have already seen. It is worth mentioning that Kahnweiler did not abandon, or for that matter, significantly alter his earlier views but seems to have considered his later ideas as supplementing the old ones without contradiction.

There seems to have been more agreement among the various commentators on what I am calling the 'essentialism' of Cubism than there was about the role of geometry. Although the latter was frequently expressed ambivalently, I think the essentialist idea nonetheless *needs* geometry, not least as a means—via drawing—of pinning a rather vague epistemological aspiration on to a perturbing way of painting. The essentialist idea and its various spin-offs, spring from a conventional dichotomy, namely: if (obviously) the typical Cubist painting does not aim to capture the *appearance* of objects, then it must be their *essence* that it seeks. Likewise, according to the usual dichotomy, if the representation does not seem to be based on visual sensation (how things look), then—especially in contrast to impressionist painting—it must have to do with conceptions of things instead of perceptions of things. Geometry was the key, not only because of the way it was involved in the various philosophical elaborations of the dichotomies I have mentioned, but also because it had a history in visual art, and, so to speak, a history in modernity. It therefore provided a stock of ready-made justifications handed down through the tradition of the *Académie* on the one hand, and of the *École Polytechnique* on the other. The actual confrontation of painting with mathematics was always something of an embarrassment. It was much more convenient—and in many ways more appropriate—to configure Cubism in the style of the customary oppositions, Poussin v. Rubens, Ingres v. Delacroix, Cubism v. Impressionism.

Kahnweiler's early text is interesting because, unlike nearly all previous criticism, he attempts to account for the association of Cubist painting with geometry in terms of the paintings themselves (instead of just the label 'Cubist'). Admittedly, he does not offer anything specific and he dismisses it as a 'sensory illusion'. He says, however, 'there is no disputing the fact [that the] "actual" individual lines in the painting [...] are very often straight lines and uniform curves. Furthermore, the forms which they serve to delineate are often similar to the circle and rectangle, or even to stereometric representations of cubes, spheres and cylinders.'

We know that simple, rectilinear or regular figures are commonly called 'geometric'. But Kahnweiler denies (his) Cubists are geometers because, he says, their aim is the representation of objects, not geometric forms. He claims that with a little practice, the superficial '"geometric impression"' falls away, and (he implies) the pictures will become transparent as the viewer 'gains in perception.'[90]

89 See *Painting as Model* and 'The Semiology of Cubism'.
90 Daniel Henry Kahnweiler, *The Rise of Cubism*, ed. by Robert Motherwell, trans. by Henry Aronson (New York: Wittenborn, Schultz, 1949), p. 13. Further page references in brackets in the text.

Kahnweiler argues that just as simple stereometric forms are the building blocks of architecture (and as he would have it, 'all styles of plastic arts which do not have as their goal the illusionistic imitation of nature'), so they form the basic structure of human perception. Amalgamating bits of Cézannism (cube replaces cone in Kahnweiler's trinity of forms) with ideas from the psychology of perception after Helmholtz and Kantian philosophy, Kahnweiler states, 'Our *a priori* knowledge of these forms [the cube etc.] is the necessary condition, without which there would be no seeing, no world of objects' (14).

He tends to lump together concepts, types, memory-images, ideal geometric forms, intuitions, things-in-themselves and primary qualities along with their philosophical baggage in a characterisation of the longings of humanity that may be difficult to square with the evidence we have of Cubist practice. Nonetheless, Kahnweiler declares:

> In its works Cubism, in accordance with its role as both constructive and representational art, brings the forms of the physical world as close as possible to their underlying basic forms. Through connection with these basic forms, upon which all visual and tactile perception is based, Cubism provides the clearest elucidation and foundation of all forms. (14)

From a twenty-first century perspective, such claims might appear somewhat ridiculous. But it is worth remembering that in the 1920s, such ambitious statements were more likely to be taken as pointing to the current shortcomings of painting, which the pretenders to the title *avant-garde* were about to rectify.

It is hard to see how the interpretation of Cubism as an art 'd'essence conceptuelle' upon which Kahnweiler insisted in his later writings as determinedly as he did in *Der Weg zum Kubismus* is not dependent on ideas connected with geometry, even if it is qualified by approximation, as a 'tendency' rather than an achievement. Indeed, in much of Kahnweiler's argumentation 'Cubism' seems simply to replace the word geometry in the philosophy he has borrowed from various sources.

There is also another aspect of geometry that Kahnweiler presents as fundamental to the aims of Cubism, this time in connection with methodology. In his *Juan Gris*, he expresses it in unmistakably Mongean terms, echoing a formulation from his earlier tract.

> The real problem which had seemed fundamental to Cézanne, which would form the principal aim of Cubist research [was] the *representation, on a two dimensional canvas, of three-dimensional bodies.*[91]

91 Daniel Henry Kahnweiler, *Juan Gris, sa vie, son oeuvre, ses écrits* (Paris: Gallimard, 1946), p. 148, emphasis in the original. Cf. 'The Rise of Cubism': 'In the spring of 1908 [Picasso] resumed his quest, this time solving one by one the problems that arose. He had to begin with the most important thing, and that seemed to be the explanation of form, the representation of the three-dimensional and its position in space on a two dimensional surface' (7).

This was the problem which the traditional perspectival painting had failed to solve because it was concerned only with appearance, the rigour of its geometrical rules notwithstanding. In his account of the development of Cubism, Kahnweiler makes a clear analogy with 'geometrical drawing', that is to say, orthography.

> Picasso's new method made it possible to 'represent' the form of objects and their position in space instead of attempting to imitate them through illusionistic means. With the representations of solid objects this could be affected by a process of representation that has a certain resemblance to geometrical drawing. This is a matter of course since the aim of both is to render the three dimensional object on a two dimensional plane. In addition, the painter no longer had to limit himself to depicting the object as it would appear from one given viewpoint, but wherever necessary for fuller comprehension, can show it from several sides, and from above and below. (11)

In *Juan Gris*, Kahnweiler also makes analogies with isometric drawing. Kahnweiler's explanation is unusual in Cubist literature in that it makes explicit reference to technical drawing, which was normally repressed in the avant-gardist effort to establish a high art. However, one could argue that 'geometrical drawing' (as technical drawing methods were commonly called) and its quasi-idealist justifications are close to many of the discussions of Cubism that I have reviewed here. I would not argue for the influence of technical drawing on painters before the first world war, and perhaps Kahnweiler is right to attribute dissatisfaction with perspective to the influence of Cézanne. But the dispute with perspective, as we have seen, had already been rehearsed in the teaching of technical drawing in the nineteenth century and had helped to establish the currency of notions such as the view point at infinity, the roving eye, the combination of multiple view points, rigorous definition of three-dimensional form, selecting the most revealing aspect of an object, representing objects 'not as they appear, but as they really are',[92] eliminating perspective distortion, and so on. All that the earlier discourse lacked was outright metaphysics.

Kahnweiler was not shy of metaphysics, especially of a Kantian sort. Although his later theory that Cubist painting should be regarded as a kind of *writing* is suggestive, I do not think it is possible to recover from it much that would resemble a modern notion of semiotics. He maintains that when the spectator 'reads' the picture, '[he] will "see" what the painter intended to represent: he will have identified the sign with the object signified.' But this suggests an unambiguous decoding (at least for those that have the key) and it is not at all clear what Kahnweiler means by 'the object'.

Sometimes he says the painter records his *Erlebnis*[93] although this is not necessarily an

92 See for example Joshua Petty, *Geometrical Drawing for Science and Art Students* (London: Newmann, 1896), p. 96, echoed by Bernhard Schneider in 'Perspective refers to the viewer, Axonometry refers to the object'. in *Daidalos* 1 (1981), p. 81.

93 *Juan Gris, sa vie, son oeuvre, ses écrits*, p. 82. Kahnweiler says in a note that the German word *Erlebnis* (lived experience) is closer to what is at the basis of the work of art than *émotion*, which is what he says in the text.

'optical sensation', sometimes the painter is supposed to have 'endeavoured to penetrate to the very essence of an object by representing it, not as it appeared on a given day at a given time, but as it exists ultimately composed in the memory,'[94] sometimes the 'emblems' which the painter invented were supposed to have '"signified" the whole object which he meant to represent.' Kahnweiler explains, 'the picture contains not the forms that have been collected in the visual memory of the painter, but new forms, forms which differ from those of the "real" objects we meet with in the visible world, forms which are truly emblems and which only become objects in the apperception of the spectator.'[95] Both these 'forms' and these 'objects' are presumably different from that 'permanent element which makes a work of art [...] This element, which we can neither define nor analyse, but of whose presence before our eyes we are conscious, can only be the "quality" which the artist's genius has mysteriously and unwittingly given to his creation and which we call beauty. In Kantian terminology one can call it "the thing in itself", that element which is active, permanent, free, but unknown, as opposed to that other element "the appearance", which is neither free nor spontaneous and is conditioned by the spirit of the time.'[96]

It seems to me the whole philosophical tangle stems from the effort to justify a style of painting that did not obviously depend on imitation, illusion or perspective, an effort (at justification) which depended on certain received ideas about perspective, from which it benefited rhetorically, but in which it placed too much faith philosophically, even in rejecting them. The notion of script which Kahnweiler emphasised in his later writing seems to have been introduced in order to negotiate between geometry and poetry, to explain how the superficial impression (the 'appearance' or 'illusion') of geometry is supposed to disappear as the spectator learns to 'read' Cubist painting. In the end, Kahnweiler's later account is hardly less mysterious than when it was left without explanation. However, apart from being a general defence of Cubism against conservative critics who might have dismissed it as an 'undéchiffrable jeu de patience,'[97] Kahnweiler's theory helped to underline his resistance to those of Cubism's admirers who promoted Cubism as an esoteric or hieratic art, or who claimed that the puzzling aspects of Cubist painting would be resolved by perception in the 'fourth dimension'. It also supported his personal contempt for abstract art, which he regarded as a deplorable misunderstanding of Cubism's intentions.

Despite Kahnweiler's perhaps naïve and certainly long-winded concern with philosophical and historical 'proof', his most convincing (although hardly more coherent) attempts at validating a Cubist poetics emerge from his comparisons of Cubist aesthetic strategies with African art on the one hand, and with Mallarmé's poetics on the other.[98]

94 *Juan Gris, sa vie, son oeuvre, ses écrits*, p. 149, trans. in *Juan Gris: his life and work*, p. 71.
95 *Juan Gris, sa vie, son oeuvre, ses écrits*, pp. 179–80, trans. in *Juan Gris: his life and work*, p. 90. This would appear to be a good enough description of perspectival painting.
96 *Juan Gris: his life and work*, p. 55. Kahnweiler continues, 'It remains for me to establish that this "appearance" really corresponds to a projection of spirit of the time. There is no room to pursue the proof of this through the whole course of history; but we can find sufficient evidence in the history of painting during the Christian era.'
97 Henri Guilbeaux (on Metzinger) in *Hommes du jour*, 30 September 1911, reprinted in *Les peintres cubistes* (1965), p. 165.
98 This is really the topic of Bois's essay 'Kahnweiler's Lesson' in *Painting as Model*.

Kahnweiler maintains that the true lesson or 'real influence'[99] of African art became apparent only long *after* what he says was wrongly called 'the Negro Period' (that is, around 1908), particularly in Picasso's sculptures of around 1912. The point being that in a Grebo[100] mask or in a work like Picasso's famous *Guitar*, the representation of a known object is composed of various signs whose forms do not resemble their referents (a cylinder on its own does not resemble an eye or the soundhole of a guitar).[101] Nonetheless, the ensemble amounts to some kind of figurative representation. Importantly for Kahnweiler, the issue was not 'primitivism', but the main stream of western art, as he made clear in 'L'art nègre et le Cubisme':

> It was negro sculpture which allowed these painters to see clearly into the problems in which the evolution of European art had got tangled, and to find a solution which, while avoiding all illusionism, brought them to the freedom they were after.[102]

The passage from Mallarmé which Kahnweiler quotes in *Juan Gris* has to do with the power of invocation, how from the virtual extinction of the object 'selon le jeu de la parole' the poet can bring it forth again, not as a fact of nature but in ideal form from the depths of memory, 'l'absente de tous bouquets.'[103] It would take more than I could attempt here to elucidate Mallarmé's theory but a point that is worth making is that although Kahnweiler is writing this in the late 1940s, this alternative form of idealism had already emerged in the Cubist debates of the late teens and early twenties and was influential in the post-Cubist milieu that was in many respects the 'opposite camp' from Kahnweiler's, namely, the circle around Léonce Rosenberg's Galerie de l'Effort Moderne.

To follow up Kahnweiler's partial analogies would be to raise the questions: if Cubism is a *script*, what would be its repertoire of signs? What would be its language? What would be its grammar? Furthermore, what role would it have for the index? In other words, what capacity would it have for the specificity and historicity of the trace?

Is Kahnweiler's appeal to Mallarméan 'incantation' meant to offer an analogy with a kind of ideographic script, mediated neither by the appearance of the objects to which it refers nor by another language? Something as direct as the relationship between word and object might have seemed to a poet? The poet Maurice Raynal might have had his own reasons for believing so and he expressed his conviction plainly by asserting how 'the appellation table [for example] constitutes *that piece of furniture itself*, in its essence.'[104] The poet Raynal imagined the equivalent

99 'On le voit: une vraie influence ne se manifeste que bien longtemps *après* l'époque appelée improprement "nègre."' *Juan Gris, sa vie, son oeuvre, ses écrits*, p. 156, trans. in *Juan Gris: his life and work*, p. 75.

100 See 'Kahnweiler's Lesson' in *Painting as Model* for the justification of this identification.

101 Kahnweiler, incidentally, refers casually to the simplified forms of African sculpture as 'geometric'.

102 Daniel Henry Kahnweiler, 'L'art nègre et le cubisme', in *Confessions esthéthiques* (Paris: Gallimard, 1963), p. 232. Kahnweiler also aims to defend the influence of African sculpture against those that rejected it in frankly rascist terms: those whom Kahnweiler mentions in *Juan Gris*, for whom 'negro' meant crude and ugly, and those like Jeanneret and Ozenfant who felt African art had nothing to do with the establishment of a pure art inspired by geometry in a specifically French rational tradition (see *Après le cubisme*).

103 See *Juan Gris, sa vie, son oeuvre, ses écrits*, p. 180, trans. in *Juan Gris: his life and work*, p. 130.

104 Maurice Raynal, *Quelques intentions du Cubisme* (Paris: Editions de L'Effort Moderne, 1919), pamphlet without numbered pages.

to the 'appellation' in painting would be the simple 'geometric' form which he understood as the 'eternal and synthetic aspect'[105] of a given object. Furthermore, according to Raynal, 'le veritable tableau,' an autonomous object, would be 'a sort of formula, to say more, *a word*. It will be, in effect, to the objects it represents, what a word is to the object it signifies.'[106]

Raynal's essay, 'Quelques intentions du Cubisme', first issued as a pamphlet by Rosenberg in 1919 and reprinted in 1924 as the first article of the first issue of his *Bulletin de l'Effort Moderne*, in many ways stands as the manifesto of the group which Rosenberg promoted. Raynal wrote:

> To conceive of an object is, in effect, to desire to know it in its essence, to represent it in the mind, so to speak, with this aim, as purely as possible, in the status of a sign, of a *totem*, if you will, and absolutely removed from useless details such as all too numerous aspects and all too fickle accidents. Aspects, in effect, situating the object in time and space in such an arbitrary way can only defile its primary quality. And just as he fixes on the canvas or in stone, not that which passes, but that which remains, the artist does not situate the object in a particular place, but in space, which is infinite.[107]

If Cubism is supposed to offer a statement of the general forms of objects or of idealised concepts in purely symbolic form, then how is one to account for *any* of the facts of Cubist painting? In 'Mallarmé et la peinture', Kahnweiler recounts with obvious pleasure the anecdote in which Degas was trying to write sonnets, but, the painter complained to the poet, he had not had much success despite the ideas he had. 'It's not with ideas that one makes sonnets, but with words,' came the reply from Mallarmé.[108] However, to reverse this situation, to be able say with what paintings are made, is, in my view, not so clear-cut.

It seems to me that Cubist theory did little to elucidate this point and possibly did more to obscure it. It could be argued that Cubism was a kind of painting capable of mobilising a wide range of semiotic strategies, possibly even a kind of painting intent upon unfolding the range and limits of its own capacity for representation and, I believe, a kind of painting that would repay semiotic analysis. But the (recent) attempt to assimilate Kahnweiler's theory (for instance, as Bois and Krauss suggest) with Saussure's general linguistics is potentially misleading (regardless of what one thinks of the adequacy of that theory). To be sure, Kahnweiler and his predecessors discuss various truisms that belong to what we know as semiology or semiotics, but the 'sign' they are interested in is based on an epistemological model entirely foreign to both Saussure and Peirce.

Although it might have seemed that the discussion of signs, script, poetry and so on had been introduced in Cubist criticism as counterweight to the discussion of mathematics, as a way of reasserting the autonomy of painting, it should be clear from my discussion how the

105 *Quelques intentions du Cubisme*.
106 *Quelques intentions du Cubisme*.
107 *Quelques intentions du Cubisme*.
108 Daniel Henry Kahnweiler, 'Mallarmé et la peinture', in *Confessions esthéthiques* (Paris: Gallimard, 1963).

ideas connected with geometry and the ideas connected with signs were drawn into the same circle of implication, where they were not explicitly identified. The traditional dependence of idealism on geometry for its epistemological justification and the correlate notion of geometrical forms or mathematical symbols as the script in which are written universal laws can be traced as far back as Pythagorean mysticism. Against this background, there would be no contradiction in assimilating one's aspirations for Cubism with mathematics on the one hand and magical incantatory formulae on the other. But the question remains: what has that got to do with painting and/or with modernism? For the committed idealist—or anyone who took the essentialist interpretation at its word—actually existing Cubism was bound to be a disappointment.

There is some irony in the fact that as the 'philosophy' of Cubism became more and more remote from the practice of painting, 'Cubism' would be adopted (arbitrarily almost) as the emblem for a set of idealist aspirations that motivated the post-Cubist avant-gardes of the 1920s. The geometric rhetoric which emerged in the defence of Cubism had a lot to recommend it to those who set their sights beyond Cubism. For the advocates of the much-advertised post-war *retour à l'ordre*, it had an obvious appeal. But more specifically, geometry on the basically Platonic model (with Kantian and Hegelian flavours according to taste or circumstance) offered all the transcendent authority one could want from religion, but with the advantage of, as it were, a charm against irrationality. It seemed to authorise the use of religious metaphors while substituting 'the spiritual' as an aesthetic category for the notion of a personal god. Geometry moreover lent itself to the formation of an alliance with the forces of industrialisation, that is, science and technology, very much on the Galilean model, flush with the conquests of the nineteenth century and undisturbed by the epistemological reassessments that emerged in the second half of the same century, hence the irony, especially of the use to which the 'fourth dimension' and non-Euclidean geometries were put.

Irony, that is, mainly from our point of view, for the artists who embraced the 'fourth dimension' in the 1920s were sincere, despite the fact that these ideas were to some extent discredited in the art world after Apollinaire's rhapsodies which I touched on earlier.[109] However, the new geometries had seized the public imagination again in the wake of the successful result of astronomical observations designed to test Einstein's General Theory of Relativity during the solar eclipse of 1919.[110] Einstein won his Nobel Prize in 1921 (actually for his earlier work on the photoelectric effect). The chief appeal of non-Euclidean geometry, the 'fourth dimension' and now the concept of space-time for the propagandists of the avant-

109 Marcel Duchamp's *Readymade malheureux* of 1919 is unusual for the period and is given another degree of separation from the Paris milieu by the fact that Duchamp was in Buenos Aires when he sent the instructions for this work to his sister Suzanne and her husband Jean Crotti in Paris. Their wedding present, Duchamp later explained, 'was a geometry book, which he had to hang by strings on the balcony of his apartment [...]; the wind had to go through the book, choose its own problems, turn and tear out the pages.' Pierre Cabanne, *Dialogues with Marcel Duchamp* (London: Thames & Hudson, 1971), p. 61. Duchamp commented, 'I was interested in introducing the precise and exact aspect of science [...] in order to discredit it, mildly, lightly, unimportantly.'

110 See above page 90n.

garde was the feeling that these were at the leading edge of natural science and therefore must be at the heart of a world view fitting for the twentieth century. The excitement generated by the high public profile of Einstein's Theory of Relativity in the 1920s helped to obscure not only the fact that many of the relevant ideas had their origin in the mid-nineteenth century, but also any distinction between non-Euclidean and *n*-dimensional (flat) geometries or any precise idea of space-time. (In fact, Einstein's theory proposed a four-fold Riemannian space of variable curvature.)

Several artists of the period are said to have taken a more than superficial interest in such topics (although that usually means, for example, reading popular expositions of Relativity or the popular writings of Helmholtz and Poincaré that were in vogue at various times). However, for the later advocates of the new geometries in art theory as for the earlier ones, 'four-dimensional space-time', 'non-Euclidean geometry' and so on were so many words which could be invested with a variety of meanings and aspirations. It is seldom, if ever, the case that such terms are used in an explanatory way. It would be a misguided communicator in any case who attempted to explain something hard to understand like modern art by means of an analogy with something *even harder* to understand, even if the latter were relevant. Reference to, or adoption of such terms, however, should not be dismissed as mere obfuscation. The writer could rely on the fact that the terms had currency. Even if they were not widely, deeply or correctly understood, they nonetheless bore the stamp of a discourse that their audience had been taught to hold in high esteem and regard as having indisputable contemporary relevance. References to new geometries or new dimensions would thus authorise claims for art that could not otherwise be so easily made, or could not otherwise be so easily made to seem a *necessary* part of modernity.

The vocabulary of the 'fourth dimension' and non-Euclidean geometry served to mark an old idea with the sign of the new. Or, to put it in a way perhaps closer to how it was understood at the time, the revolutionary reputation of the new geometries and especially of Relativity, suggested a radicalisation of a timeless truth which modern(ist) art would reveal for its own time. Put critically, it served a kind of fundamentalism in which the avant-gardist stance masked a deeply conservative agenda (as it was in the beginning ...), flying in the face of the actual revolution in thought that took place in mathematics in the previous century and, one might add, in painting with Cubism. It is as if the artists, having been expelled by Plato from his ideal state, return to knock at the gates of the Republic, not to overthrow it but to claim, on the strength of their new-found geometrical credentials, their rightful place among the ruling élite. The challenge to the existing order was perhaps epitomised in Rosenberg's motto, clearly aimed at the tenets of the French republic:

> Symétrie — Vérité — Éternité[111]

111 This line concludes Rosenberg's article, 'Parlons peinture ...' in *De Stijl* 4/1–3 (1921).

But I am beginning to generalise. There were, of course, a variety of different attitudes to geometry expressed by different artists or by the same artists at different times. For example, Gleizes turned his attention in the 1920s to the Christian tradition, specifically French mediaeval Catholicism, in his search for the fundamental laws of painting which he felt had been lost as a result of the dominance of Renaissance prejudices which he regarded as heresy. He does not expound a particular geometrical doctrine, but his two vital principles were rhythm (mathematical proportion) and space. In 'La peinture et ses lois: ce qui devait sortir du Cubisme' (1923)[112] he puts forward his 'new mechanism' by means of a series of exercises in plane geometry. Gino Severini (1883–1966) repudiated the enthusiasm he had expressed for the 'fourth dimension' during his futurist and Cubist years, though he continued to underline the importance of mathematics. His book *Du Cubisme au classicisme* (1921) advocated a return to Renaissance principles of perspective and proportion. In the 1920s, his paintings, purportedly made according to the 'aesthetic of compass and number'[113] revived themes from the *comedia dell'arte* and his re-born Christian faith. In the thirties he returned to Mussolini's Italy where he took part in several public commissions. Amedée Ozenfant (1886–1966) and Charles-Edouard Jeanneret (1887–1965) (Le Corbusier), who campaigned under the banner of Purism in their magazine *L'esprit nouveau* and produced rather boring domestic still life paintings, were unrestrained in their belief in the total scope of geometry and emphasised the mediation of science, technology and industry.[114] They published articles about Relativity Theory, but were sceptical about the application of the 'fourth dimension' or non-Euclidean geometry to painting. For them, 'le vrai Cubisme' still had its roots in Cézanne and now displayed a 'tendance vers le cristal,'[115] the crystal being their emblem for the geometric orderliness of nature and the confirmation of man's abstract geometric laws. Malevich's Suprematism is well known for its deployment of 'geometric' forms and his self-justifications included references to the 'fourth dimension' similar to what we saw in connection with Cubism in France, to which he added notions from Russian brands of spiritualism and, in the 1920s, vague ideas of space-time.

**8**

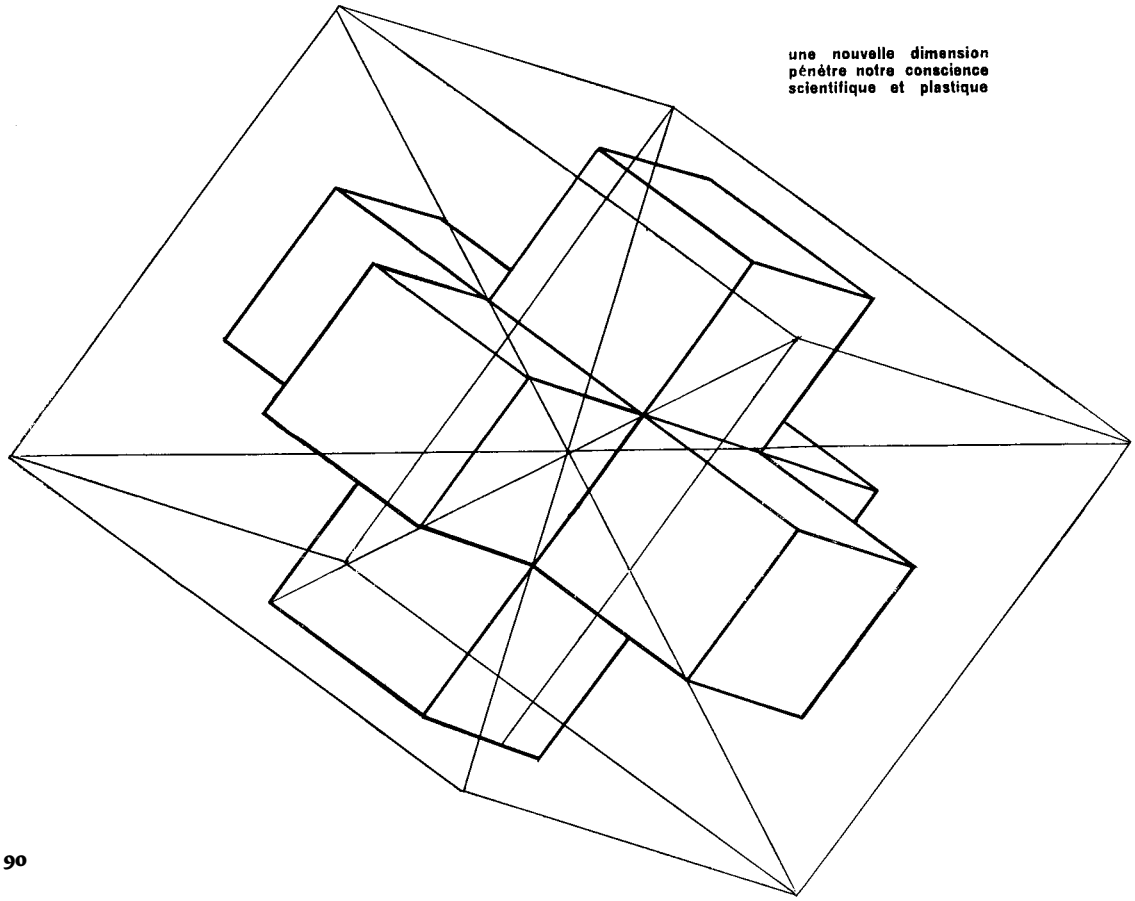
Theo van Doesburg published this drawing **(90)** in the 1927 tenth anniversary issue of *De Stijl*. It seems to represent a box containing six smaller cubes in a three-dimensional cruciform arrangement. The smaller cubes are drawn in a heavier line than the outer box. The

112 Originally published in *La Vie des Lettres et des Arts* (1923) and reprinted in Rosenberg's *Bulletin de L'Effort Moderne* 5–15 (1924).

113 This was the subtitle of Gino Severini, *Du cubisme au classicisme: esthétique du compas et du nombre* (Paris: Povolozky, 1921).

114 'Analysis shows that our knowledge of the world refers to the geometric system which is a pure creation of the mind: all aesthetic pleasure springs from the system of geometry. What we see today is essentially geometric. Ourselves and our minds are impregnated with it; man is a geometric animal, animated by a geometric spirit.' Amedée Ozenfant and Charles-Edouard Jeanneret, *La Peinture Moderne* (Paris: Crès, 1925), p. 11.

115 *La Peinture Moderne*, p. 137.




**90**

'hidden lines' of the smaller cubes are not visible, giving them a solid appearance, although the lines of the outer box can be seen through them. Van Doesburg has also inscribed the diagonals of the outer box, which likewise can be seen through the object in the middle. Because of the way it is drawn, these diagonals suggest 'false attachments' at some of the vertices of the central object, giving the drawing a slightly confusing appearance. The reading of the drawing is further disturbed by two slips of the pen where van Doesburg has drawn the diagonal from the near-top-right vertex of the box to the near-bottom-left corner of the lower cube inside, instead of to the far-bottom-left corner of the box. He has also failed to extend the near-right vertical edge of the box to the near-right-bottom corner, but instead it stops at the bottom-right edge of the lower cube inside. The whole drawing is tipped at an angle on the page and presented with the caption, 'a new dimension penetrates our scientific and plastic consciousness.'

The printed image is a reproduction of an ink tracing from a drawing on graph paper which has been dated 1924/1925.[116] Other tracings exist, showing corrections of the slips of the pen in the ink tracing I mentioned. All the tracings correct the shape of the box which was

**90 Theo van Doesburg, 'Une nouvelle dimension pénètre notre conscience scientifique et plastique', from *De Stijl*, 1927**

116 *Theo van Doesburg: oeuvre catalogue* ed. by Els Hoek and Marleen Blokhuis (Utrecht and Otterlo: Centraal Museum and Kröller-Müller Museum, 2000), cat. 739: ten sheets called 'Tesseractic Studies', all dated 1924/1925. h is the graph paper study, i the ink tracing, d, e, g and j four variant tracings based on h.

not square in the original graph paper study. Although the drawing is clearly intended as a representation of a three-dimensional object in a quasi-technical manner, the way it is laid out on the graph paper shows it is not a formal projection. The *ad hoc* oblique 'projection' adheres to the grid of the graph paper. The distant face of the cube is displaced three steps to the right and one step up, putting the receding edge at an angle of about 18° from the horizontal (instead of the conventional 30° or 45°) and giving a foreshortening of about 63% (instead of the conventional half- or true length).

The drawing is assumed, although van Doesburg does not say so directly, to be a representation of a hypercube, more specifically, a drawing of three-dimensional development of a four-dimensional hypercube such as we saw above in the illustration from Manning's *The Fourth Dimension Simply Explained* (1910).[117] If van Doesburg's drawing is a modified version of that form, then the last cube has been omitted, or replaced by the box. The drawing of the diagonals would also be unusual. In the context of De Stijl, which as a movement aimed for the direct expression of unity, harmony and universality through what its adherents regarded as the only pure forms of painting, namely straight lines and rectangular (primary) colour planes, why van Doesburg might have been interested in the representation of a three-dimensional object, let alone the fourth dimension, would need explaining.

The jubilee issue of *De Stijl* was a chance for its founder and editor to reflect on ten years of De Stijl as an 'idea', a 'movement' and as a stimulus for artistic production. He also took the opportunity to re-assert his own personality at the centre of the movement, as prophet and leader of the unfolding revolution in modern art and life. His idealism is undaunted, but appears somewhat beleaguered. By 1927 van Doesburg feared that De Stijl was being eclipsed or perhaps overtaken by the success of the modern movement in general and by the prominence in particular of the Bauhaus, Russian Constructivism and the architecture of Le Corbusier. Although van Doesburg was eager to proclaim a universal art that was somehow historically inevitable, he was quick to accuse others of stealing *his* ideas and tended to regard his sometime allies in the struggle for the new always as rivals and often, eventually, as enemies. Van Doesburg's effort to maintain the initiative theoretically is certainly influenced by his personal relations with other artists and he does not refrain from somewhat bitter comments on former De Stijl collaborators, their work and their alleged motives.[118] The introduction to the jubilee issue, '10 Jaren Stijl' is notable for here he comes out against Piet Mondrian (1872–1944), with whom in 1917 he had founded the magazine on the principles of Neo-plasticism. In contrast to 'a closed, dogmatic and completely static experience' (219) which he now associates with his former comrade, he declares a new dynamism, whereby De Stijl is not *a* style (among styles), but *the* style, the dissolution and unification of all styles. Apparently as inevitable an outcome of the 'logical evolution' of art as ever, van Doesburg

117 See above **(64)**, page 98. See also *The Fourth Dimension and Non-Euclidean Geometry in Modern Art*, p. 324.

118 ... not to mention their politics and their dress-sense. Theo van Doesburg, '10 Years of Style, general introduction', trans. by R. R. Symonds in *De Stijl*, ed. by Hans Ludwig C. Jaffé (London: Thames & Hudson, 1970), p. 223. Further page references in brackets in the text.

freely appropriates from attitudes expressed by several other contemporary '-isms' of art and now celebrates openly paradoxical formulae. The new attitude is to be 'based on optimism, gradual progress towards perfection, acceptance of life, spiritual omnipotence, revolt.' (220) This renewal or radicalisation of the De Stijl idea, he says, stems from the moment when pure form was no longer the goal, but the point of departure of the new art. This moment he dates to 1924 and its principle is Elementarism:

> De Stijl as a product of logical evolution draws its strength from a growing understanding of the principle of Elementarism. As the original basic tenets of De Stijl are now generally known and largely put into practice, the further extension and exploration of the De Stijl idea has now a totally new dimension. (223)

Here I think is a clue to the interpretation of the drawing I introduced above. It suggests why that drawing (apparently made c. 1924) and its slogan might have merited a double page spread in a special issue of *De Stijl* and hints at what it might have signified to van Doesburg at the time.

Before following up this clue, a brief word on the drawing's context in the magazine: the jubilee issue consisted of the introduction by van Doesburg I have just discussed, an essay by I. K. Bonset (van Doesburg's Dada poet alter-ego) and an album of *De Stijl* collaborators past and present, represented by portraits, short texts and reproductions of works. Van Doesburg, of course, comes first with a picture of himself at the Aubette (as work in progress and an advertisement for the forthcoming issue of the magazine devoted to the project) and, in addition to the 'nouvelle dimension' drawing, reproductions of two paintings, *Comp[osition] IX*, 1916–17 and *Contra-Comp[osition]*, 1924.[119]

It is debatable whether van Doesburg's later theorisations of the De Stijl idea really differ very much in content from the founding principles based on theosophically-inspired meditations on Neo-plasticism, but there is a change in tone: a turn away from turgid and repetitious style of Mondrian's abstractions and, in contrast to the supercilious sermonising of prominent French writers like Raynal, towards a more combative style. This could be attributed to the influence of, or van Doesburg's sense of competition with rival avant-gardes, but it is also tempting to associate it with the apocalyptic style of the movements which animated the European political scene after the turmoil of war and the weakening of the traditional party system (which he would also have experienced in Weimar and Berlin).[120] In any case, it was not a theoretical development that gave rise to a change in some formal characteristics of the work van Doesburg made (or wished he had made) in the 1920s any more than it was a

119 The following others are represented (in the order and style of *De Stijl*): Rob. van't Hoff, V. Huszar, Antony Kok, Piet Mondrian, J. J. P. Oud, G. Rietveld, G. Vantongleroo, Jan Wils, Hans Arp, Hugo Ball, Const. Brancusi, Marx Burchartz, César Domela, C. van Eesteren, Werner Graeff, F. Kiesler, Peter Roehl, Vordemberge-Gildewart. There are also some general articles on architecture.

120 The lecture van Doesburg delivered in Weimar in 1922, 'The Will to Style: The reconstruction of life, art and technology' embraces the rhetoric of 'struggle'. *De Stijl* V/2 and 3 (1922), trans. by Mary Whitall in Jaffé, pp. 152–163.

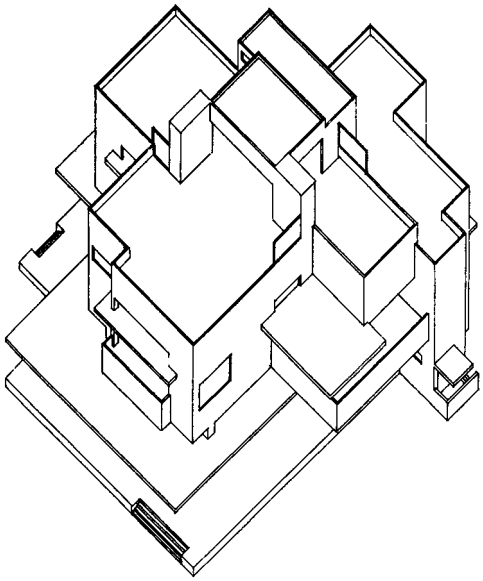
geometric-theoretical critique of perspective that gave rise to Cubism. Whatever we may think of their claims to 'historical necessity' or 'inevitability', the artists and their defenders of this time were probably honest when they emphasised that theory came after practice.

The re-evaluation (or as van Doesburg would have preferred, a Nietzschean 'revaluation') of the De Stijl idea that van Doesburg refers to as occurring in 1924, with the shift from composition to counter-composition, the advent of Elementarism and the new dimension, got its impetus from a shift in van Doesburg's attitude and ambitions in relation to architecture and, I think, from an encounter with drawing.

Van Doesburg had been involved in architectural projects and commissions since the early days and it was important from the start for the constitution of De Stijl as a collective identity that it included architects. However, his activities had mainly been confined to providing colour schemes, decorative borders, stained glass window designs and occasionally garden ornaments (or as van Doesburg would have preferred, monuments). There seems to have been a combination of circumstances which prompted van Doesburg's change in orientation towards architecture in the early 1920s, namely his contact with the Bauhaus and with El Lissitzky in Germany and, perhaps above all, his meeting with Léonce Rosenberg in Paris.

Van Doesburg and Rosenberg first met at Mondrian's studio in 1920. As we have seen, Rosenberg was establishing himself as a patron of the avant-garde and took a keen interest in De Stijl. He promised to mount an exhibition of Mondrian's paintings and soon expressed his intention of building a country house near Paris in the modern style which he would like to commission from the De Stijl group. The house was to comprise living, entertaining and the display of modern art in quarters built around a central courtyard: in fact, a highly classical arrangement as far as Rosenberg conceived it. Although Rosenberg had neither the funds nor any site on which to realise the project, van Doesburg seized on the idea as an opportunity to make a decisive demonstration and set about immediately configuring the group of collaborators he deemed worthy of taking part, with himself and Mondrian at the head. As it turned out, nothing was ever built and van Doesburg was almost alone in his enthusiasm for such a utopian project. Mondrian did not take an active interest and was in any case preoccupied with painting. J. J. P. Oud (1890–1963), a founding associate of De Stijl whom van Doesburg had imagined as the chief architectural collaborator on the Rosenberg house, was not willing to make any commitments without a concrete assignment. By the time the offer came from Rosenberg to mount an exhibition of De Stijl architecture in his Galerie de l'Effort Moderne in 1923, van Doesburg and Oud had already fallen out over a disagreement connected with van Doesburg's colour schemes for one of Oud's projects in Holland, and it seemed as if the supposed De Stijl group lacked any trained architect whose contribution would be essential if it were to make a convincing showing in Paris.

Luckily, van Doesburg managed to recruit a young Dutch architect, Cornelis van Eesteren (1897–1988), whom he had met in Weimar. Van Eesteren arrived in Paris in the Summer of 1923 to start work on the exhibition. The model of the Rosenberg house that eventually



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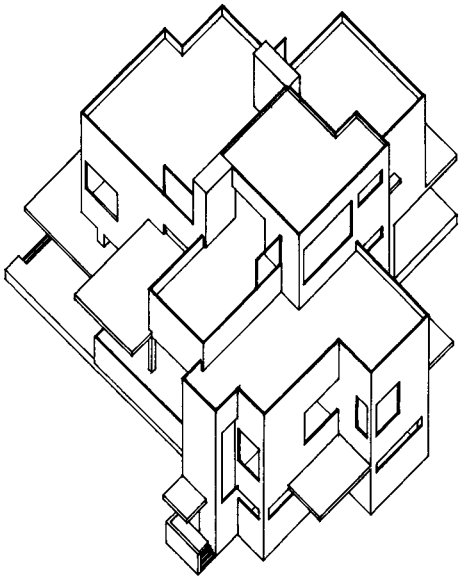

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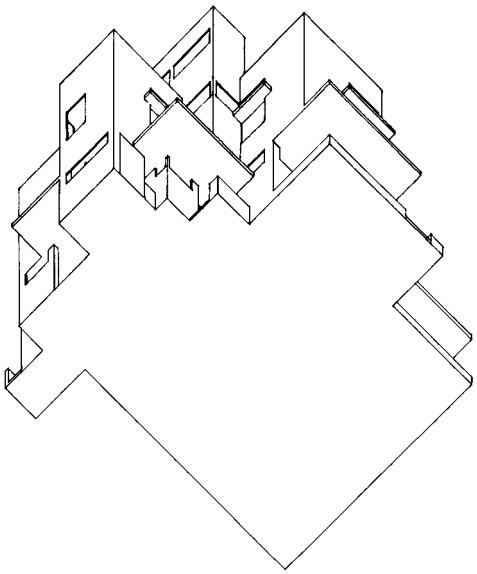
formed the centre-piece of the show was made by Gerrit Rietveld (1888–1964) from designs worked out by van Eesteren, apparently mainly on his own. Van Doesburg never got round to colouring the model as he had originally intended. His attention was captivated by two smaller house designs which he and van Eesteren prepared for the exhibition as speculative projects. The first *Maison particulière* was their joint work and the other, *Maison d'artiste* was worked out mainly by van Doesburg (and would have suited his own requirements). Models were made for the exhibition and van Eesteren produced the drawings. Among the latter was a striking series of so-called 'axonometric projections' of the private house. In each drawing the plan is oriented at 45° relative to the sheet and the elevations raised vertically in a form of 'cavalier perspective'. Rotating the plan ninety degrees at a time and showing each orientation as if from above and as if from below, van Eesteren showed four 'views' of each facade. The technique is well-adapted to the form of the building, whose façades are deeply stepped. It also tends to underline the ideal character of the design in so far as in the drawings the house is isolated from any context, uncannily so in the 'views' from below where the house appears to be floating in the air **(91–94)**. From these drawings van Doesburg made a number of tracings he called 'analyses of architecture' to some of which he applied colour **(95)**.

The architectural drawings and the analyses were widely published at the time and have continued to be so. They are frequently cited as contributing to the revival of this style of drawing and its adoption as a sign of the modern. I want to consider the impact of these drawings on van Doesburg's practice and how they might have prompted the theoretical revisions he looked back on in the jubilee issue.

There is a risk in following a train of thought like van Doesburg's, which abounds in contradictions, of doing it an injustice by attributing to it more coherence that it possesses or, perhaps more to the point, attributing to it the wrong kind of coherence. Despite his logical

**91–92 Theo van Doesburg and Cornelis van Eesteren, *Maison particulière*, 1923**



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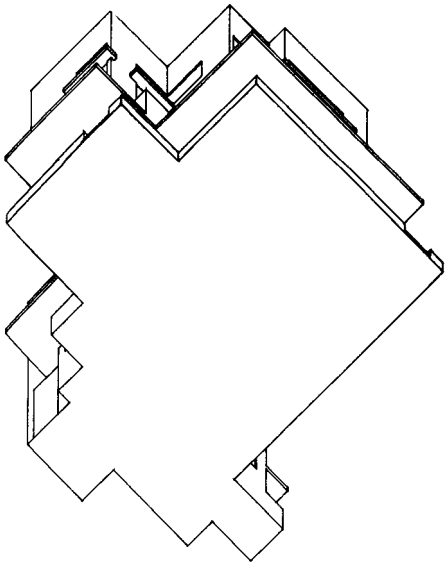

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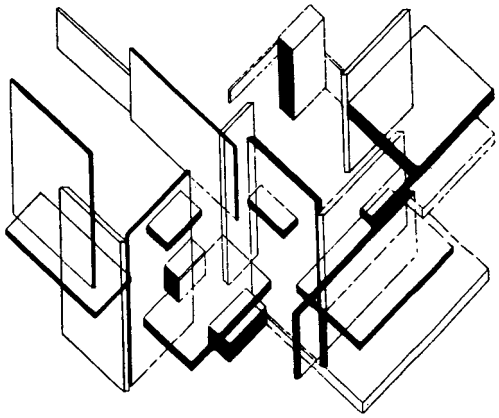
and verbal contradictions, his affectation for deliberate paradox and his apparent repudiation or revision of ideas earlier held to be fundamental, van Doesburg at all times asserts his convictions aggressively. His frequent invocations of fundamental and absolute laws, universal methods, objective systems, pure and unambiguous means of expression, logical evolution, scientific and historical necessity and the like do not stop him from denying the immutability of principles or extolling relativity. He declares (variously) the reconciliation, synthesis and overcoming of opposites with the same single-mindedness with which he contends that Elementarism overcomes all dogmas of religion or philosophy, that is, without mediation or explanation. It is as if Elementarism is a juggernaut that would crush every other doctrine by force of a higher truth. This, however, is not to say there is no method to it. What we are presented with is the rhetoric of a kind of manic Hegelian dialectic but stripped of philosophical discussion. The vaunted necessity of the synthesis spares van Doesburg the effort of actually articulating it. Despite advertising 'Logical construction instead of lyrical constellation'[121] as one of the characteristics of the 'new style' as opposed to the old, his approach amounts to a kind of syncretism.

Although van Doesburg was throughout his life an avid sketcher, he had always struggled with formal architectural drawings meant to render three dimensional objects. Extant drawings of this type, like the 'nouvelle dimension' drawing, betray his lack of confidence. Drawings associated with his 'basic elements of architecture' **(96)** or his design for a pond (both c. 1922), for example, show a clear intention of rendering cubic volumes in space, but the results are distinctly cock-eyed.[122] Van Eesteren's architectural drawings provided van Doesburg with a sure framework and therefore opened up new possibilities for his graphic variations and colour compositions.

**93–94 Theo van Doesburg and Cornelis van Eesteren, *Maison particulière*, 1923**

121 'Logische Konstruktion statt Lyrische Konstellation.' *De Stijl* V/2 (1922), p. 35, trans. in 'The Will to Style', p. 159.
122 *Doesburg: oeuvre catalogue*, cat. 674: *Fundamentals*, cat. 702li: *Design Pond* .



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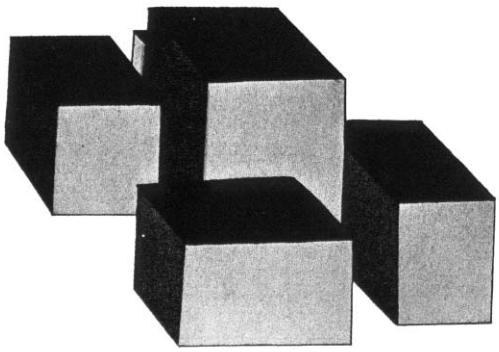

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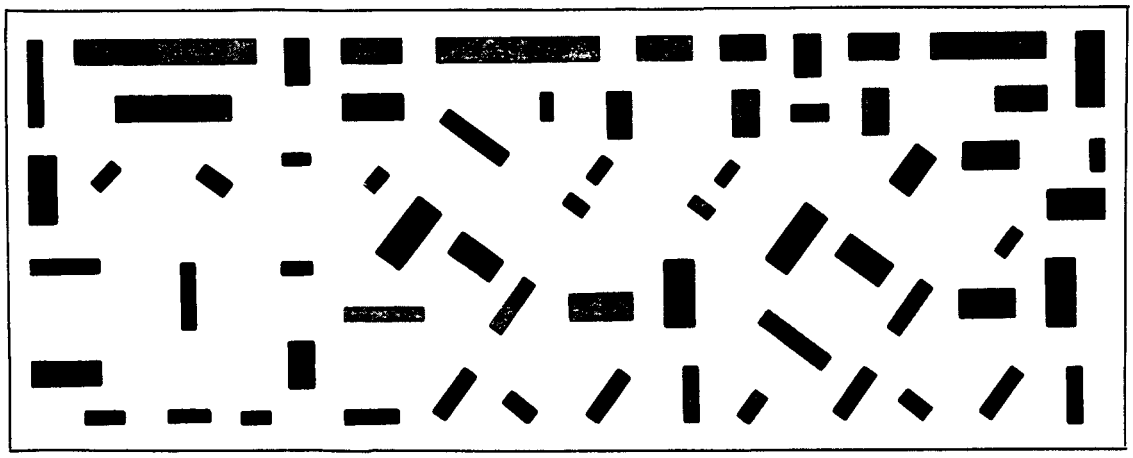
The graphic 'analyses of architecture' hint at opening up the box of the building to reveal interior spaces, although not systematically. The alternative label 'Counter-construction' which van Doesburg coined for the drawings is apt in so far as the cubic volumes of the architecture here become discrete rectangular slabs of varying thickness arranged without visible means of support.

Despite the reduction of the design to the plainest possible elements and the drawings' lack of any indication of site or material, van Eesteren's 'axonometric projections' forestall any ambiguity as long as they are equipped with the label 'house' and the tell-tale signs: step, door, window, chimney etc., which successfully determine orientation, scale and the possibility of inhabitation. These are the signs which van Doesburg erases in his 'analysis' in accordance with his notion of the elements or essentials of architecture being 'pure' form. Yet, the 'analyses of architecture' or 'counter-constructions', I think, betray potentially conflicting motives. On the one hand, van Doesburg makes an earnest project for the colour scheme of the house, in which the material surfaces of the house become colour surfaces disposed at right angles to one another. This is a project for a three-dimensional arrangement which the viewer can recover from the drawing and so imagine moving through or around the building, experiencing a succession of colours and spaces. Removing the shell of the building, as it were deconstructing it, the drawings suggest a coherence articulated autonomously by colour. On the other hand, the analysis still owes something to the kind of sublimation of form that was demonstrated in an earlier phase of De Stijl. The exemplar of this process is perhaps most clearly found in the paintings of Bart van der Leck (1876–1958). Van der Leck's work of around 1916–1918 retains figurative motifs but subject to severe

**95 Theo van Doesburg, *Architectural Analysis*, 1923, (a.ka. 'Architecture: Private House, Counter-Construction' in *De Stijl*, 1924, a.k.a. 'Elementary Expressional Means of Architechture' in *Principles of Neo-Plastic Art*, 1925)**

**96 Theo van Doesburg, *Fundamental of Architecture*, 1922 (a.ka. 'The Elementary Expressional Means of Sculpture' in *Principles of Neo-Plastic Art*, 1925)**



**97**

abstraction. However, unlike Cubism and Mondrian's Cubist-influenced work of the same time, van der Leck's works such as *Mine Triptych* (1916) or *Donkey Riders* (1917) **(97)** explore an uncompromisingly flat reduction of form. In a letter to the artist, van Doesburg hailed his work as an unprecedentedly 'pure and mature application of the principles of plastic art [...] —the rhythmic translation of the universal life,' and praised *Mine Triptych* in particular for 'the way the universal qualities of life were dealt with in relation to the pure means of the art of painting.'[123] Van der Leck's repertoire of simple rectilinear shapes and primary colours had a vital influence on Mondrian and van Doesburg before the publication of the first De Stijl manifesto, although van der Leck kept aloof from the 'the movement' and was reluctant to subscribe to the codification of the 'pure forms' of painting. A discussion seems to have emerged (which did not interest van der Leck) about whether the new painting should, as Mondrian believed, exclude all but the horizontal and vertical. Van Doesburg's own demonstrations, the 'aesthetic transformation' of a cow and the 'composition in dissonances' based on a portrait of his wife, seem to suggest the progressive suppression of anything oblique.[124]

The experience of van Eesteren's oblique projections of cubic architecture seems to have reconciled van Doesburg with the diagonal. My aim is to suggest how I think from this experience the diagonal came to be elevated in van Doesburg's thought to being the principle and epitome of elementarism, his -ism to end all -isms. It is worth restating in case it seems I have allowed van Doesburg to draw me towards the extreme horizon of abstraction, that my purpose is to give a historical assessment of how the aspirations of (this version of) the post-Cubist avant-garde were mediated by ideas connected with geometry. For the moment, I will

**97 Bart van der Leck, *Composition No. 5 (Donkey Riders)*, oil on canvas, as illustrated in *De Stijl*, 1917**

123 Letter to van der Leck, 1916, quoted in Rudolf W. D. Oxenaar, 'Vand der Leck and De Stijl 1916–1920', in *De Stijl 1917–1931: Visions of Utopia*, ed. by Mildred S. Friedman (Oxford: Phaidon, 1982), p. 72.

124 *Doesburg: oeuvre catalogue*, cat. 567a–o (c. 1918), reproduced in *Principles of Neo-Plastic Art* (1925); cat. 621a–f (1919).

continue to do that by working towards and interpretation of the drawing I introduced at the head of this segment **(90)**.

The Effort Moderne show was intended as a manifesto exhibition and van Doesburg did not fail to provide verbal declarations of the De Stijl mission in architecture (texts signed jointly by him and van Eesteren). In 1923, van Doesburg foresaw the reciprocal collaboration between painters and architects as erasing the traditional division of roles. Painters and architects would be united as 'constructeurs de la vie nouvelle.'[125] Going as far as to say that painting separated from architectural construction had no *raison d'être*, he proclaimed architecture as the 'unité plastique de tous les arts'[126] which would combine the laws of space with the laws of colour. Furthermore, the future would come finally to the expression of 'une nouvelle dimension dans la realité en trois dimensions.'[127]

> We have examined the relation between space and time and we have found the plastic realisation of these two elements *by means of colour* give a new dimension.[128]

This specification of the role of colour, by implication of the painter, hints at what van Doesburg imagined he was doing in his colour studies for the private house, an intention he underlined by the inscription he added to one of the drawings, 'Construction des couleurs dans la 4eme dimension de l'espace-temps.'[129]

It seems then that van Doesburg's 'new dimension' is derived at least in part from ideas not traditionally associated with geometry: time and colour. In his writing, van Doesburg assembles a variety of references that, on the one hand, borrow from accepted notions—that is to say, they invoke the authority of geometry for his cause in a traditional way—and, on the other hand, hint at more modern ideas. The criterion seems to be the 'friendliness' of the concepts he obtained by hearsay. For example, van Doesburg might have felt justified by association with the concept of 'colour-space' first discussed by Helmholtz in the 1870s,[130] and was certainly impressed by the popular success of Einstein's theory of relativity. It did not bother him if the bits of the various geometries he called on might have been incompatible if one were to attempt to develop a mathematical interpretation of his theory. I think his texts are more profitably read as a kind of semiotic refurbishment of his private house. In other words, from the relatively innocent and frankly Cartesian sign-vehicle of van Eesteren's architectural drawings he attempts to fashion a sign of *the new*. Drawing and colour suffice for the destructive needs of the task, although writing is indispensable (as we saw with diagrams associated with non-Euclidean geometry) for its constructive aspect. However, the allusions van Doesburg makes to four-dimensional space-time, 'non-Euclidean calculations' and rel-

125 Theo van Doesburg, 'Vers une construction collective', in *De Stijl*, VI/6–7 (1924), p. 90.
126 Theo van Doesburg,'- [square] + $=R_4$', in *De Stijl*, VI/6–7 (1924), p. 91.
127 'Vers une construction collective', p. 90
128 '- [square] + $=R_4$', p. 91.
129 *Doesburg: oeuvre catalogue*, cat. 763 (1925).
130 Helmholtz's point was that any manifold of variables can be configured as a space. In this case, a colour could be specified by its red, blue and green 'co-ordinates'.

ativity are not permitted to undermine the habitual claims to objectivity, universality or the supposed self-evidence of absolute space. Instead, it is almost as if those intellectual monuments of modernity should, in the light of the new science proclaimed by Elementarism, be found eventually to be no less precarious in their foundations than the glories of the past.

The diagonal occurred to van Doesburg in a situation where he identified it with the ambitions he then held both for himself as an architect and for architecture in general. It must be said, however, that this appearance of the diagonal is somewhat arbitrary.[131] Appropriate though van Eesteren's drawings are to the design for a house, the architect might easily have used a different convention. But for van Doesburg 'the diagonal' was not just any oblique angle. While the general appearance of the drawings might have excited van Doesburg by giving him access to the kind of 'space' he had seen in Lissitzky's work, the specific 45° orientation of van Eesteren's so-called 'axonometrics' might also have suggested a special significance, being the diagonal of a square. Thus it might have offered an answer to the cult of the square promoted by his Russian friends, which van Doesburg had supported in the magazine. Malevich's *Black Square* and Lissitzky's *Proun* both appeared on the covers of *De Stijl* in 1922. In the same year, van Doesburg devoted a special issue of the magazine to Lissitzky's *Story of Two Squares*. Around the same time, he expressed sympathy with and elaborated on the acceptance of the square as the emblem of a 'new faith'.

> As I said to Mondrian at the time, what the [cross] was to the Christians, the [square] is to us. Not as a symbol, but as the basic form of outer and inner culture, as a synthesis of the new faith, to give it a name. At any rate, the square expresses everything we and mankind are searching for today: absolute Harmony, the unity of all duality.[132]

This letter is worth quoting because it gives an indication of the way van Doesburg thought about the significance of form. In another comment to the same correspondent, he wrote, 'I am afraid, though, that "one" will see the [square] as a *symbol* again, just like the cross, but to me it is a *sign* or *signal*, in short universal.'[133]

In 1926, in an article entitled 'Painting, from composition to counter-composition' he could state that his discussion of the spiritual and historical aspects of 'counter-composition' were 'no more than imprecise indications of what is immediately expressed plastically by the diagonal.'[134] In 'Painting and Sculpture, about counter-composition and counter-sculpture. Elementarism (fragment of a manifesto)' the same year, he united the diagonal with the new dimension, stating that, 'Elementary (anti-static) counter-composition adds to orthogonal, peripheral composition a new diagonal dimension. Thereby,' he continued, 'dissolving, in a

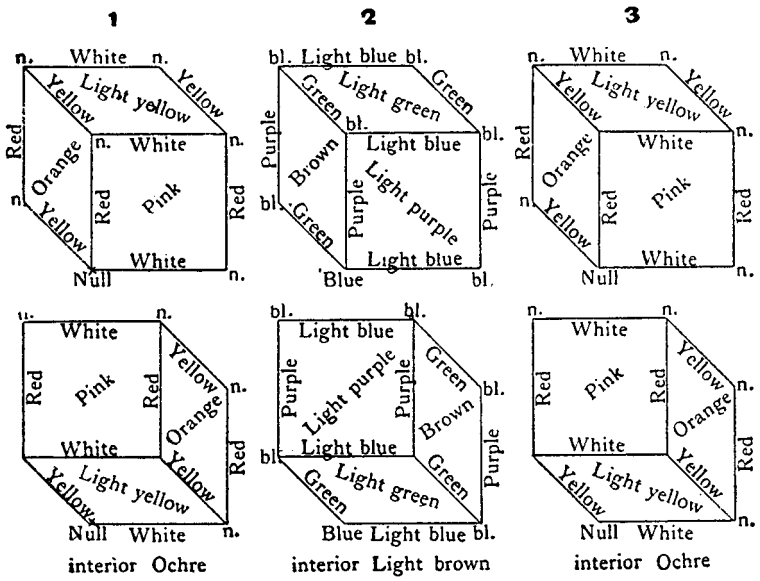
131 The diamond or lozenge shaped canvases that Mondrian produced from around 1918 were intended to underline the horizontal-vertical orientation of his compositions.
132 Letter to Evert Rinsema, 19 June 1922, quoted in Evert van Straaten, *Theo van Doesburg: constructor of the new life* (Otterlo: Kröller-Müller Museum, 1994), pp. 23–24.
133 Letter to Evert Rinsema, 20 August 1922, quoted in *Theo van Doesburg: constructor of the new life*, p. 24.
134 Theo van Doesburg, 'Painting, from composition to counter-composition', in *De Stijl*, VII/73–74 (1926), trans. by R. R. Symonds in Jaffé, p. 207.

real manner horizontal-vertical tension. Introduction of sloping planes, dissonant planes in opposition to gravity and static architectural structure.'[135] By this time, having fallen out with van Eesteren and having been disappointed by the lack of architectural commissions he had imagined coming his way, the diagonal was assigned the burden of his opposition not only to 'horizontal-vertical' painting but to architecture as well. Furthermore, preparing a swipe against the constructivists, he announced the 'possibility of an elementary counter-sculpture,' for which, 'the first thing to be done is to destroy, out of contempt for the Euclidean view of the world (from a fixed point), this [static] axis.' In a footnote van Doesburg pointed out that Tatlin's Counter-relief had nothing to do with counter-sculpture and accuses him of being a 'romanticist' who 'understood neither the modern problem of sculpture nor that of architecture,' and continued, 'This is proved sufficiently by the spiral, baroque monument which, in addition to its illogical combination of parts and spaces, is symbolic! Russian muddle-headedness and snobbish bravado to impress the flappers!'[136]

One might ask: what kind of idea could have motivated or sustained this indefatigable tendency to appropriate and oppose so many different notions and positions? Henderson has noted how van Doesburg's 'fascination with the new relativistic fourth dimension was reinforced by the earlier ideas on the fourth dimension, particularly nineteenth-century hyperspace philosophy.'[137]

Hyperspace philosophy is the term Henderson uses for a trend which started in the late nineteenth century in which ideas from the geometry of more than three dimensions were appropriated by non-mathematical literature. It seems to have been expressed in a variety of genres from earnest popularisations of mathematics to allegorical tales with religious overtones, science fiction, explanations of spiritualism and theosophically-inspired tracts. One of its most influential advocates and, according to Henderson, 'the first true hyperspace philosopher' was the English mathematician (teacher, bigamist, émigré and inventor of a baseball pitching machine) Charles Howard Hinton (1853–1907). Under titles such as 'What is the Fourth Dimension' and *A New Era of Thought*, he published books and articles in which he promoted a philosophical justification of the reality of the 'fourth dimension' as a kind of higher world. He brought Plato on his side by reminding his readers of the parable of the cave dwellers who identified the world with its shadow and he urged the possibility that our three-dimensional perception delivers us a mere shadow of a four-dimensional reality. From Kant he drew the conclusion, not that the possibility of *n*-dimensional geometry would undermine his thesis on intuition, but that human beings should cultivate intuition of higher dimensions, indeed that the fourth dimension would reveal the 'thing-in-itself'. To this end he developed a system of conceptualisation of four-dimensional bodies as a kind of spiritual exercise. Hinton claimed however that, 'All attempts to visualise a fourth dimension are

135 Theo van Doesburg, 'Painting and Sculpture, about counter-composition and counter-sculpture. Elementarism (fragment of a manifesto)', in *De Stijl*, VII/75–76 (1926), trans. by R. R. Symonds in Jaffé, p. 209.
136 'Painting and Sculpture', pp. 211–212.
137 *The Fourth Dimension and Non-Euclidean Geometry in Modern Art*, p. 324.

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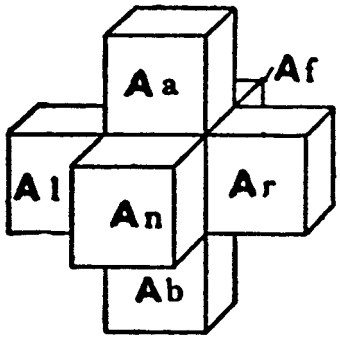
futile. It must be connected with a time experience in three[-dimensional] space.'[138] Arguing by analogy with a three-dimensional solid passing through a plane, which, for a 'plane-being' who knew nothing of the third dimension, would be experienced as a succession of plane sections, Hinton suggested a multi-coloured four-dimensional 'tesseract' (as he called it)[139] passing through ordinary three-dimensional space. Thus it could be imagined as a sequence of different coloured cubic 'sections'. The tesseract exercises are in fact very complicated and involved memorising arrays of colours (or alternatively names) applied to the faces and edges of a multitude of cubes **(98)**.

It is evident that van Doesburg was to some extent familiar with this system (probably dating from his earlier interest and commitment to theosophical ideas) and in the 1920s he crossed Hinton's temporal model for the representation of the fourth dimension of space with relativistic space-time. In a late article van Doesburg described the 'scholarly foundation of the space-time continuum' as 'Lorenz-Minkowsky-Hinton-Einstein.'[140] In 1925 van Doesburg wrote in a letter to Hannah Höch in Berlin:

> Artistically I have been developing a schematic representation for the new space. Have now acknowledged the tesseractic space as the only universal space in which to express form (including film). I am quite sure that mathematical and lucid knowledge is needed, and that all film, architecture, Proun etc. experiments, no matter how interesting, are based on aesthetic speculation.[141]

**98 Charles Howard Hinton, 'Six Cubic Sections of the Tesseract' from *The Fourth Dimension*, London, 1904**

138 Charles Howard Hinton, *The Fourth Dimension* (London: Swan Sonnenschein, 1904), p. 207.
139 Sometimes spelled 'tessaract'.
140 'Der Kampf um den neuen Stil' in *Neue Schweitzer Rundschau* XXII (1929), p. 630, quoted in *The Fourth Dimension and Non-Euclidean Geometry in Modern Art*, p. 324.
141 21 May 1925, quoted in *Theo van Doesburg: constructor of the new life*, p. 190–191. In 1921 van Doesburg also published two articles in *De Stijl*, under the pseudonym I. K. Bonset, entitled 'Kritische Tesseracts'. [cont.]

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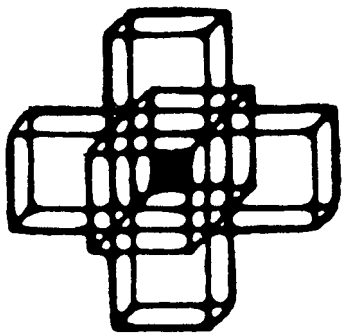

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It is likely that here van Doesburg is referring to the group of drawings to which the 'nouvelle dimension' he published in 1927 belongs, hence the label 'Tesseractic studies' applied by the editors of his œuvre catalogue, but the visual evidence is not conclusive, even allowing that van Doesburg's interpretation of Hinton is unlikely to be as pedantic as a PhD researcher's. Although Hinton offers a bewildering set of variations on his tesseract system, he does not propose the representation of a four-dimensional or hypercube by means of its development as a net of eight cubes. A similar figure to the one van Doesburg has drawn, however, appears in Hinton's chapter 'The Simplest Four-dimensional Solid', but it is only intended there as a preliminary to the tesseract to show how a normal cube is completely enclosed by six others **(99)**. But it would not have been difficult, from various sources, for van Doesburg to put the popular presentation of the hypercube together with Hinton's nomenclature, which might still have kept the connotation of the experience of colour in time. In Claude Bragdon's *Primer of Higher Space* (1913) the net of cubes is displayed with the label 'tesseract' as it is too in *Projective Ornament* (1915), where Bragdon also derives a symmetrical (seven cube) version as a decorative motif **(100–101)**.[142] It is possible van Doesburg might have seen those books, or they might have influenced whoever put the labels on the drawings. Van Doesburg's own explanations are scanty. When he published two variants on his

**99 Charles Howard Hinton, 'Six Surrounding Cubes' from *The Fourth Dimension*, London, 1904**

**100 Claude Bragdon, an arrangement of seven cubes from *Projective Ornament*, Rochester NY, 1915**

141 [continued] The editors of van Doesburg's oeuvre catalogue also provide another reference to Hinton from an article written in 1923.

142 Claude Bragdon (1866–1946), the American architect and theosophist, was an important promoter of hyperspace philosophy in the early twentieth century through his own books on theosophy and architecture as well as his English translation of P. D. Ouspensky's *Tertium Organum*. He is generally regarded as a conservative architect and crackpot. Bois (in 'Metamorphosis of Axonometry', p. 41) insists that 'epistemologically [...] Bragdon bears no relation to the modern architectural movement: A master of Art Déco, his concern with axonometry grew out of his occult and theosophic studies of the fourth dimension.' I don't think the distinction that Bois makes is nearly as clear as he would like. Besides the fact that many of the masters of the modern movement started out as apprentices of Art Déco, it could be argued that Bragdon was not much less avant-gardist than his younger European contemporaries and that the latter were hardly less esoteric.

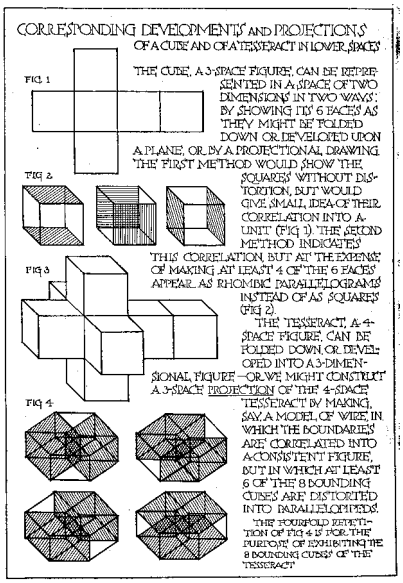

CORRESPONDING DEVELOPMENTS AND PROJECTIONS OF A CUBE AND OF A TESSERACT IN LOWER SPACES

FIG. 1

THE CUBE, A 3-SPACE FIGURE, CAN BE REPRESENTED IN A SPACE OF TWO DIMENSIONS IN TWO WAYS: BY SHOWING ITS 6 FACES AS THEY MIGHT BE FOLDED DOWN OR DEVELOPED UPON A PLANE, OR BY A PROJECTIONAL DRAWING. THE FIRST METHOD WOULD SHOW THE SQUARES WITHOUT DISTORTION, BUT WOULD GIVE SMALL IDEA OF THEIR CORRELATION INTO A UNIT (FIG 1). THE SECOND METHOD INDICATES THIS CORRELATION, BUT AT THE EXPENSE OF MAKING AT LEAST 4 OF THE 6 FACES APPEAR AS RHOMBIC PARALLELOGRAMS INSTEAD OF AS SQUARES (FIG 2).

FIG. 2

FIG. 3

THE TESSERACT, A 4-SPACE FIGURE, CAN BE FOLDED DOWN OR DEVELOPED INTO A 3-DIMENSIONAL FIGURE—OR WE MIGHT CONSTRUCT A 3-SPACE PROJECTION OF THE 4-SPACE TESSERACT BY MAKING, SAY, A MODEL OF WIRE, IN WHICH THE BOUNDARIES ARE CORRELATED INTO A CONSISTENT FIGURE, BUT IN WHICH AT LEAST 6 OF THE 8 BOUNDING CUBES ARE DISTORTED INTO PARALLELOPIPEDS.

FIG. 4

THE FOURFOLD REPETITION OF FIG 4 IS FOR THE PURPOSE OF EXHIBITING THE 8 BOUNDING CUBES OF THE TESSERACT

**101**

version of the form in 1925, the meaning seemed to depend on the direction of arrows he added pointing inwards or outwards, the latter being characteristic of a new 'hypercubic' architecture. Another version has arrows *and* diagonals.

If van Doesburg followed Hinton, as would seem plausible in view of his sympathy with the idea of representing the fourth dimension as a colour-time experience, this would also have supported (by association with Hinton's fiction of a four-dimensional solid passing through our space) the idea of 'penetration' which van Doesburg stressed in the 'nouvelle dimension' drawing.[143] It is as if, in that drawing, the diagonals of the outer box are assigned the role of penetrating, while in their 'essence' as diagonals they are meant to bear the message of Elementarism. One might even go as far as to suggest that the diagonals are here intended also to carry the burden of colour in this drawing which remained in outline only.[144]

The model of semiotics I have developed up till now would tend to induce extreme scepticism regarding the idea of 'immediate expression' that van Doesburg attributed to the diagonal, especially at such a level of abstraction. We have seen how even a sign linked to its sense by means of a *physical cause* cannot be regarded as unmediated, how a reaction alone falls short of signification, and we have examined the role of the indexical 'designator'. Nonetheless, it is clear from the comments I have quoted, especially the private remarks on the square, what van Doesburg had in mind. This might be reminiscent of the 'theological symbols' we came across during my discussion of the 'dialectical image' in Part I. But, just as

**101 Claude Bragdon, 'Corresponding developments and projections of a cube and of a tesseract in lower spaces', from *Projective Ornament*, Rochester NY, 1915**

143 Van Doesburg's notion of penetration might also have received an impetus from Georges Antheil's ideas about music which were published in *De Stijl* in 1925: 'My Ballet Mechanique comes out of the first and principle [sic] stuff of music ... TIME-SPACE. [...] Now I hope to present you not with an explosion, but the FOURTH DIMENSION ... THE FIRST PHYSICAL REALISATION OF THE FOURTH DIMENSION. I am not presenting you with an abstraction. I am presenting you with a PHYSICALITY LIKE SEXUAL INTERCOURSE.'

144 One of the tracings (*Doesburg: oeuvre catalogue*, cat. 739j), contains indications for a colour scheme for the drawing which was never executed.


faith is not required for critical consideration of theological texts, it would be pointless to dismiss van Doesburg's aspiration as simply futile. Although a strict terminological mapping would not be fair, the writer probably doth protest too much when he denies the art of De Stijl, or its 'elements', are symbolic.

It is interesting that the theological or religious aspect of the De Stijl's aspirations seems to have been expressed more openly in private than in public, although one hardly needs to read between the lines of Mondrian's and van Doesburg's publications to discover it.

The distance they kept (in public) from religious symbolism stems in part from the desire to underline their rejection of imagery of any kind, in part from the desire to express their sense of surmounting all kinds of sectarianism in their revelation of the universal, but perhaps above all because they considered the traditional symbols deficient by the criterion of immediacy. The reproach against the Christian cross as merely anecdotal probably went without saying. Van Doesburg was more inclined to analyse it on aesthetic principles—horizontal and vertical—and find it wanting in harmony. Either way, that sign falls short of the direct, plastic expression of the universal that they aimed for.

Yet, there is a sense in which the De Stijl dogma of painting thwarts the mystical-religious drive, paradoxically, because this dogma is itself an aestheticised religious sentiment. The language of De Stijl art theory seems to parallel the aesthetic reduction on which Neo-plasticist painting was founded: the stripping away of everything except what was considered pure, primary and essential. So, as with Mondrian's 'transitional' work of the war

**102 Theo van Doesburg, 'From Neo-plasticisme to Elementarisme' from *De Stijl*, 1927**

years, when the depiction of a scene was driven towards the iteration of a grid, 'God the Father', religious practice and the symbolic mediation of priests were translated into their 'purified' equivalents, the universal, the spiritual and the rational mediation of artists. Call it sublimation. Call it repression. The more this doctrine discarded of the semiotic ballast of the past (including religious art), the more it relied on geometry as its epistemological keel,[145] the more it had to press meaning into geometry as virtually its only remaining form of articulation, even if that went against the grain of the modern 'scientific consciousness' whose authority it sought both to co-opt and usurp.

Such a doctrine survives not on its logic (which, by compelling the repetition of the eternal, denies the future), but on its contradictions. Thus, masked by geometry, the quasi-religious conception of the De Stijl mission could still develop. Thus an image like the 'nouvelle dimension' drawing I have described could be made to stand for an ideology whose tenets it appears to contradict in its constitution as a sign.[146]

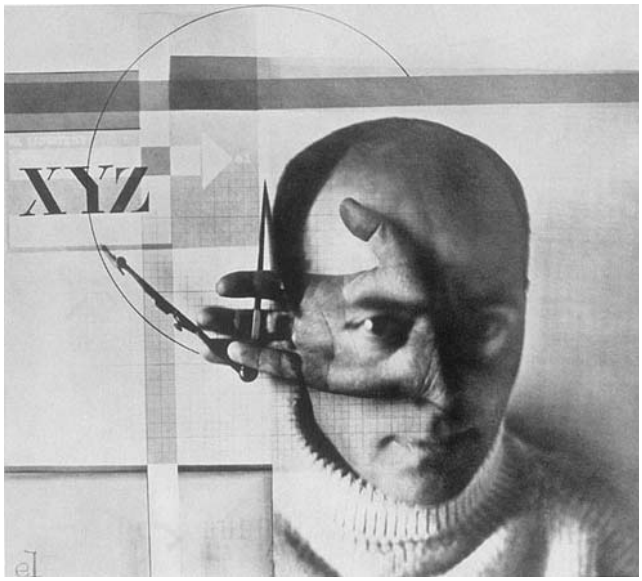
**9**

Although van Doesburg and Lissitzky have frequently been linked under the rubric of utopian modernism, it would be possible to contrast their work and propose Lissitzky as the counterbalance, within a set of overlapping aspirations, to van Doesburg's self-contradictory single-mindedness.

Lissitzky himself provided the image that has been used to encourage this view in his photo-montage self-portrait known as 'The Constructor' **(103)**. The self-portrait dates from the end of 1924, while Lissitzky was in Switzerland (to get treatment for tuberculosis which had been diagnosed the previous year) and shortly before his return to the Soviet Union. Despite his illness, 1924 was an extraordinarily and diversely productive year. The portrait itself results from an engagement with photography and photographic processes he had begun in Germany and which also bore fruit in commercial designs he undertook for the Hannover firm Günther Wagner (for the Pelikan brand of office and graphic products). He produced two important publications in which he was involved as editor, writer and designer: an edition of *Merz*, in collaboration with Kurt Schwitters (1887–1948) entitled *Nasci*, and *Die Kunstismen*, produced in collaboration with Hans (Jean) Arp (1887–1966). During the year, Lissitzky also translated writings by Malevich and worked on speculative architectural projects reflecting a more intense engagement than he had shown since he left Russia with what he perceived to be the needs of the Soviet Union, or perhaps how he imagined his future

145 Mondrian even urged a purified geometry: 'Even the most general geometric forms express something specific [Mondrian's footnote: Geometric figures, furthermore, are often seen in the light of traditional symbolism, which obstructs pure vision.] To destroy this limitation (or individuality) is the task of art and constitutes the essential of all style.' 'The New Plastic in Painting' in *The New Art—The New Life: the collected writings of Piet Mondrian*, ed. by Harry Holtzman and Martin S. James (London: Thames & Hudson, 1987), p. 52.

146 An post-script to this episode might compare the 'nouvelle dimension' drawing with van Doesburg's design for the back cover of the jubilee issue of *De Stijl* **(102)**.

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role in his homeland. His projects included a public building dedicated to the memory of Lenin (who died 21 January 1924) and the so-called *Wolkenbügel*, a large office building-type he imagined straddling major road intersections in Moscow.

Emerging at what appears to be a turning point in his career, it is tempting to regard Lissitzky's self-reflection as something like taking stock of the story so far or perhaps announcing future intentions.[147] Lissitzky made presents of several copies of his self-portrait to friends as a kind of memento. It was very well received and soon appeared in print and in various exhibitions.[148] It was published early in 1925 in the Swiss architectural journal *ABC* and notably, later, on the front cover of Franz Roh's and Jan Tschichold's *Foto-Auge: 76 Fotos der Zeit* (1929).[149] A Berlin architect apparently ordered a large-scale print for his office as a kind of inspirational or advertising poster.[150] Tschichold praised the self-portrait much later as Lissitzky's 'finest and most important work' in which 'the intention, the technique and the final form coincide perfectly,' in Tschichold's view ensuring Lissitzky's place in the history of photography 'once and for all.'[151]

The prestige Lissitzky won in western Europe through this image (and which the image continues to support today) was built on the foundation of the respect accorded on the one hand to Lissitzky's qualifications as a trained architect and engineer and on the other hand to his perceived involvement with the communist revolution in Russia (thus securing the appeal

**103 El Lissitzky, *Self Portrait (The Constructor)*, photomontage, 1924**

147 See Peter Nisbet, *El Lissitzky in the Proun years: a study of his work and thought, 1919–1927* [doctoral thesis, Yale University, 1995] (Ann Arbor: UMI Dissertation Services,1998), p. 316.
148 Printing Trades Exhibition, Moscow, 1927, Film und Foto, Stuttgart, 1929 (and tour) (information from *El Lissitzky in the Proun years*).
149 First published in *ABC*, 1/3–4 (1925), the image was also reproduced in *Modern art at the Sesqui-Centennial Exhibition* [foreword by Katherine S. Dreier, text by Christian Brinton] (New York: Société Anonyme, Museum of Modern Art, 1926) and with Trugott Schalcher's article, 'El Lissitzky, Moskau', in *Gebrauchsgrafik* 5/12 (1928) (information from *El Lissitzky in the Proun years*).
150 See *El Lissitzky in the Proun years*, pp. 331–333, Sophie Lissitzky-Küppers, *El Lissitzky: life, letters, texts* (London: Thames & Hudson, 1968), p. 58.
151 'Typographische Mitteilungen' (1965) trans. in *El Lissitzky: life, letters, texts*, p. 390.

of the image to the politically uncommitted or right-wing avant-gardists as well as to the leftists among them). It would also have been seen against the background of the work for which he had become known since he arrived in Berlin in 1921—the works he called Prouns—and his publishing activities as designer, editor and writer. 'The Constructor' would also have influenced the reception of his Prouns and lent something to the interpretation of the Proun concept Lissitzky put forward in his writings and lectures of the period. In texts such as the introduction to *Veshch*, the short-lived magazine he produced in Berlin in 1922 together with Ilya Ehrenburg (1891–1967), or the piece on Proun he published in *De Stijl* the same year, there is an accent on rational organisation, technology and a notion of architecture as the culmination of the tendencies of modern art. Somewhat retrospectively, Lissitzky famously called Proun the 'interchange station between painting and architecture.'[152]

Before I declare 'The Constructor' a self-portrait of the artist about to change trains, I would like instead to offer the following which, though it might fall short of a new interpretation of this much-discussed image, will, I hope, help me focus on the topic of this essay rather than the attempt to solve the riddle of El Lissitzky.

My question is: what role did geometry have to play in Lissitzky's modernist project, his ambitions, aspirations and strategies? In keeping with the approach I suggested at the beginning of this essay—that it calls for a historical as much as a structural explanation—consideration of the circumstances of Lissitzky's life will be indispensable. However, I am prepared to leave aside the question of the nature of the 'self' supposed to be the author of the self-portrait and of the 'life-work'. In my discussion of 'The Constructor', I want to confine myself to tracing its repertoire of iconographic elements in Lissitzky's other work (there might be one or two things to add there to the prior literature) and commenting on some previous interpretations of the image. This will cover indirectly many of the relevant biographical details and prepare me for an assessment of Lissitzky's semiotic strategies and the use he made of geometry.

**El's Logo**

In the upper left corner of the composition Lissitzky has placed a transparent, negative image (possibly a contact print) of the stationery design he had recently made for himself and had had printed in Switzerland. The original design, printed in red and black, is reminiscent of elements from Lissitzky's Proun works and variants of the motif appear in this context.[153] **(104)** The reversed L-shape also occurs from time to time in Lissitzky's typographic work,

152 El Lissitzky and Hans Arp, *Die Kunstismen = les ismes de l'art = the isms of art* (Erlenbach-Zurich: Rentsch, 1925), p. XI, repeated in 'The Film of El's life' (1926, wrongly dated in *El Lissitzky: life, letters, texts*, p. 329).

153 It is not clear whether comparable Prouns (as, for example, the untitled gouache reproduced in *El Lissitzky: exhibition from 9th April until end of June 1976* (Cologne: Galerie Gmurzynska, 1976), p. 122, dated 1924) came before or after the logo design. A close variant of the logo can be found in Proun 88, dated 1925 according to Nisbet's 'Annotated Transcript of El Lissitzky's Proun Inventory' in *El Lissitzky, 1890-1941: catalogue for an exhibition of selected works from North American collections, the Sprengel Museum Hanover, and the Staatliche Galerie Moritzburg Halle* (Cambridge MA: Harvard University Art Museums/Busch-Reisinger Museum, 1987), p. 174, given the additional title *Geometric Composition* in *El Lissitzky: life, letters, texts*, pl. 32 **(105)**.


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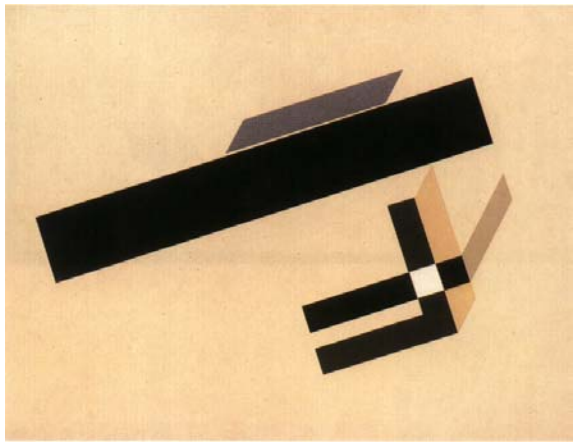

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notably perhaps in the cover design for *Veshch* (1922) **(106)** where it is the main non-alphabetic element, or in the title page of the portfolio of Proun lithographs published by the Kestner Society in Hannover (1923), where bold rules frame the printed text **(107)**.

The arrowhead included in the logo design seems to suggest a progression from 'EL LISSITZKY' to 'el'. The former is itself already a contraction of his given name, Lazar Markovich Lissitzky, which he seems to have adopted around the time he moved to Moscow in 1921.

Lissitzky sent a proof copy of the letterhead design to Sophie Küppers (the woman he later married and who followed him to the Soviet Union) with the message, 'I have just received this proof copy from the printer. The typesetter asked me to say whether he had understood the meaning correctly: Light (the red arrow) breaks through the darkness (the black). What answer should I give?'[154] Nisbet remarks that 'this is one of the very few genuine examples of a (presumably) working-class response to a specific item of so-called "high modernist" design,'[155] and remarks that Lissitzky's response seems to underline some of the difficulties of interpretation in which Nisbet himself is engaged. It is worth noting that the letterhead did not include an address. Lissitzky usually inserted it by hand or in typescript between the red and black horizontal bars.

### XYZ

In the self-portrait, the space where Lissitzky normally inscribed his current address is occupied by the forms of three stencilled letters, XYZ. For these, Lissitzky used the same letter-

**104 El Lissitzky, letterhead, 1924, from a letter to Jan Tschichold, 6 March 1925**

**105 El Lissitzky, *Geometric Composition (Proun 88)*, 1925**

154 Noted in Peter Nisbet, 'A Summary Catalogue of Typographical Work by El Lissitzky' (Typ. Cat., entry 1924/17) in *El Lissitzky … North American collections*, pp. 190–191.
155 *El Lissitzky in the Proun years*, p. 323n.


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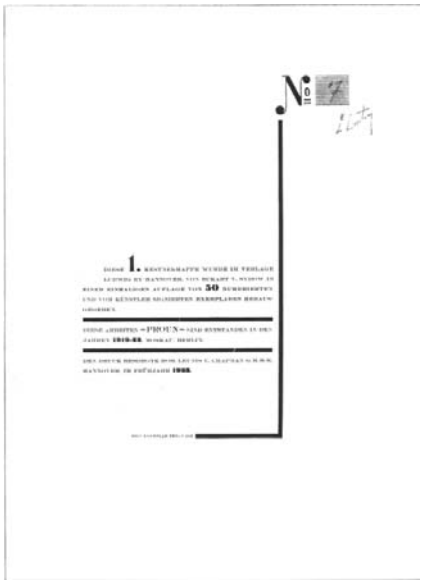

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forms he had employed to spell TINTE on advertisements for Pelikan ink **(108).**[156] Lissitzky seems to have treated this series of advertising designs for ink and carbon paper as experiments in photographic technique without a camera. (None seems to have been produced by the company.) They could also, of course, be regarded as experiments in the integration of photography and typography and as such the advertisements are related to the numerous examples from his typographic work where Lissitzky deployed letter-forms as more or less autonomous figurative elements. It is interesting that although Lissitzky's work as a graphic designer undoubtedly owed a great deal to his work as a 'fine artist', he almost never mixed typographic elements in his Proun works. As exceptions or borderline cases, one could point to the 'workbenches' propaganda board[157] and related works from Lissitzky's Vitebsk period (1919–20) under the tutelage of Malevich and the protection of the Bolshevik party. In a piece like 'Beat the Whites with the Red Wedge,' **(114)** it is difficult so say whether the message is carried more by the graphic elements or by what is spelled out in letters. The poster form, however, locates this work in the typographic category. Another work that might have started out as a project for a poster seems to have achieved Proun status by the suppression of its inscription. This small gouache (c. 1920–21) owes more to Malevich than most of Lissitzky's works, featuring prominently a black square on a red circle and being predominantly 'flat'. The characters 'ROSA LUXEMBURG.' written across the square and circle seem to have been blacked or redded out (as the case may be). An enlarged copy without any trace of inscription (c. 1922–23) is acknowledged as a Proun.[158] Another exceptional piece is *The Machinery* from

**106 El Lissitzky, magazine cover for *Veshch*, Berlin, 1922**

**107 El Lissitzky, Kestner Portfolio, title page, 1923**

156 Typ. Cat. 1924/9, for example.
157 T. J. Clark translates the slogan, 'The workbenches of the depots and factories are waiting for you.' He sets it out in italics with initial capitals as if it were the title of an art work. T. J. Clark, *Farewell to an Idea: episodes from a history of modernism* (New Haven and London: Yale University Press, 1999), p. 229.
158 Van Abbemuseum, Eindhoven, also discussed in *Farewell to an Idea*.


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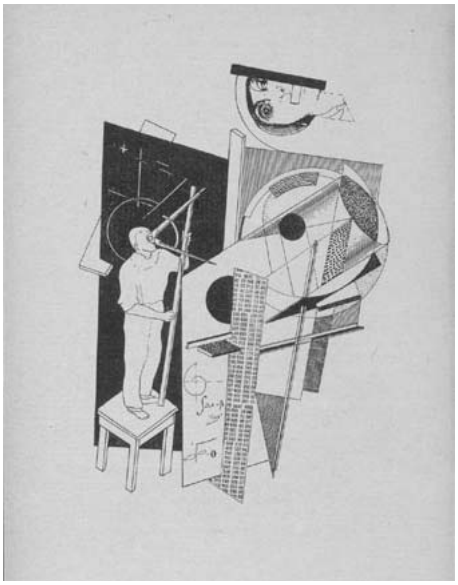
the so-called Puppet Portfolio, a suite of lithographs in which the abstract Proun-forms are mobilised to embody the characters in an 'electro-mechanical' theatrical. This image includes the depiction of a banner written in a mixture of German, French, English, Russian and Italian which can be read, 'All's well that begins well and has no end.' The title *Victory over the Sun* is spread over the page (in Russian) in transparent yellow ink, making this sheet at once a part of the content of the portfolio and a part of its typographic apparatus. In the case of 'The Constructor' self-portrait there is no clear indication whether it was intended as an advertising piece or as an art work (or both).

I mention these examples to suggest how Lissitzky's letter-forms and his abstract 'geometrical' forms could be made to do both figurative and 'structural' work. Unlike the 'geometrical' forms, however, letters could also be used to spell a message, even if it were uttered in a strange mixture of languages or might be subject to a tendency towards integration-to-the-point-of-disappearance. Lissitzky does not seem to have had the taste for random(-looking) bits of text such as appeared in Picasso and Braque's Cubist paintings around 1911 (which the stencilled letters certainly recall to some extent): what one might call the phenomenology of everyday life, which nourished the work of an artist like Schwitters. So, what of XYZ?

Most commentators suggest an allusion, in keeping with the other 'geometrical' references in 'The Constructor', to *x*, *y*, *z*, the co-ordinate axes and their correlates *x*, *y*, *z*, the variables or 'unknowns' in a three-dimensional equation. The reference is perhaps too general for it to be worth citing a 'source' or even a precedent in Lissitzky's output, although one can be found in a passage from a lecture Lissitzky delivered in 1921:

> In the new mathematics of x, y, z there is no definition of the quantity. They are signs of the connection between an infinite number of possible positions within one and the

**108 El Lissitzky, advertisement design for Pelikan ink, photomontage, 1924**



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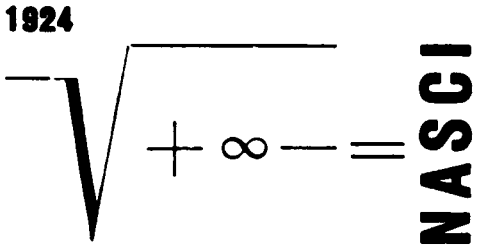


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same character [figure?]; taken as a whole, they equal a number. [...] The principle of number today is dependence, FUNCTION. If x is the function of y, then, vice versa, y is the function of x (the masses and their leader).[159]

Whatever that means,[160] it is worth remembering that Lissitzky took a serious interest in mathematics as well as displaying an affec(ta)tion for mathematical nonsense, for instance: the incomprehensible operations inscribed on his illustration to *Vitrion* from Ehrenburg's *Six Tales about Easy Endings* **(109)**, or the Dada equation for 'Nasci', announced complete with a symbolic formula **(110)**:

In the year 1924 will be found the square root (√) of infinity (∞) which swings between meaningful (+) and meaningless (-); its name: NASCI.[161]

It has also been suggested that XYZ might be an answer to *ABC*, the title of the architectural journal on which Lissitzky was an active collaborator and which was the venue for the first publication of his self-portrait. Nesbit entertains an interpretation based partly on a (possibly perverse) reading of a phrase in Schalcher's 1928 review[162] in which XYZ could

**109 El Lissitzky, Vitrion from *Six Tales with Easy Endings* by Ilya Ehrenburg, Berlin, 1922**

**110 El Lissitzky, formula for 'NASCI', from *Merz*, 1924**

159 El Lissitzky, 'Prouns: Towards the Defeat of Art' (lecture given at Inkhuk, Moscow, 1921),trans. in *El Lissitzky: exhibition ... 1976*, pp. 61–62. Lissitzky's reference to 'Röntgen and X, Y, Z rays' which he says in a 1926 autobiographical text 'have all combined to place in my forehead 20, 2,000, 200,000 very sharp, polished searching eyes,' (*El Lissitzky: life, letters, texts*, p. 329, wrongly dated 1928) has also been mentioned, although the connection with 'The Constructor' is probably be more tenuous.

160 In this passage, as with many of Lissitzky's references to mathematics, one can trace reference to schoolbook definitions, possibly skewed by the historical perspective on mathematics that Lissitzky derived from Oswald Spengler and possibly rendered slightly more obscure in translation from Lissitzky's original German or Russian. However, it is unlikely his explanations would mean very much to a reader not already familiar with concepts.

161 *Merz* 8/9 (1924), trans. in *El Lissitzky: life, letters, texts*, p.351

162 See *El Lissitzky: life, letters, texts*, p.382.


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allude to the 'last things', in accordance with an alleged retrospective mood.

Before moving on with my inventory, I would like to mention a pervasive feature of Lissitzky's typographic work: his fondness for acronyms, initials and acrostic configurations. To glance briefly only at the covers of the two print portfolios he produced in Germany: there one can read, 'First Kestner Portfolio', 'El Lissitzky', 'Proun', but one finds KESTNERMAPPE dwarfed by a giant 1 which takes up about a third of the page, ROUN is engulfed in its initial P, LISSITZKY is subordinated to EL **(111)**; a giant F stands alone on the cover of the Puppet Portfolio for *Figurinen: Die plastische Gestaltung der elektro-mechanischen Schau Sieg über der Sonne*. For Lissitzky, it seems as if naming itself was never less than a nexus of sound, script and form. His own adopted name El is also his adopted monogram EL, or el, and recites his initial L for Lazar or for Lissitzky. The neologistic term Proun is customarily supposed to be an 'acronymic composite' of the Russian phrase 'project for the affirmation of the new' although Lissitzky himself never made this clear. Nisbet suggests, 'the process by which the "Proun" concept was born (as a way of suppressing linguistic signification of a conventional kind) parallels the evolution of the abstract compositions to which the term came to be applied.'[163]

### A Pair of Compasses

The pair of compasses pictured in the self-portrait is presumably Lissitzky's own instrument and so, it could be argued, had left its mark throughout his work after 1919 when Lissitzky adopted an ostensibly geometric idiom. It would thus be almost as ubiquitous indexically in the Prouns as it is symbolically in the history of western art, where it is the traditional attribute of geometry. It appears in the hands of figures epitomising the liberal arts and the paradigms of related trades such as masonry, architecture and cartography so often that it

**111 El Lissitzky, Kestner Portfolio, cover, 1923**

163 *El Lissitzky in the Proun years*, p.37.

would be pointless to try to discover a particular source. It makes more sense, as most commentators have done, to regard Lissitzky's 'Constructor' as an addition to this tradition. Lissitzky's later use of the same photograph of the hand and compasses against the background of graph paper would back up this view. He appears to have exhibited the photograph with the title *Architect's Equipment*[164] and it was also used for the cover of *Architecture: Works from the Faculty of Vkhutemas* (Moscow, 1927) a volume to which Lissitzky contributed only the cover design.[165]

The mention Lissitzky makes of the compasses in his writing also owes something to traditional emblematics in the context of a justification of 'geometric' abstraction. 'Suprematism of world construction' was published in 1920 under the auspices of Unovis (Affirmers of the New Art), the group gathered around Malevich in Vitebsk in which Lissitzky had quickly come to be seen as the leading disciple of the master of the black square. It is an unapologetically avant-gardist text, apparently unconstrained by the exigencies of the political situation in which the Bolsheviks were still fighting to consolidate their power in the aftermath of the October Revolution. Nonetheless, Lissitzky is conscientious about acknowledging the needs of the time but, as with his art-historical references, the emphasis is on going beyond, as it were taking flight from the things of the past, escaping from their gravitational pull. This is the text which ends with the prophetic declaration, 'AFTER THE OLD TESTAMENT THERE CAME THE NEW AFTER THE NEW THE COMMUNIST—AND AFTER THE COMMUNIST THERE FOLLOWS FINALLY THE TESTAMENT OF SUPREMATISM.'[166] Even a short quotation will give an indication of what was at stake for Lissitzky in 1920:

> those of us who have stepped out beyond the confines of the picture take ruler and compasses—following the precept of economy—in our hands. for the frayed point of the paintbrush is at variance with our concept of clarity and if necessary we shall take machines in our hands as well because in expressing our creative ability paintbrush and ruler and compasses and machine are only extensions of the finger which points the way.
>
> this path into the future has nothing in common either with mathematics and scientific studies or with raptures of sunset and moonlight—or indeed with the decline of the subject with its plague-ridden aura of individualism—rather is it the path leading from creative intuition to the increased growth of foodstuffs for which neither paintbrush nor ruler neither compasses nor machine were required.[167]

The image of the compasses in 'The Constructor' could easily be interpreted—in terms of

164 See *El Lissitzky: beyond the abstract cabinet* ed. by Margarita Typitsyn (New Haven and London: Yale University Press 1999), p. 27.
165 Over the photograph, Lissitzky arranged the words VKhUTEMAS and ARKhITEKTURA (twice) about an enlarged X (Kh) like *x*, *y*, *z* axes.
166 *El Lissitzky: life, letters, texts* , p. 334. According to Nisbet, the title I have cited here is a more accurate translation than the one given in *El Lissitzky: life, letters, texts* (*El Lissitzky in the Proun years*, p. 76n).
167 *El Lissitzky: life, letters, texts* , p. 333 (no capital letters in the original).

extensions of the finger which points the way—as a literal illustration of this passage, although the forked instrument would seem to introduce a note of ambivalence or equivocation that is not so obvious in the earlier text.

Lissitzky's intervention in the debate about 'construction versus composition' which exercised the Moscow scene in the early 1920s also put forward the compasses as an emblem. Paraphrasing Spengler (although implicitly altering his values) Lissitzky wrote, 'The compasses are the chisel of construction, the brush is the tool of composition.'[168] The task of construction is, of course, far-reaching, but the compasses put the tools (emblematically) in the hand of the artist-constructor.

There are two more instances in Lissitzky's oeuvre where the compasses make a figurative appearance. The first is in the illustration to Ehrenburg's *Vitrion* which I mentioned already **(109)**. Here a pair of compasses appears to protrude from a man's head. The interpretation of this image has been distorted by the title it has acquired, *Tatlin at Work*,[169] on account of the fact that the drawing of the man is derived from a photograph of Vladimir Tatlin (1885–1953) in his studio (the same photograph which Lissitzky later reproduced in *Die Kunstismen* under 'Konstructivismus'). Matthew Drutt claims, 'Lissitzky had linked the compass with the artist's creative consciousness in his collage with Tatlin [...] working on the *Monument to the Third International*.'[170] The placing of the compasses in the eye could certainly recall Alberti's dictum about the eye which measures 'as with a pair of compasses' (see above, page 108) as well as the saying attributed to Michelangelo in which he is supposed to favour the 'compasses in the eye' instead of geometric constructions. So what kind of consciousness might be meant is not very clear. In any case, Lissitzky did not identify with Tatlin, from whom he seems to have maintained a respectful, but critical distance as his chief potential rival in the Soviet Union.

Nisbet has shown how Lissitzky's illustration closely follows aspects of Ehrenburg's story, whose protagonist is indeed characterised as 'an artistic constructor'. It is the tale of the creator, and eventually destroyer, of a kind of mechanical Golem which was supposed to be a walking 'monument to the new era' but ended up as a circus act. As well as mention of the 'jaw of compass' that would seize, measure and reconstruct existence, the text contains enough references satirically implicating Tatlin to justify Lissitzky's use of the Tatlin figure, but clearly this is no homage.

The collaboration between Lissitzky and Ehrenburg was undoubtedly a sympathetic one. They had in many ways similar backgrounds and had got to know one another while in Kiev during the civil war. One of Lissitzky's last works was a suite of illustrations for Ehrenburg's *The Fall of Paris* (1940). The writer and the artist were from the same generation of intellectuals from middle-class Jewish families from the Pale of Settlement whose coming of age was marked by the Revolution. Both men had spent time in western Europe in the

168 'Prouns: Towards the Defeat of Art', p. 69.
169 Apparently since the 1960s, see *El Lissitzky in the Proun years*, p. 223n.
170 *El Lissitzky: beyond the abstract cabinet*, p. 21.

years before the First World War and maintained their contacts there during the Soviet period in more or less official capacities. Both returned to the Soviet Union and, though neither was a party member, served prominently as propagandists for Stalin. Both displayed a knack for survival and managed to live through the purges that led to the disappearance of many of their contemporaries, friends and colleagues. For Ehrenburg, it might have been his close friendship with his former schoolmate Nicolai Bukharin (1888–1938) that helped prevent his record as an SR sympathiser and opponent of the Bolsheviks during the civil war—or indeed as a bohemian poet in Paris and freelance émigré intellectual in Berlin—from coming under too close scrutiny from the Soviet authorities although, clearly, there came a time when this would not have been an advantage. He would then have had to rely on his own talents for adaptation, adjustment and persuasion. These must have been prodigious in view of the fact that the prolific journalist, poet, novelist, satirist and propagandist lived his life on the record and moreover had to contend with the fact that he was, so to speak, a constitutional heretic.

Ehrenburg's writing of the period of *Six Tales* is, to say the least, ambivalent towards the Soviet Union and the style characterised by merciless satire verging on the grotesque and irony verging on sarcasm. The 'happy endings' of the *Six Tales* usually involve sudden death. His *Extraordinary Adventures of Julio Jurenita and His Disciples* (1921) was praised, by no less than Bukharin, for its even-handedness in exposing the comic and repulsive sides to life under all regimes. The émigré, the revolutionary, the conspirator, the spy, the swindler and the suicide are all recurring themes in Ehrenburg's novels.

In view of the dearth of biographical information about Lissitzky and a life's work seemingly dominated by formal principles (be they of Jewish folk art, abstract painting or socialist realism), it is tempting to let Ehrenburg fill in some of the details. Although he might not necessarily be a reliable witness, it could also be argued that Ehrenburg never wrote a word of fiction.

To return to Lissitzky's meeting with Ehrenburg's *Six Tales*, the occasion seems to have encouraged the illustrator to adopt a far from pure means of expression. The 'maquettes' on which the printed designs were based included drawing—both figurative and 'geometric'—as well as collage of photographic and printed matter. Alongside fragments from newspapers and advertisements, Lissitzky included quotations from his own work which suggest a note of self-irony. The 'constructor' figure in the *Vitrion* illustration is surrounded by a Proun-like environment of interlocking slabs, planes and discs only partially intelligible spatially. In another picture, a page from *About Two Squares*, Lissitzky's Suprematist fairy tale 'in six constructions' (1920, published Berlin 1922), is invaded by a crude, child-like drawing (of a house and a man looking like a priest) and seems to have spawned three black circles. I will come back to another of these illustrations in connection with the hand.

The second instance where the compasses turn up that I had in mind above is in another photo-montage self-portrait done around the same time as the so-called 'Constructor' **(112)**.

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Here, the opening of the compasses—or rather, the shadow of the compasses, as they appear to be imprinted as a photogram—frames the artist's face. The head and neck are wrapped in white cloth. Other superimposed elements have been identified as a page from Lissitzky's edition of Vladimir Mayakovsky's (1893–1930) poems, *For the Voice* (Berlin, 1923) and an illustration used in Lissitzky's article 'A. and Pangeometry' (1924, published, Berlin 1925).

Nisbet suggests this self-portrait was done prior to 'The Constructor' and, as a preface to his interpretation of 'The Constructor', he offers a convincing biographical reading of the image, based largely on literary references mediated by the 'quotation' from the book of Mayakovsky's poems. The reading is intended somewhat as an exercise to show that in this apparently private (or rejected?) study (it was never duplicated or published in Lissitzky's lifetime) Lissitzky displays a conventional artistic subjectivity, that the meaning of his work is accessible to normal iconographic investigation, and furthermore that Lissitzky is capable of a subtle and affecting complicity with this mode of reception in this 'meditative, almost tragic' self-portrait.[171]

Nisbet's point, when he turns to 'The Constructor' is that by comparison, the latter is 'significantly less anecdotal, less narrative, less definably political than the attempt at self-portraiture that preceded it.' He sees 'a move from decipherable reference to vaguer allusiveness' which he suggests parallels the shift away from identifiable architectural motifs in the Prouns.[172] In my context, the question will be what role geometry played in this alleged shift, for Lissitzky could have argued his meaning was becoming more general, more immediate, more direct.

**112 El Lissitzky, *Self-portrait*, photomontage, 1924**

171 *El Lissitzky in the Proun years*, p. 316.
172 *El Lissitzky in the Proun years*, p. 318.

**The Open Hand**

This item is more difficult to isolate from Lissitzky's montage than most of the others. We have seen how it is entwined with the compasses and how the original photograph of the hand holding the instrument against a background of graph paper was re-used. In the self-portrait, the hand is superimposed on the face so an eye shines from the middle of the palm while the wrist disappears into the shadow on the other side of the face. The hand and eye could remind one of the traditional symbol common to many cultures (known in Hebrew as *Hamesh* or Hand of Miriam, in Arabic as *Hamsa* or Hand of Fatima), used as a symbol of God or good luck charm. Several commentators on Lissitzky note that the eye and hand, this time wielding a sword, not a pair of compasses, appear for God slaying the Angel of Death in Lissitzky's illustration of the culminating lines of the Passover song *Khad Gadya* (Kiev, 1919). This is a work which dates from towards the end of Lissitzky's period of engagement and preoccupation with illustrated books on Jewish themes, associated with the 'renaissance' of Jewish and Yiddish-language culture in Russia following the Revolution (which had released Russian Jews from official oppression). Although the new government encouraged the revival of Jewish culture, along with that of other national minorities in an effort to win them over, the post-Revolutionary regime did not end popular anti-semitic violence. Jews in the former Pale of Settlement suffered pogroms unleashed by both sides during the civil war.

It was in part Lissitzky's reputation as an illustrator of Jewish books that led to the invitation from Marc Chagall (1887–1985) to join the faculty of the art school in their hometown Vitebsk, where the latter had recently been appointed head. As well as the commitment to Jewish themes, Chagall's and Lissitzky's works of the period shared a post-Cubist figurative style and Chagall no doubt expected he would find an ally in his former school-mate. As it turned out, Chagall was disappointed. While Lissitzky might have welcomed the opportunity to escape the difficult, potentially dangerous conditions in the city of Kiev, he seems not to have shown an interest in pursuing the 'Jewish renaissance' in Vitebsk, even before his 'conversion' to abstract art was confirmed with the arrival of Malevich. Instead, through the teaching method he proposed to adopt and what he later called Proun, Lissitzky took the opportunity to renew (at least theoretically) the commitment to architecture which he had been forced to abandon owing to the circumstances of the war years.

> May the overthrow of the old world [of art] be imprinted on the palms of your hands.

This was 'the dictum promulgated tirelessly by Malevich in his Vitebsk days'[173] and adopted by Lissitzky at the head of his script for the lecture entitled 'Prouns (towards the defeat of art)' delivered in Moscow in 1921. The prophetic tone of this injunction is typical of Malevich and is not alien to Lissitzky's writing and speeches. I am going to look at some other details of this 'Prouns' text below. For now I want to think about the imprint, so to speak, of

173 *El Lissitzky in the Proun years*, p. 321.


**113**

its motto on another of the illustrations to *Six Tales* **(113)**.

The story *Schifs-karta* is set amid the pogroms of the civil war and concerns the hazy life and mysterious death of a pious Jewish watchmaker. He lives with his granddaughter, as his wife and daughter were killed and his son emigrated to America. It seems the protagonist cannot really tell the difference between the promise of a 'schifs-karta'—a ticket for a ship's passage to America—and redemption or catastrophe. The most striking feature of Lissitzky's illustration is a palm-print with the Hebrew letters *Pe Nun*. The composition is arranged in two interpenetrating triangles, making a skewed star of David. In the lower part are collage fragments relating to traditional Judaism, in the upper part, pieces relating to the ports (Hamburg, New York) and lines which carried many thousands of Jews fleeing persecution since the latter part of the nineteenth century. Lissitzky's father too had made this journey but, apparently on the advice of the local rabbi in Smolensk, returned to rejoin his family. An autobiographical sketch (1932) hints at this episode under the heading 'Ancestors'.

> Reaction against the Czarist regime drove my father, an official in the Smolensk government, to America and from there back to the approved settlement area.[174]

In the earlier text (1926) on which this was partly based, Lissitzky had, on the strength of this episode—a round trip to the New World–styled himself cryptically the descendant of Columbus and inheritor of 'great discoveries.'[175]

*Pe Nun* is a traditional inscription on Jewish gravestones, being the initial letters of the Hebrew phrase for 'here lies buried'. In the context of the *Schifs-karta* illustration, the passing

**113 El Lissitzky, design for 'Schifs Karta' from *Six Tales with Easy Endings* by Ilya Ehrenburg, Berlin, 1922**

174 *El Lissitzky: life, letters, texts*, p. 330.
175 *El Lissitzky: life, letters, texts*, p. 329.

of the 'old world' could hardly be more clearly signalled (provided one understands the meaning of the Hebrew letters), or at least we can see here a distinct echo of the motto of the 'Prouns' speech where Lissitzky apparently omitted the phrase 'of art' from Malevich's original formulation.

Alan Birnholz mentions *Pe Nun* in his discussion of possible Hebrew etymologies for Proun and might also have adduced this version of the inscription in the palm of the hand to support his thesis. Birnholz's speculations follow in a tradition of Jewish exegesis that makes use of various kinds of mystical puns, anagrams and acronyms in order to reveal the hidden meaning of sacred texts. These methods are predicated on the attribution of extraordinary symbolic and creative powers to the letters of the Hebrew alphabet. It is not that such notions are all that esoteric, as they were handed down in conventional form through the common practice of Judaism and the popular use of amulets and the like. It is likely that Lissitzky was familiar with such things, he was certainly accomplished in Hebrew calligraphy (which has its own traditions of significance attributed not only to the letters but to individual strokes in the letter-forms) and I have already remarked on his fascination with various typographic games with letters. But that does not necessarily privilege a decoding of Lissitzky's work in terms of Jewish ideas. Birnholz surely takes his approach beyond plausibility when he claims 'the *overriding* impression one gets looking at a Proun' is of the more or less obscure aspects of Jewish theology he discusses in his article.[176] The fact is, for most viewers, a Proun is unlikely to give any such impression and it is even questionable whether it would make any single overriding impression. Nonetheless, we will have to consider the forms of encoding that may be operating in Lissitzky's work.

**Graph Paper**

The graph paper pattern against which Lissitzky has posed his hand and which extends across half his face and completes the background of the 'The Constructor' to the right of his head is almost unique in his work. Except in his typography, where a grid is implicit, Lissitzky was not in the habit of using graph paper as a design aid or, in general, of submitting his drawing to a grid. Though there is of course a connection with the world of mathematics or engineering, the strength of the associations the graph paper evokes in this context perhaps owes more to the way the device was used by some of Lissitzky's contemporaries than to any particular practice outside the realm of art. It is noteworthy that in a poster design of 1925 which is laid out on a sheet of graph paper (Lissitzky Mondrian Man Ray Moskau Paris New York) no part of the design conforms with the grid. It therefore seems to function autonomously as a formal pattern and as an iconographic element.[177]

176 Alan C. Birnholz 'El Lissitzky and the Jewish Tradition' in *Studio International* 186/959 (1973), p. 133. My emphasis.
177 Typ. Cat. 1925/7.


**114**

### The Circle

The arc of a circle drawn on the self-portrait (the real trace of the pictured compasses) is possibly the most troubling item in Lissitzky's montage. Beyond the suggestion that a hand has raised the instrument above the photograph to inscribe the picture surface, thus beginning a narrative of sorts, the circle seems to set up a series of semiotic and metaphysical snares. For a start, it is hard not to generalise. Although the circuit is not complete, it is usually accepted as a circle,[178] and hence generically as *the* circle, standing for any and every circle as well as for the symbolic attributes traditionally ascribed to the figure. Codified in the Platonic tradition, the circle stands for the sphere and, along with its three-dimensional counterpart, is understood to symbolise the totality and unity of the universe as well as to carry innumerable connotations of perfection, heaven, eternity, divinity, origin and so on. These ideas represent something of a semiotic abyss, compounding the difficulty of ascribing any specific meaning to the circle in the self-portrait. The difficulty already arises in part from the ubiquity of circles in Lissitzky's work and in part from the generality of the form as the mechanical trace of a drawing instrument. Moreover, the circle does not seem to have acquired the same kind of connotations particular to modern art as, for example, the square or the grid. In Lissitzky's work, a circle occasionally suggests 'planet' or 'head' where there is already a discernible narrative or figurative subtext as, for example in the story-book *About Two Squares* or the Puppet Portfolio *Victory Over the Sun*. More often, the iconographic role of the circle seems merely to be to advertise itself as a 'geometric' element. I'm going to discuss briefly some remarks on the circle from Lissitzky's writings, although it would probably not be wise to regard them as definitive (especially as they are taken somewhat out of context).

**114 El Lissitzky, 'Beat the Whites with the Red Wedge', lithograph, 1919**

178 The interruption does not 'make sense', in the way, for example, the interruption of the white circle penetrated by the red wedge made sense **(114)**.

In his lecture on new Russian art first delivered in Berlin in 1922 Lissitzky made the case for 'geometric' abstraction with Suprematism as its exemplar:

> It is essential that [the form] be unequivocal. The form which is unequivocal, and that means immediately recognisable to everyone, is the geometric form. No one is going to confuse a square with a circle, or a circle with a triangle.[179]

When such forms are distributed on a flat surface, a relationship obtains between the individual parts. 'This relationship had to be organised,' he says, and:

> The result was not a personal affair concerning one individual artist, the intention was to create a system of universal validity. To be effective, this system had to formulate for itself its own individual interpretation of space.

Thus the idiosyncratic, Suprematist space—the white plane, 'infinity' as Lissitzky would have it—would be the matrix within which the repertoire of 'geometric' shapes could become a system of differences and hence articulate meaning. He seems to be hinting at the creation of both a geometry *and* a language or script. Much of Lissitzky's elaboration on the concept of space and of the sign is obscure, but he is keen to assert that 'Every flat surface is designed as a sign—not a mystical symbol, but a concrete sketch of reality.'[180]

There seems here to be a wariness of the pitfalls supposedly 'universal' symbols could put in the path of articulation—problems which Lissitzky's semiotic theory, if we can call it thus, could be seen as an attempt to overcome. He took up this theme again in 1924 in an article for *ABC*, the architectural magazine, entitled 'Element and Invention'. There the circle makes an appearance in the guise of one of three 'plastic elements'. Cube and cone both get 'explanations' that relate in some way to drawing and projection but the sphere is qualified only as 'the crystallisation of the universe.'[181] The task of 'invention' is devising the most logical combination of elements to perform the function assigned to the design. The model Lissitzky invokes, suggestively—and with more than a hint at the metaphors of flight which animated Suprematist rhetoric—is aerodynamic engineering. Without explanation, he adds, 'Invention is the universal force, the biomechanical force, which impels everything forward, overcoming all obstacles, along the path of progress.'[182]

Lissitzky's ambivalence towards the sphere/circle, the way in which it is at once the foundation of and threat to his aspirations, is expressed more clearly in a letter written around the same time to the former De Stijl architect, Oud. We can trace here the way in which Lissitzky's thought veers between the symbolic and the structural, based sometimes on modern, some-

179 *El Lissitzky: life, letters, texts*, p. 338.
180 *El Lissitzky: life, letters, texts*, p. 338.
181 *El Lissitzky: life, letters, texts*, p. 349.
182 *El Lissitzky: life, letters, texts*, p. 350.

times on ancient ideas and reconciled by a belief (hard not to call mystical) in a creative force. He writes, taking issue with '"square" mondrianism' and the formula put forward by van Doesburg:

> The 'Universal' = Straight Line + Vertical, does not correspond with the universe, where there are only curvatures and no straight lines [an assertion possibly dependent on Lissitzky's understanding of Einstein's Theory of Relativity]. Hence the sphere (not the cube) is the crystal of the universe [just as, of course, the crystal sphere was the model of the Ptolemaic universe], but we cannot do anything with it (the sphere) since that is the final state (death); that is why we concentrate on elements of the cube, which can always be reassembled and destroyed at will (life). A modern machine must have something spherical, since the circular motion is its *advantage*, compared with the straight-line and to-and-fro motion of the human hand/foot [how does this compare with the circular motion which was *necessary* for celestial mechanics on a purely doctrinal basis?]. And if [...] our house, is an apparatus for accommodating our body (like clothing) [a reply perhaps to Le Corbusier's 'machine for living'] why should it not incorporate the spherical [like a modern machine?]
>
> But all this is likely to become academic scholasticism, unless we can prove it by creative life, by the work we create.[183]

Reading Lissitzky, one could get the feeling he had more to fear from the equivocation in his thought bringing it to a standstill, than he would from a fixed dogma—the same equivocation which, I would argue, had until then sustained and mobilised his practice.

**The Face of El Lissitzky**

The self and its avatars do not figure prominently in Lissitzky's work, especially not by comparison, for example, with an obsessive self-portraitist such as Picasso who, when he did not represent his own likeness, populated his paintings with his alter-egos, or even by comparison with van Doesburg who, despite his proclamations of the universal and the collective, insisted on his personality as the fount of creativity and whose early work seems to have taken Rembrandt's self-portraiture as a model.[184] One could perhaps say little more of Lissitzky than that he did not find it quite so easy to abjure the genre 'self-portrait' as he did the standard painting types 'still life', 'nude', 'landscape', which are not present in his work at all. In this respect, Lissitzky had the advantage of a lack of academic art training.

However, one could add to the other photo-montage self-portrait I mentioned only a few other images of this type. These include some sketches in private letters where Lissitzky caricatured himself for Sophie and/or her children and a strange collage in which he cut himself

183 *El Lissitzky ...1976*, p.73.
184 In a dispute that arose with Oud, van Doesburg protested, 'I am Theo van Doesburg,' even though this was his pseudonym.

out along with two now-disembodied hats from a group portrait taken at the 1922 Dada reunion in Weimar and affixed the printed label, 'EL LISSITZKY, PROUN B 111 1922',[185] suggesting, perhaps self-ironically, that it is 'El Lissitzky' which is the project. (But even if Lissitzky's face in this montage wears a smirk, this is still not Marcel Duchamp with his tongue in his cheek.)

As for literary self-portraits, I have already mentioned the autobiographical sketch entitled 'The Film of El's Life' and its variant (in connection with his father's aborted emigration), to which could be added one or two more or less bland resumés. However, the notion of a literary self-portrait is suggestive and could be extended, in so far as these may be understood as forms of self-presentation, to cover any of Lissitzky's manifesto pieces. It is perhaps clearer from the texts than from his graphic work how his self-presentations are adapted to a variety of different contexts; how the self is veiled by means of texts delivered in Russian, German or Yiddish as the case may be. Again, I do not propose to unmask the 'real' or the 'essential' El Lissitzky, but to examine the technique of the veil.

If we accept the title his self-portrait acquired, then Lissitzky's writings might offer some suggestions about who 'The Constructor' might be. There is a hint that the constructor is not a person but a creature. In 'Suprematism of World Construction' Lissitzky writes (it must be admitted, in accordance with the somewhat overblown style of the piece—this is the article which culminates in the hubristic claim for the 'testament' of Suprematism—but also in justification of his own position as an art school teacher):

> The first forges of *the creator of* the omniscient omnipotent omnific constructor of the new world must be the workshops of our art schools.

He continues, in a formulation which underlines his conception of the task of the constructor as structural, both in the way we would understand it from geometry *and* in the way we would understand it from linguistics. Lissitzky's own peculiar stamp on the idea is the notion of meaning, as it were, projected into the future.

> When the artist leaves them [the workshops], he will set to work as a master-builder and as a teacher of the new alphabet and as a promoter of a world which indeed already exists in man but which man has not yet been able to perceive.[186]

A little later, in the Moscow speech, the constructor is the ex-painter, the one who has escaped from aesthetic prejudices (in which, Lissitzky makes out here, Malevich should be implicated). He is the assassin of painting, not its saviour, reborn from the corpse of painting:

185 *El Lissitzky: beyond the abstract cabinet*, pl. 6, p. 72, also reproduced as an isolated photo-excerpt in *El Lissitzky: life, letters, texts*, p. 31 and in *El Lissitzky …1976*, p. 105, dated 1922 (on the strength of the label alone?).
186 *El Lissitzky: life, letters, texts*, p. 334. My emphasis.

> If some people thought of saving the painting by 'pure', 'abstract', or 'non-objective' painting, well this merely sounded its death knell. But it was at this juncture that the artist began to undergo a reincarnation into the constructor of a new world of forms, of a new world of objects.[187]

In the version of Proun, published in *De Stijl* in 1922, 'Not World Vision, BUT—World Reality', Lissitzky toned down the attack on painting, but only slightly. The process of renewal (for this occasion, in deference to his editor, on the road to Neo-plasticism) would still rise from the 'ground fertilised by the dead bodies of pictures and their painters.' The *De Stijl* article seems to put more stress on subjectivity where earlier the emphasis had been on a kind of mathematical-biological-historical inevitability of the destruction of old and the dawn of the new. Lissitzky says:

> The path of Proun does not run through the narrow maze of scattered individual scientific systems. These are all centralised by the constructor in the knowledge gained from his experiences.[188]

Nonetheless, this centralising subject seems to relinquish its autonomy to the enigmatic Proun. What the constructor loses in the eclipse of self, he is supposed to gain in objectivity. From our perspective, it is questionable whether this is really possible except in representations such as Lissitzky's self-portrait, which lean heavily on traditional notions of artistic subjectivity even if they intend to confound them.

It is not clear whether 'The Constructor' of 1924 should be read as an attempt by Lissitzky to restore a more conventional subjectivity or whether, as Nisbet suggests, it 'summarises the new image of the creator as a supra-subjective constructor of life.'[189] What we might call the normal reading of the image does not hesitate to affirm the former—basically regarding the self-portrait as a masterpiece—despite the fact, as we have seen, that it is not certain whether the piece was intended as an advertisement, a fiction or, indeed, a joke.

Lissitzky's reference to his self-portrait in a letter to Sophie as a 'great piece of nonsense'[190] and his epithet for it, 'my monkey hand',[191] contrast sharply with the characterisation in an influential review published in 1928. In this assessment, the self-portrait 'bears out' the impression the author gained from all of Lissitzky's work (in 1928 therefore including Lissitzky's designs for Soviet trade exhibitions) that it 'reveals an intellect and a conscious will rather than instinct and inspiration.' It goes on, 'The hand which seems to start from the

187 'Prouns: Towards the Defeat of Art', p. 63.
188 *El Lissitzky: life, letters, texts*, p. 347. The earlier Russian text had 'The path of Proun does not rely on any particular narrow scientific discipline—the artist-constructor accommodates them all within his experience.' ('Prouns: Towards the Defeat of Art', p. 67)
189 *El Lissitzky in the Proun years*, p. 320.
190 *El Lissitzky: life, letters, texts*, p. 56. The German, 'Ein kolossaler Blödismus' might be translated, 'a colossal nonsensism'.
191 See Paul Galvez 'Self-portrait of the artist as a monkey-hand (Lissitzky's "Self Portrait of the Artist as Constructor")' in *October* 93 (2000), p. 109.


**115**

brain between the eye and brow, belongs, like the head, to an intellectual type [...] such is the character of this self-portrait; cool consideration, mathematic speculation, combined with geometrical mysticism.'[192]

This is the version of 'The Constructor' which became, in the words of a recent commentator, 'the symbol of the art of the 1920s, signifying the pursuit of creativity through a combination of modern technology and human intellect.'[193] In a sense, the dissenting readings of the image have also conformed with the norm in so far as they presuppose the idea of the self-portrait as the staging of an individual artistic subjectivity. Taking their interpretations beyond the conventional parameters of modernism (rationality, geometry, technology, utopianism), some commentators have been able to see quite specific references in the generalised (if not clichéd) attributes with which Lissitzky equipped his self-portrait. For one writer, these amount to a self-portrait of the artist as God,[194] for another, a self-portrait of the artist as Christ crucified.[195] To be sure, these conclusions are reached more by free association of ideas than by critical exegesis, but it must be admitted—and this is the point for the present discussion—that the image itself does not put up much resistance, for example, to reading the circle as a halo, or the eye in the palm as standing for the stigmata. Each of these readings seems to regard the image as coherent and on this basis proposes a decipherment of the supposedly intentional meaning.

A possibly more sophisticated approach retains the notion of a normal artistic subjectivity, and indeed its pathos, while suggesting the self-portrait is intended to stage a dilemma (with reference to biographical data) or dialectic (with reference to theory). Parallels have

**115 Albrecht Dürer, *Melencolia I*, engraving, 1514**

192 Traugott Schlacher, 'El Lissitzky, Moskau' in *Gebrauchsgrafik* 5/12 (1928), trans. in *El Lissitzky: life, letters, texts*, p. 382.
193 Matthew Drutt in *El Lissitzky: beyond the abstract cabinet*, p. 22.
194 W. Hofmann, 'Sur un auto-portrait de El Lissitzky' in *Gazette des Beaux-Arts* 107/1404 (1986).
195 'El Lissitzky and the Jewish Tradition'.

been drawn with Dürer's image *Melencolia I* (1514) **(115)** which hybridised the *Typus Acediae,* associated with the melancholic and the sin of sloth, with the *Typus Geometriae*, found among the traditional paradigms of the liberal arts. One can find some of the same objects in both Dürer's and Lissitzky's pictures. Much has also been made of the mood of brooding introspection the photograph seems to express but I think the alleged correspondence between them owes at least as much to Panofsky and Saxl's interpretation of Dürer's engraving (which incidentally was first published in 1923). The classic study in iconology reads the dejected and torpid figure of Geometria as a self-portrait of the artist and allegory of the conflict between reason and (divine) inspiration. Nisbet remarks that 'Lissitzky's self-portrait can be read as an extraordinarily faithful modernisation' of *Melencolia I*, but the meaning he attributes to Dürer really comes from Panofsky. Likewise, Paul Galvez's argument that 'The Constructor' is Lissitzky's 'great counteroffensive against reason'[196] closely parallels Panofsky's psychologising and somewhat romantic conclusions about *Melencolia I*. Galvez's notion of 'a perpetual battle between reason and anti-reason'[197] or the 'conundrum' he thinks is posed in the self-portrait, namely 'how to rescue art from its own instrumentalisation,'[198] like Panofsky's version of Dürer, perhaps overemphasises the pathos of genius in the effort to reconcile the ambiguities which seem to emerge from the work.

For Nisbet, ultimately, it is the 'very fluidity of the ['Constructor'] image's meaning'[199] which is disclosed by the multitude of roles which it could plausibly play in different contexts, that is, the multitude of ways it could be instrumentalised by Lissitzky and others. The geometrical references which dominate 'The Constructor' cut both ways. They permit, in the eye of the beholder, on the one hand the symbolism of 'geometrical mysticism' and the associated idealism which, as we have seen, was an important strand of post-Cubist art theory. On the other hand they permit the symbolism of the technological 'Realpolitik' initiated by Mongean pedagogy. The grounds for Lissitzky's deployment of such references is the ideological entanglement of both tendencies which prevailed in the 1920s.

Lissitzky seems to have addressed both sides of the debate and in his ideological statements prepared the reception of his work by sympathisers of either tendency. The point he insists on in his writing is not a commitment to one side or the other but a kind of historicism that points beyond, to a future at once indefinite and somehow just around the corner. Thus his theory encompassed what the history of mathematics, science and technology had to offer him as so many signs. Following Spengler, he took them up as historical indices.[200] In

196 'Self-portrait of the artist', p. 120.
197 'Self-portrait of the artist', p. 137.
198 'Self-portrait of the artist', p. 128. This is a theme of the 1921 Moscow speech, where Lissitzky proposed the Proun concept partly as a means of justifying his activity as a painter when his colleagues were on the verge of abandoning all forms of 'fine art' in favour of a 'production art' whose justification was precisely its total instrumentalisation. But it will be remembered that the subtitle of the piece was 'Towards the Defeat of Art'. After 1924, Lissitzky seems to have embraced instrumentalisation in practice as well as in theory and was thwarted in achieving it according to his own ambitions only by the frustration of his architectural projects.
199 *El Lissitzky in the Proun years*, p. 336.
200 Nisbet in *El Lissitzky in the Proun years* and Bois in 'From - ∞ to 0 to + ∞ Axonometry, or Lissitzky's mathematical paradigm' discuss Lissitzky's use of Spengler's historicist assessment of number systems down the ages.

his digression on the history of mathematics and the representation of space which he presented in the Moscow speech and reworked in 1924 in the article 'A. and Pangeometry', he perhaps allowed the details of number systems, perspective and non-Euclidean geometry (which were undoubtedly designed to strike various chords in his readers) to overshadow his conviction that 'art creates BEYOND NUMBERS, because it creates a living thing,'[201] —that it is subject to, and driven on by natural forces. As he put it in 'A. and Pangeometry', 'Parallels between A[rt] and mathematics must be drawn very carefully, for any overlap is fatal for A[rt].'[202]

Yet this is an assertion which his graphic works on their own are incapable of making. Lissitzky therefore needed to provide his works with a semiotic theory, or at least ambition, if they were not to remain mired in ambiguity, or if their ambiguity were somehow to be redeemed. I think we will also find here a clue as to why Lissitzky remained committed as long as he did to an ostensibly geometric idiom, even though it seems—and not just on our criteria—so deeply compromised.

The Moscow speech of 1921 announced the concept of Proun to INKhUK (Institute of Artistic Culture), a kind of art-theoretical think-tank set up by IZO Narkompros (Fine Art Section of the People's Commissariat for Enlightenment) in 1920 under Wassily Kandinsky (1866–1944). By 1921, however, the formalistic research initiated by Kandinsky was in the process of being ousted by the more politically engaged Constructivists who advocated giving up fine art altogether in favour of devoting artistic talents to the tasks of industrialisation, propaganda and the service of the proletariat. The big debate of the day, composition versus construction, therefore had clear political overtones. There appears to have been some mutual tension or suspicion between the Constructivists in Moscow and the Unovis group centred around Malevich in Vitebsk, of which Lissitzky was perceived as a delegate. The circumstances in which Lissitzky was 'summoned' to Moscow in 1921 are not very clear and as we know, he was in Berlin before the end of the year.[203] That might make the circumstances of the INKhUK lecture seem even less auspicious than they might have done to Lissitzky at the time, but in any case his task in the lecture would have been a delicate one.

Proun appears as Lissitzky's means of putting an appropriate spin on his activity as a painter, of expressing some loyalty to Unovis while putting certain distance between himself and Malevich's Suprematism. The neologistic term is a tabula rasa, ready to be defined. Actually, Lissitzky lends the term concreteness only by identifying it with his works, which exist. Beyond that, one might call Lissitzky's game strategically vague. The emphasis he puts on Proun as a 'project' moreover saps the concreteness of the works and hints at an unprecedented regime—semiotically, epistemologically and technologically.

The text is an astonishing web of non-sequiturs, mathematical, biological and some-

201 'Prouns: Towards the Defeat of Art', p. 61.
202 *El Lissitzky: life, letters, texts*, p. 352.
203 *El Lissitzky: life, letters, texts*, p. 22. Lissitzky also lectured at Vkhutemas, was involved in the publishing division of the Comintern and took part in exhibitions.

times brutal metaphors. Only the more extreme apocalyptic formulae, it seems, were omitted when he covered the same thematic ground for a western audience.[204]

We read that the Suprematist black square, which he elsewhere referred to as a (revolutionary) banner or pennant, brought painting to a zero from which something (else) would emerge 'on the other side.'[205] The Suprematist canvas 'bore within it a kind of symbol', but 'for all its revolutionary force, [...] remained in the form of a picture.'[206] In contrast, under the sign of Proun, 'In continuing to paint with brush on canvas, we have seen that we are now building and that the picture is burning up. We have seen that the surface of the canvas has ceased to be a picture. It has become a construction and, like a house, you have to walk around it, to look at it from above, to study it from beneath.'[207] Lissitzky also contrasts two kinds of symbol: the first coming into being when 'Its meaning can be stipulated beforehand, by agreement.' The example he gives is a graphic symbol on a map.

> The second derivation is when a symbol is born, when it acquires its name later and when its meaning is revealed later still. That is why the symbols created by the artist are incomprehensible to us[208]

... provided, that is, mankind has not reached the right stage of evolution. Proun, we are given to understand, is just such a symbol that has just got its name and lies in wait for its meaning. Towards the conclusion of his speech, Lissitzky returns to the theme of anticipation. Even if the moment was one of 'intermission' ('Life was accelerating so much over the last few years that we believed that by tomorrow our Proun would become a concrete design'),[209] it should be one of readiness.

The syllables pro-un come into play then as the justification and the destiny of the works so called, although the meaning of the word is constantly deferred. He wrote for *ABC* (most probably in the same period as 'The Constructor', published in 1925):

> I cannot define absolutely what 'Proun' is, for this work is not yet finished. [...] When life is fulfilled and it lies down gently in the grave of the history of art, only then will this idea be defined.[210]

He refers the reader back to the works, which of course remain as enigmatic as ever. In a way, Lissitzky is prepared to bet on his Prouns, but, like Big Jule's dice in *Guys and Dolls*, which

204 These, incidentally, being the texts on the strength of which he got his reputation as a rationalist.
205 'Prouns: Towards the Defeat of Art', p. 64.
206 'Prouns: Towards the Defeat of Art', p. 65.
207 'Prouns: Towards the Defeat of Art', p. 66. This discussion is accompanied with obscure mathematical and spatial analogies which contrast the old system with the new.
208 'Prouns: Towards the Defeat of Art', p. 65.
209 He ends with a prophetic flourish: 'It is not for us to see how the new world will be built. It will be built not with our knowledge or our technology. It will be built with a direct and accurate force, a kind of lunatic force from which all will retreat in shame.' ('Prouns: Towards the Defeat of Art', p. 71)
210 *El Lissitzky: life, letters, texts*, p. 358.

have no spots on them, something has been erased. It is this erasure which seals the alliance of the works with the Proun-concept. The empty sign-vehicle /Proun/ gets an object which defies denotative interpretation but is replete with connotations. (Big Jule's dice are real not imaginary.) The works get a general concept which deflects interrogation from the object and mobilises the discourse which supplies and supports its connotations.

We have touched on how geometry operates semiotically, both in the erasure of sense—the emptying out of the sign-vehicle—and its reinvestment with various connotations, not to say portents. What seems to matter to Lissitzky is not the content of the work but its pregnancy. So to say might be partly accurate, and the paradox is seductive in so far as it gives the impression of accounting for some of the problems of interpretation which emerge from Lissitzky's work. But it only does that because it draws the logic of Proun into a circle, joining the *consequences* of Lissitzky's engagement with geometrical drawing to a transfigured goal.

Lissitzky himself makes no secret of this circularity: that for him, the naming of Proun at once discloses and bestows its aim.[211] On 'the question of expediency,' he elaborates, 'we define an aim as something which is already behind us. Creativity produces a fact and this becomes the aim.' He adds the remark (with another reference to Columbus), 'it happens sometimes that people take the path to India, but discover America.'[212]

It is reasonable then to ask: What trace can we discover of Lissitzky's motives in taking up the geometrical style that he later identified as Proun? Why should Lissitzky have chosen to abandon the figurative art that sustained his career until then in favour of geometric abstraction? What did geometry hold for Lissitzky in 1919 and why was it *expedient*? Indeed, Why should *this* have been expedient when the turmoil and hardship of the civil war period might have prompted a multitude of compromises?

Several memoirs (not just Ehrenburg's) are testimony to the milieu in which one could plausibly place Lissitzky in the aftermath of the Revolution. The social and political upheavals of the period brought artists and intellectuals into a proximity with political operators and the state apparatus (revolutionaries, terrorists, officials and agents of the secret police) unimaginable in the west.[213] For some, their relationships with the élite of the day might have protected them from the threat of starvation which much of the population faced but did not spare them from the violence and shifting political grounds of the civil war. Ehrenburg wrote about his time in Kiev, 'No one knew who would be arrested tomorrow, whose portrait was best to hang on the wall and whose to hide, which currency to accept and which to try and pass on to some simpleton. Life, however went on. [...] Sometimes there would be firing in the morning, but downcast patients would already be sitting in the waiting room [at the doctor's house where Ehrenburg was staying at the time]. They invariably looked away from each other, and some tried to hide their faces behind newspapers. The

211 'Prouns: Towards the Defeat of Art', p. 67.
212 'Prouns: Towards the Defeat of Art', p. 69–70.
213 This is why the insults hurled by van Doesburg against Tatlin fail to hit the mark.

names of the newspapers changed and what they said was quite different from what they had said the day before, but this did not worry the patients.'[214]

It probably does not make much difference to this description that the doctor for whom the patients were waiting was a specialist in venereal diseases. In many ways this period of instability and temporary alliances engendered an atmosphere of suspicion and insecurity which paved the way for the terror which was instated only after the consolidation of power by the Soviets. Lissitzky's involvement with the Jewish organisations which supported his activity as an illustrator of Yiddish folk tales would not have isolated him from the shifts of power between the warring parties or within the Bolshevik party itself. In any case, he seems also to have had some official connection with Narkompros which was a temporary haven for many artists and writers.

Amid the anti-semitic violence he would have witnessed in Kiev, it is likely that Lissitzky saw the writing on the wall for the so-called 'Jewish renaissance' before he went to Vitebsk to take up his post as head of the workshop for graphic arts, printing and architecture (as Nisbet remarks, 'an unlikely combination that seems tailored to suit his interests').[215] and went there with the intention of turning over a new leaf. I have already mentioned how Lissitzky might have welcomed the opportunity of reviving his interest in architecture, despite there being no prospect of building. Lissitzky seems to have been a sympathetic, if not very active, supporter of the Revolution, but there is no reason to suppose that abstract art should have been perceived as of greater service to the Revolution than the figurative style encouraged by Chagall, which in many ways could be considered closer to the people. A programmatic statement written shortly after his arrival in Vitebsk acknowledges the need for a new system of art education fit for Communism. Lissitzky puts the emphasis on books for mass-circulation, which, he says, the contemporary artist should make his 'monument of the future'. To this end, contemporary art education should be based on the 'fundamental principles of architecture [that is,] the art of bringing order, expediency and rhythm to chaos.'[216] It is difficult to assess in what measure it was the aesthetic impact of Malevich's paintings, the fervour of his writings, the force of his personality or his role in school politics that most encouraged Lissitzky's temporary identification with Suprematism.

Why should abstract art, in particular abstract art with geometric overtones, have appealed to Lissitzky under conditions that forced many of his contemporaries—some of whom had better revolutionary credentials and had shown more avant-garde promise than Lissitzky—into silence, emigration, exile or government service?

The fact is, I cannot answer this question, but I would like to suggest in more detail how the geometric aspect of the path Lissitzky took enables a particular kind of semiotic expediency.

214 Ilya Ehrenburg, *Men, Years—Life, Volume I: First Years of Revolution 1918–21*, trans. by Anna Bostock with Yvonne Kapp (London: MacGibbon & Kee, 1962), p. 80.
215 *El Lissitzky ... North American collections*, p. 17.
216 Trans. in *El Lissitzky in the Proun years*, p. 49.

It is not clear how closely Lissitzky followed the post-Cubist debates after he left Germany at the beginning of the First World War, or indeed how much interest he took in painting while a student.[217] Nonetheless, we can imagine that the theory of the avant-garde that developed in Russia offered a set of legitimations that were readily adapted to the post-revolutionary situation. Malevich produced this effect with alarming facility. The politics of the avant-garde was in any case highly elastic and just as easily found its accommodation with right-wing aspirations, not to mention straight-forward capitalism. (The riskier proposition was anticipating the aesthetic doctrine of the regime.) The avant-garde, moreover, offered a legitimation of geometry, and of itself by means of geometry, that went beyond—in some ways simply exaggerated—the justifications contained in the engineering textbooks and drawing manuals that were the backbone of Lissitzky's own education. The basic notion of geometry as fundamental and universal suggested grounds upon which all could agree, upon which it would be impossible to hold a political dispute. Furthermore, the agreement was witness to the laws of nature, human reason and/or divine providence, whichever one preferred. Geometry signalled the radicalisation of art itself understood as something fundamental, eternal and true; with the invocation of non-Euclidean geometries, a revolutionisation of art; as well as an alignment with the forces of modernity. Drawing with ruler and compasses sufficed to signal geometry.

Abstract art seemed to be the destiny and goal of such aspirations. The process of geometrisation (reduction, generalisation, essentialism) was also an iconoclastic process, taking up hammers against the art of the past, but with the advantage of not putting painters out of work, owing to the rich symbolic legacy of geometry within the practice and institutions of art. Thus the black square found its niche as the icon of iconoclasm, the supposed zero from which a new symbolic order would be built.

The attempt at a detailed critique of an art which makes a point of striving to eliminate specific contents always risks losing its grip on its subject matter. The kind of detective-work I tried on 'The Constructor' is bound to yield no more than a constellation of probabilities (and that is why it probably seemed half-hearted). What I want to say now can only be stated theoretically, although it also suggests *why* it would be difficult to attribute conclusively.

We have seen, both in the context of mathematics and of art, how geometry functions as a kind of semiotic acid, corroding, breaking down, dissolving particulars. Meaning is reduced to 'elements'[218] and ultimately to undefined terms. This is the process I hinted at above in terms of erasure and the emptying out of the sign-vehicle. Geometry nonetheless holds out the promise of articulation. In the present context, several semantic or epistemological traditions flow together, namely: the idea of *deduction* by means of which geometry constructs from its primitive elements ever more complex truths (that is, propositions which, provided they are free from contradiction, are regarded as necessarily true); the idea

217 Lissitzky himself destroyed much of the evidence that might have thrown light on this.
218 My inverted commas signal a wariness of mixing mathematical and chemical metaphors. It is worth noting in passing that the analogy of chemical composition also appealed to Lissitzky.

of *natural philosophy* in which geometry is understood as the code by means of which the scientist deciphers nature and discovers its laws, and from which is also derived the theological corollary that geometry is the code and its supposedly primary forms the alphabet in which nature is written; to which may be added the *symbolic traditions* in which such primary forms are identified with principles or substances. These flow together in the hands of the artist because geometry and its traditions provide a manageable complement of recognisable forms which on their own do not necessarily mean anything at all, but which are replete with possibilities. (Malevich claimed to have set up 'the semaphores of Suprematism.'[219])

The way meanings or systems of meaning seem to spring from the suppression of figurative signs and the traditional gestures of painting images suggests how the apparent destruction of meaning (that is, the literal destruction of appearance) may also be a form of encoding. Perhaps more precisely, a form of encryption, because the 'message' is hidden. What is hidden is thus preserved in a kind of burial, as if in anticipation of a resurrection or a finder who succeeds in unlocking the code. The object is placed under the sign of its essence. Intention is placed under the mask of ambiguity. The face of this mask has the air of certainty associated with geometry since the Greeks found the expedient which spared them the embarrassment of irrational quantities. The mask is infinitely adaptive in that, without altering its form, it may stand for any persona or be made to play any part that circumstances dictate. Clearly, that offers an advantage if the artist expects to have to respond to potentially hostile challenges.

Geometry closes the circle encompassing the dissimulation of intention and the intention of assimilation, producing a perfect seal for the encrypted matter. The drawback is that for all its resemblance to other forms of encoding (such as informed the traditions I mentioned just now), whatever is put under this seal is irretrievable. It is as if the content is consumed in the forging of a sign-vehicle, which, though empty, is itself the trace of encryption.

In Lissitzky's case, it could be interesting to reflect on the habitual translations and transliterations (between Yiddish, Russian and German; between Hebrew, Cyrillic and Roman) which, in a way, constituted his education and which we have seen left their mark on the construction of Lissitzky's identity (his name). Letter forms, we have also seen, were the source of abundant play in his typographic work. It would not be surprising if the notion of geometry as somehow both an esoteric and a universal script had a particular appeal for Lissitzky. It was, as it were, the material from which he forged himself the passport on which he travelled from Vitebsk to Moscow, from Moscow to Berlin and the west, and finally back again.

All this has been said without really looking at the Prouns and my analysis does not hold out the prospect of much to be gained by doing so. Apart from *About Two Squares*, which has all the signs of playing out an allegorical tale in the language of Proun and has invited numerous interpretations, all equally inconclusive, Lissitzky's works from the period

219 'Non-Objective Art and Suprematism' (1919), trans. in *Art in Theory: an anthology of changing ideas* ed. by Charles Harrison and Paul Wood (Oxford: Blackwell, 2nd ed. 2003), pp. 292–293.

1919–24 have by and large successfully resisted interpretation. The Proun-theory has been much repeated (usually without critical appraisal), but Lissitzky does not discuss any details of what we might call the phenomenology of Proun. This is a topic that came into vogue in the 1970s with the revival of interest in Lissitzky's work in the wake of a new wave of geometric abstraction, especially in the United States. The discourse is indebted in part to the formalistic approach to abstract painting and in part to Albersian teaching (which I shall discuss in more detail in the next section). Its aim is to explain (and justify) how a Proun works as an aesthetic experience. It makes a point of underlining Lissitzky's deployment of the kind of subjective ambiguity we touched on earlier in connection with 'geometrical illusions', the various kinds of perceptual confusion that can be evoked by relatively simple 'geometric' figures. It is a curious and under-examined fact that Lissitzky never drew attention to these phenomena. On the contrary, he put the emphasis on what was allegedly clear, exact and unequivocal. The phenomenologists of Proun are also at odds with Lissitzky in so far as their remarks on the spatial ambiguity or indeterminacy of the designs depend on looking at Prouns as pictures, implicitly reasserting the perspective paradigm which Lissitzky (perhaps unconvincingly) was always at pains to deny.

Lissitzky's statements about space and the representation of space have succeeded in tangling his late critics in metaphysics or in attempts to reconcile observations on his puzzling Prouns with the references to infinity, imaginary numbers, space-time, the 'fourth dimension' and so on in his writings. For example, in Henderson's estimation 'it is probable that Lissitzky thought of the indefinite space of his Prouns as analogous to Einstein's curved space-time continuum,' although she continues immediately: 'In a Proun, on the contrary [that is, by comparison with the flat, white 'infinity' of Malevich's canvas] it is the complex interrelationships among Lissitzky's dynamic forms that define space.' Suggesting the Proun-forms *define* something that is already assumed to be both *in*definite *and* analogous to a scientific theory perhaps hints at the kind of visual paradoxes Prouns can pose. However, Henderson's claim that, 'Often, impossible overlappings and intersections, as well as the tendency of forms to fluctuate back and forth, suggest that only a higher dimensional space could encompass such contradictions,'[220] is more seriously misleading. This attempt to derive an interpretation from perceptual ambiguity itself seems to borrow from the logic of Zöllner's explanations of the strange phenomena demonstrated (of course fraudulently) by the spiritualists of the nineteenth century by asserting the real existence of the 'fourth dimension'.[221] There is nothing to suggest Lissitzky thought this way or that his work would have been received like this by his contemporaries. My earlier analysis I think showed that we cannot expect the drawing itself, however bizarre, to make such a suggestion either.

It might be worth asking what kind of an illusionist was Lissitzky. After all, the apparent spatial anomalies in Lissitzky's theatre of coloured diagrams, quasi-architectural forms,

220 *The Fourth Dimension and Non-Euclidean Geometry in Modern Art*, p. 294–95.
221 See above p. 135n. See Johann Carl Friedrich Zöllner, *Transcendental Physics: an account of experimental investigations from the scientific treatises*, trans. by Charles Carleton (London: W. H. Harrison, 1880).

jostling and interpenetrating planes and curves are not accidental. But the problem of squaring them with Lissitzky's often just as colourful, puzzling and prestidigitatory writings can make the attempts seem trite or arbitrary. My view tends towards regarding Lissitzky as an escape artist. But we have been taught to take modern art more seriously than that.

Bois hangs his attempt on the idea of 'axonometry'. For Bois, axonometry is a catch-all term which lumps together most of what I was at pains to distinguish (and in so doing probably inflicted some pain on the reader) in my discussion since Monge, through Farish, Haüy and Necker. Bois aims to establish it as a 'symbolic form' by analogy with Panofsky's 'Perspective as ...' and thus carries over some of the metaphysical discourse associated with perspective. Axonometry, he says, aims to resolve the contradiction of infinity 'common to all theories of perspective.'[222] Bois suggests that axonometry 'abolishes perspective' and renders infinity 'thinkable by placing the centre of geometric projection into infinity.' You will recall that the notion of a centre of projection at infinity first appeared as a means of reconciling perspective and orthography, but that would not be so clear if you based your interpretation, as Bois seems to do, on Lissitzky's explanation of Suprematist space in 'A. and Pangeometry', the text Bois regards as the 'official "birth certificate" of axonometry.'[223] Nonetheless, Bois follows the nineteenth-century school-books in insisting on conceptualising axonometry as primary geometry and suppressing consideration of secondary geometrical constructions and the pragmatic contexts of drawing. The Prouns seem to vindicate this concept in so far as they present us in fact with secondary geometrical constructions divorced from any pragmatic context, but in the guise of primary geometry. Thus Bois is able to attribute the spatial ambiguities which can occur when a drawing lacks sufficient contextual pointers—the ambiguities which are, of course, a prominent feature of the Prouns—directly to axonometry. He notes, 'The protension/retension or plus/minus effect of axonometry is intensified in almost all of the Prouns,' and remarks in a footnote, 'Josef Albers's *Structural Constellations*—a kind of abstract version of the famous duck-rabbit figure—are the mechanical exploitations of this seesaw property inherent in axonometry.'[224]

Having convinced himself or having allowed Lissitzky to convince him that what he calls 'radical reversibility' (in other words, the Necker cube effect) is somehow essential to axonometry understood as a paradigm, Bois can speak of the 'magic of axonometry's fundamental ambiguity.' The magic, I think, comes from the investment of a subjective ambiguity with the (implicitly objective) indexicality associated with primary geometry, that is, projection. This is the magic which enables Bois to pull the rabbit out of the hat for his own time, as it had enabled Lissitzky before him. Bois's version is adjusted to a milder political climate

222 'Metamorphosis of Axonometry', p. 46. The contradiction exists, he says, because, 'the vanishing point is taken to represent infinity. Infinity, however, cannot be represented—God alone is infinity.'

223 'Metamorphosis of Axonometry', p. 42. In fact, 'A. and Pangeometry' does not mention axonometry or Proun. The reference to infinity in relation to Malevich's flat, frontal painting is certainly idiosyncratic but could also be traced to the traditional text-book justification of orthography.

224 Yve-Alain Bois 'El Lissitzky: radical reversibility' in *Art in America* 76/4 (1988), p. 172. This slightly disparaging assessment of Albers belies the admiration Bois expressed in writing to Albers in 1974, when he was researching an article on 'the square in modern art' (Archives of the Josef and Anni Albers Foundation).

and an intellectual milieu more tolerant of ambiguity and more accustomed to formalistic allegories.

> Lissitzky considered his Prouns documents because they were, for him, blueprints for action, charts for a strategy to be adopted in order to transform society. This may appear to contradict the theory that the Prouns intensify perceptive ambiguity, but I do not think this is the case: they must be considered as abstract models of radical freedom and, as such their task on the ideological and theoretical levels is to fight against dogmatism and catharsis; on the pictorial level, this task becomes the deconstruction of perceptive illusions.[225]

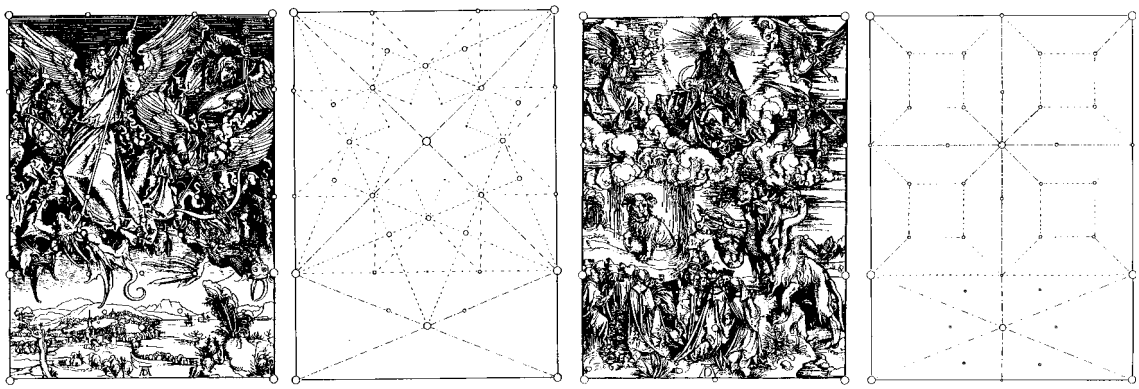
We will see in the next section what this opinion (if not Bois's method) owes to Albers, but more importantly, what Albers has to offer on the topic of this essay.

**10**

'Perceptive ambiguity' was not an issue in Lissitzky's Proun theory nor, for that matter, any of the avant-garde theories of the 1920s. Indeed, at the time, in justifying the new art, the emphasis was on what was unequivocal, universal and essential. I have shown that the meaning of Proun is not recoverable from the works, but not because they are difficult to interpret spatially. As Lissitzky would have it, their meaning would be revealed spontaneously at some time in the future when the world is ready to realise their aspirations. However, until then, the works remain irretrievably cryptic. The fact is, there is no key for reading the Prouns *as Prouns*. But this does not stop the Proun concept being understood as a statement of hope and the works being accepted correspondingly *as if* they were the expression of this hope. Perceptual ambiguity is *only* a phenomenon of looking at Prouns as pictures, an approach which is to some extent perverse. Perverse, that is, if one takes the Proun theory at its word (as Bois does): at least as perverse as reading cosmic secrets from mathematical diagrams or indeed reading geometric diagrams from works of art **(116, 117)**.[226]

Attempts at interpreting Prouns recoil into generalisations. The tendency is to interpret or revise Lissitzky's Proun theory if not simply to repeat it. More specific studies have attempted to reconcile the various schemata suggested by the works (geometry, architecture, allegory, puppetry) according to a notion of development within the Proun work taken as a whole or within a wider art historical narrative. It is not perverse of Clark as a historian to base his Lissitzky essay in *Farewell to an Idea* on a documentary photograph (a Proun work adapted by Lissitzky as propaganda billboard standing in a street around 1919) rather than

225 'El Lissitzky: radical reversibility', p. 175.
226 See, for example, Ernst Mössel, *Vom Geheimnis der Form und der Urform des Seins* (Stuttgart and Berlin: Deutsche Verlags-Anstalt, 1938). Modern works have not escaped this kind of treatment. See, for example, John Milner, *Kazimir Malevich and the Art of Geometry* (New Haven and London: Yale University Press, 1996).



**116** **117**

to approach it as pure abstract art. The tactic, which Clark also uses on Picasso and Braque, is one way of avoiding the traps set by supposedly geometric art.

In my discussion of the reception of Cubism, I have documented the tendency towards generalisation which was given a particular impetus by the rhetoric of geometry. The discourse on a genre (such as Proun made itself out to be) or on any -ism runs away from the concrete works which constitute it as a set of facts. The discourse elaborates concepts meant to subsume its objects, not to explain, interpret or explicate them. The autonomy of the discourse tends to render invisible the objects which mobilised it in the first place.

In so far as the term *Structural Constellation* appears (like Proun) as a generic or collective title (enough to base a monograph on), Albers's works are also vulnerable to disappearing under their concept. The catalogue I have compiled (**Appendix F**) attests to the power of the concept to organise a set of facts, although the concept *Structural Constellation* is perhaps only defined by assembling the catalogue. At the same time, in the context of this study, the catalogue acts as a counterweight to theory in so far as it makes the works visible. Nonetheless, the enumeration of works clearly does not amount to an interpretation of *Structural Constellations*.

In contrast with Proun and the various -isms I have touched on already, there is no *a priori* or quasi-*a priori* concept of *Structural Constellation*. It is simply the name Albers gave to works he produced from around 1950, about the same time he began the series he called *Homage to the Square* which he continued until the end of his life. It appears that Albers did not work intensely on *Structural Constellations* after 1960, although he continued to draw on his repertoire of designs for editioned and commissioned works through the 1970s **(118)**.

**116 Ernst Mössel's interpretation of Albrecht Dürer's woodcut *St Michael Fighting the Dragon* (Apocalypse, c. 1497) from *Vom Geheimnis der Form und der Urform des Seins*, Stuttgart, 1938**

**117 Ernst Mössel's interpretation of Albrecht Dürer's woodcut *The Beast with Two Horns like a Lamb* (Apocalypse, c. 1497) from *Vom Geheimnis der Form und der Urform des Seins*, Stuttgart, 1938**


**118**

The emergence of these two strands of work, on the one hand the *Structural Constellations*, or as he might have called them, linear constructions,[227] and on the other hand, the *Homages to the Square*, or as he might have called them, colour constellations,[228] suggest a radical separation of graphic work (drawing) from colour work (painting). Albers's best known theoretical work connects the latter with a third strand of Albers's work which was important throughout his career, that is, teaching. *Interaction of Color* (1963), is emphatically not *a priori*. As Albers wrote, it is 'a record of an experimental way of studying color and of teaching color.'

> This book, therefore, does not follow an academic conception
> of 'theory and practice.'
> It reverses this order and places practice before theory,
> which, after all, is the conclusion of practice.[229]

Albers's circumspection, not to say suspicion, regarding art theory of both the academic and avant-gardist sorts makes him an unusually laconic and precise writer. Albers's statements on drawing are sparse.[230] In view of the way in which Albers weighed his words, I expect that the term *Structural Constellations* was not devised or applied blithely. In discussing some ideas in connection with *Structural Constellations*, I shall refer to comments by Albers on a variety of topics. I shall also discuss the reception of *Structural Constellations*, but to begin

**118 Josef Albers, *Two Supraportas (Structural Constellations)*, stainless steel, Westfälisches Landesmuseum für Kunst und Kultur, 1972**

227 *Embossed Linear Construction* was the title of a group of editioned graphics of *Structural Constellation* designs which Albers produced in 1969 (Structural Constellations Catalogue nos. [hereafter SC] 623–630).
228 'Colors appear connected predominately in space. Therefore, as constellations they can be seen in any direction and at any speed. And as they remain, we can return to them repeatedly and in many ways.' Josef Albers *Interaction of Color (revised pocket edition)* (New Haven and London: Yale University Press, 1975), p. 39.
229 *Interaction of Color*, p. 1. Line breaks in the original.
230 Albers's statements are few, but he repeated them often.

**119**

with, it is probably appropriate to deal with Albers's practice.

This drawing from the archive of the Josef and Anni Albers Foundation (SC 1257) **(119)** is not chosen as a typical or classic example of *Structural Constellations*. In fact, it is very unusual and although it is almost invisible, it offers a point of entry to Albers's working methods. An apparently abandoned work, it consists of a sheet of high-quality drawing paper with an array of prick marks and a few faint pencil lines.

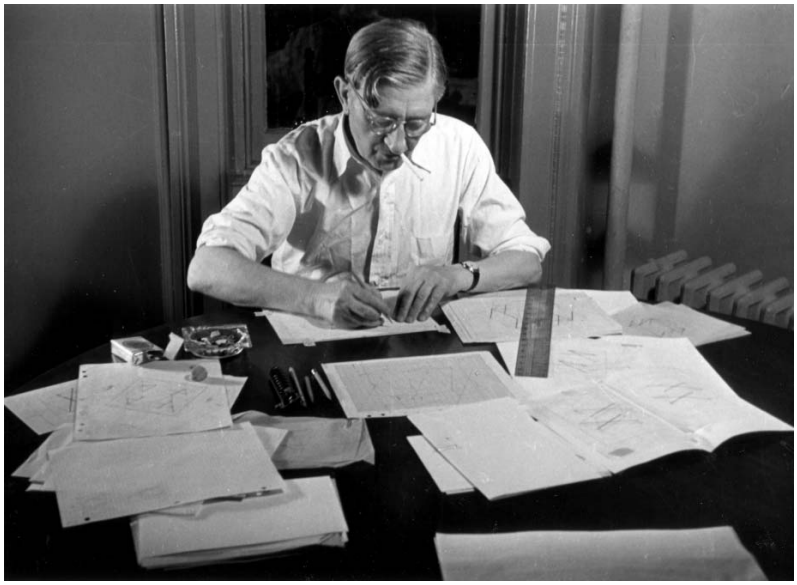
Superficially, the points marked on the sheet and the implication that they should be connected by lines seems to suggest constellation by joining-the-dots. However, a comparison with that style of constellation as we found it on star maps (Part II, p. 69) would not justify a direct analogy. In this drawing, the emphasis seems to fall on points only because there is almost nothing else on the page. In only a few other exceptional cases do drawings connected with *Structural Constellations* show this emphasis. In *Structural Constellations*, points are not given like stars. Nor are the connections between them given by the criteria claimed by celestial cartographers. As I will show, the lines are constrained differently and the points are implicated by the lines.

What is interesting about this sheet is that it discloses a work in the process of translation. I have not identified preliminary or finished works directly related to SC 1257, although this could be possible. Other drawings I have examined suggest where it might be located in Albers's process of production.

*Structural Constellations* it seems originate in Albers's notebooks. His preference was for loose-leaf pocket notebooks with squared paper. The designs sketched in the notebooks, frequently while travelling,[231] were adapted and developed at home for various purposes. For

**119 Josef Albers, drawing, not dated**

231 In one of his notebooks Albers recorded the following: [*80-, i.e., the price written in the book] 'means eighty pesos for this book bought in Satiago de Chile for the constructions which I developed there and in Peru (Summer 1953) (most of those up to page 40) [Albers numbered the pages later] worked on then, changed revised, added new ones on my boat trip to and from Germany Nov 53 Jan 54. Continued [cont.]



**120**

this, Albers used loose sheets of squared paper and, for bigger pieces, graph paper. The grid which constrained the design was employed as the vehicle for transferring and enlarging the drawings. These sheets were the site of modifications, refinements and variations carried out on the sheet itself and (more often with the smaller studies) using tracing paper. Working drawings like these extended the autonomous design process begun in the notebooks. They were also the means by which Albers adapted *Structural Constellations* for specific products. These products included finished ink drawings on squared or graph paper as well as finished drawings on plain paper for presentation and reproduction. In cases like this Albers's work remained within the traditional orbit of drawing, that is of the autograph, even if for Albers the precise formulation of a graphic statement meant repressing the repertoire of marks and gestures which animated his exploratory studies. It might be fairer to say, *translating* the repertoire of marks and gestures into a highly articulated graphic language of reduced means **(120)**.

Albers did not use a drawing table equipped with parallel motion devices such as architects used to use to carry the grid over the drawing surface. Therefore, when tracing was not appropriate, for instance when Albers wanted to transfer the image to heavy drawing paper, his expedient was to prick through the graph paper, marking the endpoints of the lines which he would then inscribe with pen and ruler. The pricked-through drawings also have cut-outs to help register the destination substrate accurately. SC 1257 shows the result of the process in which the grid was suppressed visually, before the design was reclaimed by the pen. Albers's manner may have resembled mechanical drawing, but his technique in fact required little more than a straight edge.

**120 Josef Albers working on *Transformations of a Scheme*, New Haven, 1950**

231 [continued] this on my trip to the Middle West (St Johns) + Minneapolis) March + April '53. [/] This written on the trains from Minneapolis to Chicago and Hiawatha along the Mississippi. [/] Chile [/] Peru [/] Florida [/] N[ew]-H[aven] [/] Germany [/] Middle West [/ ditto marks /] West [/] Hawaii' (SC 766).

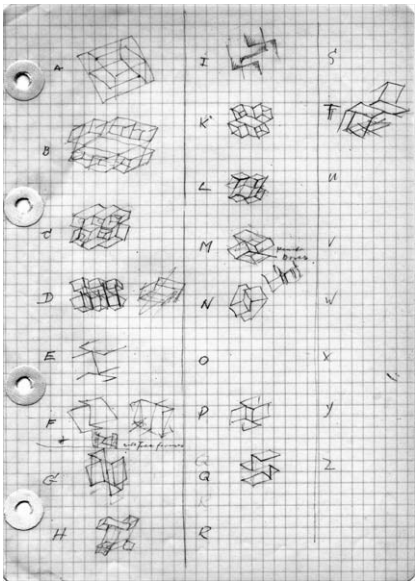
The pricking-through technique was also used in the process of preparing and transferring designs to other media such as the engraved panels and editioned works Albers had made. In cases like this, the function of the drawings was different because here Albers was not only instructing himself, but had to specify the work for a specialist manufacturer. The machine-engraved vinylite panels appear to have been made by a local sign-maker using the same laminated material as is normally used for name plates and the like (the engraving reveals a white layer underneath the black surface). Intaglio prints and lithographs were produced in collaboration with specialists in artists' editions. The drawings Albers produced for these purposes show a range of graphic notations and annotations. Often they bear the marks of how they were used and signs of the communication between the artist and manufacturer. In a sense, the finished drawings in ink that Albers made were rehearsals for these products which took *Structural Constellations* beyond the traditional orbit of drawing. Several ink drawings on good paper are modified, corrected or annotated in connection with these works. It also appears that among the ink drawings which Albers made specifically for reproduction (in books, catalogues and photographic slides) are some that were intended to be presented in negative. That is, so an image captioned in the book as a picture of an engraved vinylite panel was actually a reproduction of one of these drawings. In other words: Albers faked the copy by substituting the original manufactured object for an autograph drawing.

In preparing *Structural Constellations* for architectural-scale installations, Albers needed to provide specifications for other trades. The drawings for these projects show that Albers went to considerable trouble to find the right solutions to articulate his work in materials such as marble, granite, stainless steel and aluminium. That is, specifying the thickness of the material relative to the size of the work, how the corners should be shaped or joined, how lines should meet or bend and so on. This kind of attention, not to say obsession with the 'mechanics' of the work is no less present, although perhaps not so obvious, in the drawings and engravings where it is masked by an apparent facility.

*Structural Constellations* returned to Albers's notebooks as patterns. Albers compiled albums like pattern-books where he archived his repertoire of *Structural Constellations* and recorded which ones had been executed as engravings, labels he had given them and to whom he had presented finished works.[232] In this context Albers used alphabetical dividers to separate each family of designs. Albers's index shows a little picture of an example of each family (SC 665) **(121)**.

I have mentioned how Albers used a grid to constrain his design and to mediate its translation from one situation to another. The points Albers pricked through on a drawing such as SC 1257 are the points where the grid and Albers's intervention coincide. Thus, while the points allow the grid of lines to be erased from the work, they also remain (paradoxically) an expression of the grid specific to a particular *Structural Constellation*. This is possible because

232 Two looseleaf ring binders: SC 664–713 and SC 714–765. Other notebooks of exploratory drawings also received annotations connecting them with finished works.



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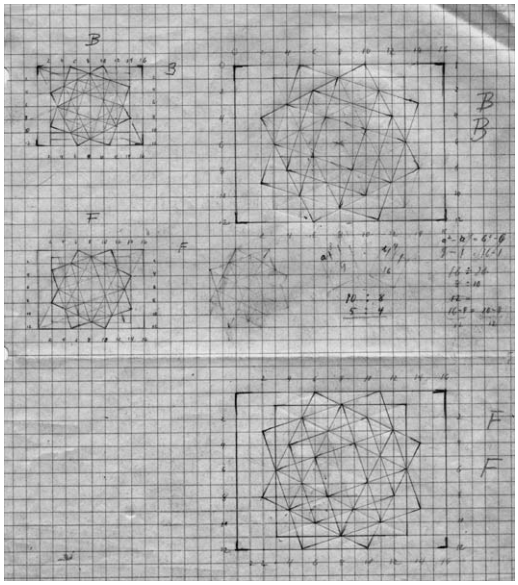


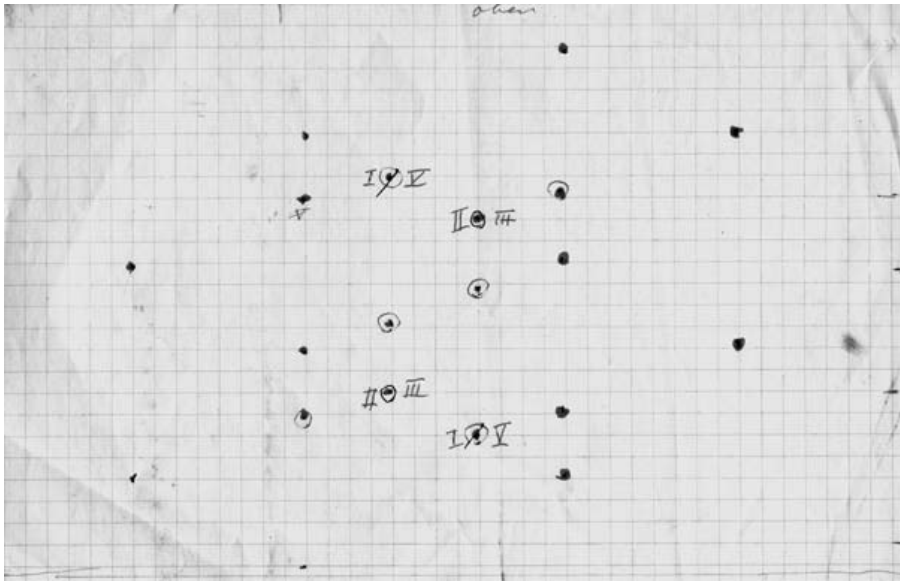
122

Albers's use of the grid is fundamentally different from that which I investigated earlier in relation to mapping and the artists' technique of 'squaring up' such as it was adapted in Alberti's veil. There, the inscription of a grid of lines established the identity of two surfaces as continua. The grid as indexical designator was the sign which guaranteed the iconicity of the graph. While the continuity of the surface was asserted, under the grid, the image was divided into discontinuous bits which could be carried away and reassembled. In the case of star maps, the grid designated a continuous matrix within which discrete objects could be inscribed. Reversing this practice, firstly Albers approaches the grid offered to him by the pages of his notebook as a ready-made. In other words, as something artificial, to be sure, but not an imaginary structure carried over into another reality. Secondly, Albers approaches the grid not as the sign of a continuum, but as a regular array of discrete points (the intersections of the lines ruled on the page). More Pythagorean than Cartesian, Albers recognises a small number of points forming a definite pattern rather than an infinite number of points specified by an equation. From these discrete points Albers generates a scheme or constellation. The scheme is a (latent) linear pattern which deviates from the ready-made grid in several ways: principally by introducing obliques which deviate from the existing orthogonals of the grid. Potentially, this could amount to a re-statement of the grid at an angle, but unlike the grid, the scheme has a specific shape and extent. The scheme is a set of straight line paths forming a template for various graphic permutations. One might add that in contrast with the array of points, the scheme is continuous and introduces irrational quantities.

The works Albers called *Transformation of a Scheme* are in many ways prototypical of *Structural Constellations* and for this reason I have included them in my catalogue. A drawing in the archive of the Josef and Anni Albers Foundation **(122)** (SC 311) shows the scheme Albers

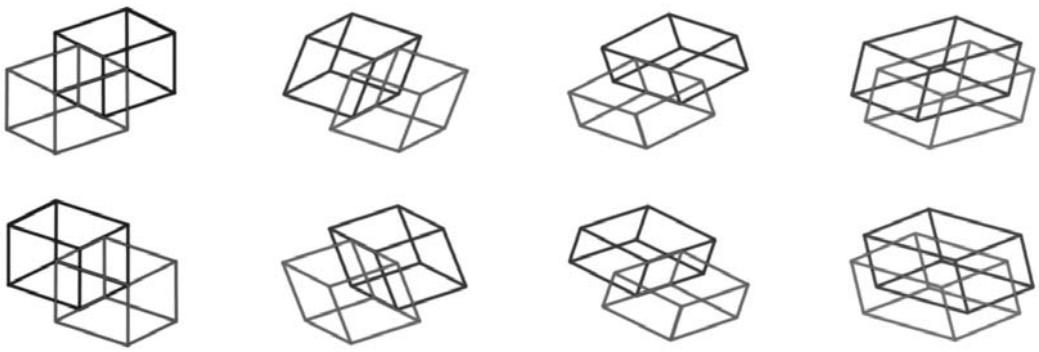
**121 Josef Albers, index to an album of *Structural Constellations*, pencil on squared paper, not dated**

**122 Josef Albers, Scheme for Transformations of a Scheme, pencil on squared paper, not dated**



123

used. This drawing was used as a guide for numerous tracing paper studies.[233] *Structural Constellations* are also transformations of a scheme. They can be distinguished from the works that got this label with a capital T and capital S by their characteristic linear schemes and by a slightly different discipline of transformation. However, Albers did not make schematic drawings for *Structural Constellations* quite like the example I have shown for the *Transformations*. In fact, even in connection with the exploratory studies, the schemes are not expressed as such. The pattern for one transformation group is stated as a constellation of dots in a small drawing (SC 604) **(123).**[234] But this is very rare. Normally, the grid sufficed for Albers to keep the scheme in mind. However, as can be inferred from Albers's variations, the scheme is better understood as a set of line segments than as a set of points. Its discipline does not permit all the connections one could imagine between the dots.[235] The precise purpose of



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**123 Josef Albers, study for *Structural Constellation* (SC 604), red and black ball point with marks in pencil on squared paper, not dated**

233 Cf. SC 767. In this notebook (untypically, a spiral bound notebook and dated by Albers 1953, SC 766–843)*Transformations* appear alongside *Structural Constellations*.

234 Cf. SC 603, 607, 1291, prints 648, 649, 652, working drawings for the prints 1311, 1313, 1322, 1322, 1323, 1325, 1384, 1385.

235 During my work on the catalogue I made schematic drawings to help identify the various transformation groups **(124)**. They could also help illustrate my point about Albers's practice, but, it cannot be overemphasised, they are not intended to suggest the 'essence' of *Structural Constellations*.

the drawing SC 604 and the meaning of Albers's annotations are not clear, but the dots (and the usual absence of them) should remind us that the complete set of line segments permitted by the scheme is a set of *possibilities* to be explored by drawing.

The relationships between points, lines, grid and scheme that I have tried to explain suggest something about what I called Albers's pattern-books. The designs Albers collected in these notebooks are not pictures of *Structural Constellations* like the little sketches on the index page (or like in my catalogue). They display *Structural Constellations* in a kind of symbolic notation as objects potentially realisable in various materials. The grid lends geometric precision to the drawing while the drawing needs only to specify the selection within the scheme and whether a line should be a thick one or a thin one. The presence of the grid here seems to assert the image is 'to be translated', but, as we have seen, not in the traditional way. The part the grid plays in the design, moreover, asserts the object specified is two-dimensional.

But what were Albers's criteria for choosing from the possibilities presented by the scheme?[236] The discipline of the scheme does not offer the answer to this question. Indeed, the scheme presents such a multitude of possibilities that the question is as good as enquiring of the motivation, meaning or language of any artwork in the most general way. Even if the intention were stated *a priori*, we would be obliged to interrogate the results of the artist's choice—that is, the appearance of the works—in an appropriate context.

*Structural Constellations* originate in the sphere of drawing and make their appearance on the stage of art. They are bound to the tradition of which we have explored a few episodes in this essay even if—perhaps, in truth, more intimately *because*—they seem to highlight the paradoxes of that tradition. The contrariness of *Structural Constellations* relies on the artist's ability to predict certain types of reaction to his work. Albers's work, I would argue, is less concerned with transmitting a message than it is with preparing a rendez-vous with the viewer. Hence the importance of the appearance of the work, not just in the sense of what it looks like, but in the sense of the time and place it shows up—perhaps to ambush the viewer's expectations.

The immediately captivating aspect of *Structural Constellations*, despite the resolute flatness of their construction (emphasised in the engravings and intaglios by the engagement with the material surface), is the compelling suggestion of three-dimensional figures and relationships. On inspection, however, the images which appear from Albers's constructions seem to contain contradictions and ambiguities. It is as if Albers has arranged a clash of the 'either-or' that Necker first remarked in a puzzling 'both-and'. An aspect which is not quite

236 Neal David Benezra's suggestion in *The Murals and Sculpture of Josef Albers* (New York and London: Garland Publishing, 1985), p. 73 that Albers 'worked from a single set of points until he had arrived at every conceivable variation' is one way of avoiding this question, but it is quite absurd. The scheme of SC 604, for example, has 20 points, which would admit 190 different connections. If we limit that to only the connections allowed by the scheme, that makes 37 line segments. Counting *only* the possible variations containing, say, 16 line segments and throwing out all that would be equivalent under rotation of 180° (according to the usual symmetry of *Structural Constellations*), this would yield [37!/(37-16)!]/2 different possible configurations, approximately $6.73 \times 10^{22}$. That would take $1.28 \times 10^{17}$ years at a variation a minute. If every human being alive joined in and worked at it 24 hours a day, it would still take more than 20 million years.

so obvious, even as one puzzles over what a *Structural Constellation* could be a drawing *of*, is the 'both-and' in which abstraction and representation are twisted round one another.

Hubert Damisch wrote in connection with Albers's abstraction:

> Would painting have broken with representation only to amuse itself with illusionistic games, perhaps pleasant, but strictly optical and without any grip on reality? This question could not get any really satisfactory response within the language of art criticism or art history.[237]

As usual with Damisch, it is a good question and maybe he is right about art history and criticism. Albers's practice certainly resists the norms on which artists, along with their critics, historians and curators have traditionally relied. As Albers put it, for him there was 'no smock, no skylight, no studio, no palette, no easel, no brushes, no medium, no canvas, ... no variation in texture or *matière*, no personal handwriting, no stylisation, no tricks, no "twinkling of the eyes."'[238] Albers, moreover, ensures that the traditional notions of the authorial signature and the original work—the unique and authentic art object—are perturbed, even though he does not repudiate them entirely. In this respect, Albers put into practice ideas the avant-gardes of the 1920s advertised under the banners of the machine age, the collective or the universal, but never carried through. It is not that Albers had more success or showed any more commitment to mass production, but his approach was radical in so far as he was willing to accept the implications for artistic production. Nowhere more so than in *Structural Constellations* where the works he exhibited—to be sure, under his own name—were not his handiwork; the autograph drawings he produced were for mechanical reproduction; his archive was not a collection of objects but of formulae. The drawings which form the bulk of my catalogue were not exhibited in Albers's lifetime.

The aspect of Albers's method—his game, as Damisch might say—which presents probably the greatest challenge to art history and criticism is his working, by variation and permutation, in *series*. While it is possible to trace the production process of a particular work or the genealogy of *Structural Constellations* within Albers's oeuvre, series halts the notion of 'development' which traditionally animates the recounting and interpretation of history; the notion which produced the 'subject' of history with which the earlier avant-gardes identified

237 Hubert Damisch, 'L'œil théoricien' in *Josef Albers* [exhibition catalogue] (Musée des Beaux Arts Tourcoing: Tourcoing, 1988), p. 11. Perhaps Damisch would have found Irving Finkelstein's response typically unsatisfying (*The Life and Art of Josef Albers*, PhD dissertation, New York University, 1968, not published). Somewhat overawed by Albers's abstraction, Finkelstein insists, regarding *Structural Constellations*, 'Albers has completely freed the structures to assert their own reality, independent of any reference, intellectual or emotional, to any other reality,' (p. 221) moreover, that Albers has 'disinherited the traditional conventions for reconstructing the visible, three-dimensional world of our experience and has replaced them with the creation of a dynamic and self contained world in which the elements form and space, or object and environment, or positive and negative, or material and immaterial, no longer have meaning by traditional definition; in fact, it has bcome increasingly difficult, if not impossible, to distinguish these elements or concepts from each other.' (p. 226) This 'other world', of course, is Finkelstein's own creation in which he has hypostatised his embarrassment as an absolute impossibility, which he tries to dignify as the 'meaning and essence' of the works.

238 Elaine de Kooning, 'Albers Paints a Picture', in *Art News* 49 (1950)

themselves—and which, for art historians and critics, seemed to guarantee the goal and meaning of their labour. Series excludes the notion of progress.[239]

Damisch suggests his question might be answered, if not within the language of art history and criticism, then with reference to the languages of geometry and psychoanalysis. Psychoanalysis, it seems, brings the formalist doctrine (applied with only feigned hesitation to Albers's work) to the threshold of meaning as an expression of the 'pleasure principle'. For the link between psychoanalysis and geometry Damisch relies on the authority (if not the arguments) of Jacques Lacan. However, Lacan's geometrical metaphors and analogies in fact owe more to the traditional way geometry has been discussed in art history than they do to any compelling connection between mathematics and psychoanalytic theory. For all his self-consciousness as a writer, Damisch does not draw attention to the fact that the borrowings from other sciences he proposes are the stock-in-trade of art historical discourse (not just his own).

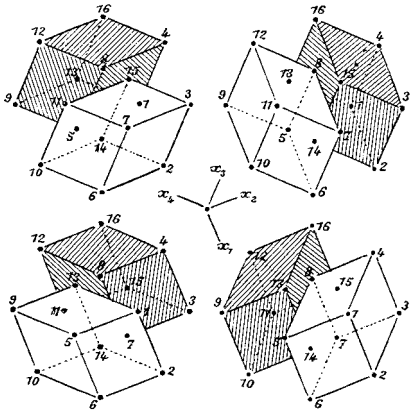
Damisch himself relies on a plane of projection on which the terms of various theories, once distilled philosophically, can be made to coincide. Although he generously begins by ascribing philosophical content to visual art, he ends up attributing to it only the truisms he can elicit from his own writing. His article on Albers concludes by drawing the idea of a '*Gestaltungstrieb*', which he claims was dear to Albers, along with its echoes of an earlier art historical doctrine—the will-to-form or *Kunstwollen* of Riegl, Worringer, Panofsky and their inheritors—into the orbit of the Freudian drives.[240] As for geometry, Damisch's abstraction sidesteps the superficial association of Albers's work with the 'geometric' abstraction of early twentieth century avant-gardes. Geometry furnishes Damisch with a bridge to his own theory of perspective (as symbolic form) and his speculation on the place of the origin, the subject and so on. But above all it serves Damisch to cast an aura of erudition around the vocabulary of 'espacement', 'déplacement', 'intervalle', 'limite', 'étendue' etc.

In the light of the discussion and critique I have elaborated up till now, the reader will be prepared to question in what sense *Structural Constellations* could be described as geometric—their abstract, ordered, symmetrical and rectilinear appearance notwithstanding. The reader would also by now recognise what the various notions of geometry which resurface in the criticism of Albers's work owe to the geometrical rhetoric connected with an earlier period of modernist art. The literature on Albers, it seems, fills some of the gaps—where the austerity of Albers's works has erased the opportunities for traditional ekphrasis—with the language of geometry inherited from Cubist criticism and post-Cubist art theory.[241] This is espe-

239 The attempt by the author of a catalogue essay to predict *Structural Constellations* from early landscape drawings by Albers of rural houses seems forced. Kornelia von Berswordt-Wallrabe in *Josef Albers:Werke auf Papier*, ed. by Volker Adolfs, (Bonn: Kunstmuseum Bonn, Wienand, 1998).

240 Damisch qualifies *Gestaltungstrieb* as 'une pulsion de la forme, [...] la mise en forme, [...] l'*information*.' ('L'œil théoricien', p. 17). Albers uses the term in the context of his characterisation of learning: 'the initial need for being occupied (in German: *Beschaefigungstrieb*) will lead to, and must be transferred to, a need of being productive, creative (*Gestaltungstrieb*). Josef Albers *Search Versus Re-search* (Hartford, Connecticut: Trinity College Press, 1969), p. 12. Original in English and German.

241 The literature on Albers is not extensive and consists mainly of exhibition catalogue essays and reviews. No book-length scholarly study has been published.



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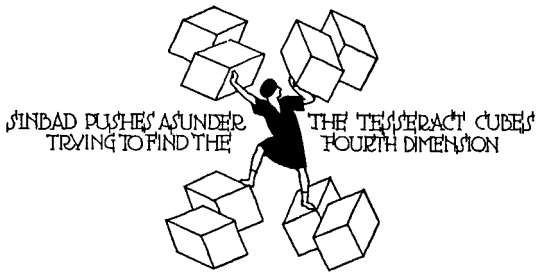


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cially clear when allusions are made to non-Euclidean geometry, given that, in principle, it is impossible get any evidence for this from the drawings themselves. All that informs the connection of *Structural Constellations* with exotic geometries is the alleged association of Albers's work with the -isms which promoted geometric abstraction in the aftermath of the First World War. François Bucher's opinion is typical and possibly influenced subsequent commentators.

> These experiments [i.e. *Structural Constellations*] are probably [Albers's] most important and as yet least developed discovery. They elegantly begin an honest visual exploration of the little known characteristics of non-Euclidean dimensions.[242]

Curiously, none of the discoverers of non- or 'anti-Euclidean' geometry in *Structural Constellations* has compared their shape with the hypercube figure proposed by Stringham which represents a displaced cuboid **(58)**. The schemata for *Structural Constellations* **(124)** resemble derivatives of this figure such as, for example, can be found in Jouffret **(125)** and Bragdon's adaptation of the same **(126)**. Unfortunately, there is nothing to suggest the resemblance is more than a coincidence (hardly unlikely when one is dealing with simple 'primary' forms). Although Albers's personal papers show he took an avid interest in all kinds of diagrams, graphic constructions, picture puzzles and the like, and his private library

**125 'The eight limiting cases of the octahedroid' from E. Jouffret, *Triaté elementaire de géométrie à quartre dimensions*, Paris, 1903**

**126 'Sinbad Pushes Asunder the Tesseract Cubes Trying to Find the Fourth Dimension' from Claude Bragdon, *The Frozen Fountain: being essays on architecture and the art of design in space*, New York, 1932**

242 François Bucher, *Despite Straight Lines* (New Haven and London: Yale University Press, 1961), p. 62. See also, for example, Jean Clay: 'Albers propose des formes isométriques, des machines anti-Euclidiennes fondés sur un illusionisme visuel.' ('Albers: Trois étapes d'une logique' in *Albers* [exhibition catalogue], Paris: Galerie Denise René, 1968) or Benezra's almost ironic comment, 'Albers' non-Euclidean geometry postulates a sphere of the imagination where such relations are possible.' (*The Murals and Sculpture*, p.149)

contained titles on art and geometry,[243] I have not discovered anything that would put diagrams of four-dimensional figures within Albers's range of visual reference. Nor is there any evidence that Albers took any interest in (or had any opinion on) the interpretations of hyperspace philosophy and Relativity Theory which preoccupied some of his contemporaries in the 1920s.

There is no reason to suppose that geometry was the objective of Albers's ostensibly geometric style. As I have shown, Albers's method is geometrical only in a rather archaic sense: in its recognition of an arithmetic order of discrete points on the plane and the use of a straight edge. However, my exploration of geometry and its entanglement with art does suggest why, despite the fact that *projection* plays no part in the construction of *Structural Constellations*, it appears to be so prominent in their reception. Here one is perhaps justified in acknowledging both the mathematical and the psychological meanings of the term.

*Structural Constellations* seem to present us with a *mise en abîme* of all the problematics of geometry and meaning we have discussed so far. An analysis could easily prompt an inventory of the ambiguities, aporias and slippages with which geometry leaves us in the field of representation. Albers seems to make use of geometry for all the expectations it can arouse as a kind of lure. It is precisely the corrosive effects of geometry which Albers deploys. Corrosive, that is, of geometry itself if we imagined it a convenient hermeneutic tool for unpicking *Structural Constellations*.

We could perhaps rephrase Damisch's question: What kind of mischief is this? What is the point of Albers's geometrical hoax? This question could *only* get a satisfactory answer in the language of art history and criticism. Why it has not yet got an answer is one of the topics of this essay. The discussion up till now would provide the basis for a structural explanation, but a historical explanation is also necessary.

Perhaps the most frustrating thing about Albers from the art historian's or critic's point of view is simply that he is late. To most critics *Structural Constellations* never seemed topical. Albers was not a pioneer of abstract art in 1915. In fact, he was a schoolteacher. He was thirty-two when he joined the Bauhaus as a student in 1920. As one the few people there who had any teaching experience, he soon became a mainstay of the faculty. His activities at the Bauhaus included work—on both artistic and applied projects—in glass, wood, metal, typography and print-making, but he had not developed a high profile as an independent artist before the Bauhaus was closed down under pressure from the Nazi regime. During this period Albers increasingly gained recognition for his contribution to the *vorkurs* (preliminary course). He gave an important paper on teaching at the International Congress for Drawing, Art Education and Applied Art in Prague in 1928, published in the Bauhaus journal the same year and later in Prague.

243 E.g. Walther Lietzmann, *Mathematik und Bildende Kunst* (Breslau: Ferdinand Hirt, 1931), Ernst Mössel, *Vom Geheimnis der Form und der Urform des Seins* (Stuttgart and Berlin: Deutsche Verlags-Anstalt, 1938), Matila Ghyka, *The Geometry of Art and Life* (New York: Sheed and Ward, 1946) and Georges Jouven, *Rythme et architecture: les tracés harmoniques* (Paris: Vincent, Fréal, 1951). Albers was also presented with a mathematics textbook which the author had chosen to illustrate with his *Transformations of a Scheme* in connection with plane geometry (Vincent H. Hagg, *Introduction to Secondary Mathematics*, Boston, MA: Heath, 1965, p.140).

Albers's Bauhaus career brought him into personal contact with its resident celebrities such as Gropius, Mies van der Rohe, Kandinsky, Klee, Itten, Bayer, Breuer and Moholy-Nagy. The Bauhaus also attracted visitors like van Doesburg and Lissitzky.[244] One should also not forget the weaver Annelise Fleischmann who became Mrs Albers in 1925. Although surrounded by what was later to be regarded as modernism's hall of fame, Albers does not seem to have engaged with the avant-garde polemics of the day. On joining the Bauhaus he abandoned figurative art (along with the Jugendstil and expressionist influences of his earlier work) but without ceremony.[245] His loyalty to the Bauhaus survived the changes of location from Weimar to Dessau to Berlin and the changes of directorship from Gropius to Meyer to Mies van der Rohe. After the Bauhaus closed in 1933, Josef and Anni Albers were offered teaching posts at Black Mountain College in North Carolina and were thus among the first ex-Bauhausler to find refuge in the United States. Compared with the hothouse milieu of the Bauhaus years, Black Mountain College was far from the focus of artistic activity. Albers kept in touch with former colleagues, several of whom eventually obtained important positions in more prestigious centres in America. Nonetheless, Albers chose to stay in North Carolina until the end of the 1940s. After a brief spell in New York City, he moved to the Department of Design at Yale University in New Haven where he also lived after his retirement in 1958. In 1970 he moved to Orange, Connecticut. From the 1950s Albers held several visiting professorships and his travels were often occasioned by invitations to lecture as far afield as Peru and West Germany (see above, p. 201n). His prominence as an internationally successful artist dates mainly from after his retirement from Yale.

How remote Albers might have been in North Carolina and Connecticut from the New York art scene (then as now the principal arbiter of an artist's critical reputation in the United States) is suggested by a 1959 article on the lack of recognition for 'geometric' painting in an art world dominated by abstract expressionism. The author considered an artist living on West 23rd Street isolated.[246] Donald Judd wrote that around this time, 'All painting that was geometric in any way was considered old-fashioned, idealistic, rationalistic, rigid and therefore European.'[247]

Albers's reputation waxed and waned with that of the Bauhaus with which he was identified through his fame as teacher. Because many of its most important protagonists settled in the United States, the Bauhaus came to be regarded in America as one of the chief symbols of (if not actually synonymous with) modernist art and design. As result, the legacy of the Bauhaus was much simplified and distorted, which in turn influenced the reception of work

244 From the evidence of Albers's own photographs, Albers appears to have been quite friendly with Lissitzky on his visits to the Bauhaus, but there is no correspondence.

245 It seems to have been Feininger's expressionist leaflet that attracted Albers to the Bauhaus.

246 Sydney Tillim 'What Happened to Geometry? An inquiry into the origins and vicissitudes as well as the present condition of geometrical painting in America' in *Arts Magazine* (1959), p. 39. 'While many of the Expressionists live and work in the same vicinity in Greenwich Village, the geometric artists are geographically dispersed [... Long Island ... New Jersey ... upstate New York ... or ...] sequestered in New York appartments, while Josef Albers pontificates from New Haven, Connecticut. Nassos Daphnis has worked in isolation for years on West 23rd Street [...].'

247 Donald Judd, 'Josef Albers' in *Josef Albers* [exhibition: Chinati Foundation] (Köln: Distel Verlag, 1991), p. 8.

Albers made long after leaving Germany. Clement Greenberg's remarks are typical of the mood Judd described.

> The strictly rectilinear art of Josef Albers [...] provides an ever recurring frustration. [...] Alas, Albers must be accounted another victim of Bauhaus modernism, with its doctrinairism, its static, machine-made, and logical art, its inability to rise above merely decorative motifs.[248]

Both the supporters and the detractors of allegedly geometric art aligned it with what they understood of earlier European movements in what must have seemed a bewildering diversity of 'meanings' (complete with 'classical' and 'romantic' tendencies) applied to superficially similar paintings. It was not until so-called Hard Edge and Op Art came into vogue in the 1960s that 'geometric' art got a warmer reception. Albers, however, made a point of distancing himself from all fashions and always advised his students to keep away from the bandwagon.[249] Though he was hailed as the 'Father of Op Art', Albers rejected this label.[250]

Albers's efforts to explain his teaching methods on a wider public platform in the 1960s may have been encouraged by the desire to correct the prejudice expressed, for example, by Hilton Kramer:

> Albers has been distinguished even among his coevals, so many of whom took up academic positions here [i.e. former Bauhaus colleagues], in retaining a cast of mind primarily pedagogic in its preoccupations [...]
>
> Now this history of Albers's teaching career is not merely an interesting biographical aside. It is of the essence; it is quite inseparable from the meaning of his work as an artist, he remains above all, even now—and I mean *in his art*, not only in the particulars of his career—a highly committed instructor whose individual works of art are in the nature of exalted but nonetheless pedagogic demonstrations.[251]

Albers's aim seems to have been, rather than defending his art or suggesting it was not inseparable from his teaching, to show that the *latter* was not 'pedagogic' in the sense implied by Kramer. Albers's awareness of his position is clear from a private interview:

> I have been called a member of 'cold art' ... unemotional. You say it is lyrical and poetic. We are friends. [...]
>
> We are segregated as the 'hard edge' people, but our edges are softer than the softest

248 Clement Greenberg, [review article] *The Nation* (19 February 1949).
249 See *Search Versus Re-search*, p. 12.
250 See editor's headline added to Josef Albers, 'Op Art and/or Perceptual Effects' in *Yale Scientific* (November 1965). Albers thought the term 'optical' painting was as redundant and silly a qualification as 'acoustical' music or 'foot' walking.
251 Hilton Kramer, 'Recent Paintings at the Sidney Janis Gallery' in *Arts* 32 (1958).

> 'soft edge' so-called. My edges are so soft they hover, but not by brush, still by straight line. I am conceited enough to believe that I have the richest palette, like a musician with a thousand variations. This is not the work of angst. [Harold] Rosenberg [the champion of Abstract Expressionism], via Sartre, thinks everything is angst. I expect the bomb, but without angst.[252]

The emphasis in Albers's teaching was not on imparting information or technique from master to pupil, but on what the student could discover for him/herself through experiment, above all in play: what Albers called 'thinking in situations'. Albers's programme bracketed art, but offered what he believed was the *sine qua non* of art: training in observation and articulation. He rejected what he regarded as 'a poor heritage of so-called progressive education: that the all-important principle of all art is self-expression.'[253] That principle seemed to presuppose a kind of spontaneous and immediate communication which to Albers was inconceivable. It implied an imperious and isolated subjectivity excluding itself from the community of language. Albers's emphasis on interaction and relatedness is sometimes allowed to stand as a metaphor for the intersubjectivity on which it is predicated. Colours and lines, of course, do not actually interact with one another. Their inter-action is a fact of perception, that is, an interaction with an interpreting subject.

In Albers's terms, the goal of art training was to discover 'The origin of art: The discrepancy between physical fact and psychic effect.'[254] Alternatively: the difference between 'factual facts' and 'actual facts'. Hence 'The measure of art: The ratio of effort to effect,' or what Albers called *economy*. It is difficult to ignore the geometrical overtones of this formulation—or its irony. Albers's idea of economy is really the opposite of the reduction normally associated with geometry and, moreover, the opposite of the essentialism usually found in tow. Albers's sum, 'One plus one should equal three and more,' does not involve any exotic mathematics.

> I prefer to show some straight lines, unmodulated and two-dimensional, which through their constellations challenge our reading of them, and with this, our imagination.
>
> As we regard these, their directions constantly change. We perform perceptual effects by adding and seeing spatial qualities and motion, both of which do not exist factually, but only in our producing and seeing them.[255]

252 Interview with Cecily Sash (artist, then researching art education), December 1965, transcript in the archives of the Josef and Anni Albers Foundation. Albers also made the point, 'I am not a result of the Bauhaus. I had more influence on the Bauhaus than it had on me.' The Greenberg-Kramer view, however, seems to have prevailed as Judd points out in his comments on the reception of Albers's 1988 New York retrospective.

253 *Search Versus Re-search*, p. 10.

254 From Albers's formulation of the origin, content, measure and aim of art, apparently first composed c. 1940 (typescript in the archives of the Josef and Anni Albers Foundation with autograph date annotation) and published many times.

255 'Op Art and/or Perceptual Effects'.

Remarks such as these on *Structural Constellations*, which admittedly fail to convey the delight he expressed elsewhere in the productivity he discovered in a few straight lines, did little to dispel Albers's reputation as a pedagogue. Other texts Albers published alongside *Structural Constellations* are even more dry. The art critics who provided additional commentaries might have felt compelled to restore Albers's artistic credentials by referring to the 'realm of geometry', 'spatial systems', 'diagrams of reality', the 'search for the absolute' and the like. Commentaries such as Bucher's contribution to *Despite Straight Lines* sit awkwardly next to Albers's observations.[256] It is hard not read such commentaries as an attempt to restore the illusions that geometry and the talk of geometry were traditionally invoked to support.

The bricolage of references to geometry applied to *Structural Constellations* seems to be bound together more by a feeling of nostalgia than by the ideological zeal that lent coherence to the manifestos of Alberti and van Doesburg—perhaps a nostalgia *for* such ideological self-confidence. Nostalgia recognises both the absence of and the longing for what art had seemed to promise in its alliance with geometry, namely the true representation of the real and the representation of the truth beyond or hidden by reality.

In Albers's work the promise becomes a lure because it was always so. Geometry, conjured by no more than straight-edge drawing was the sign by which modern art (if we trace this back to Alberti) staked its claims both to representation and to higher truth. But why did it become a lure when Albers made it so? Because Albers insists that *what you see is what you get*. Except that seeing is probably more than you bargained for. Albers makes a point of the phenomena (indeed, the phenomenology) of seeing, about which the proponents of Suprematism or Neo-plasticism as much as of perspective itself were anxious to keep quiet in order to preserve their authority as artists.

Albers's works implicate a *you* (that is, the viewing subject) at the expense of an *I* (that is, the first person of the artist-creator). The work is autonomous, not in the sense inherited from *l'art pour l'art*, or because it has somehow escaped the contingency of its material form, but because the author has withdrawn from the work. We might call it an intentionless work.

Albers was regarded as a late exponent of a modernism which in the United States was considered outmoded, even if it was given grudging respect provided it proved itself an authentic relict (fit for a museum of modern art) of a period of European history which ended in disaster for the Europeans and triumph for the Americans. In America, capitalism would realise what the defunct European avant-gardes dreamt of. Artists therefore were required to perform a different task. What appeared to be lessons in cognitive psychology from a professor of the old school were not welcome. The incoherent claims of Albers's sympathisers who linked his work with whatever geometric prior art *Structural Constellations* might have reminded them of or whatever mathematical concepts they thought lent an appropriate air

256 Especially when Albers refers to the 'helpless verbosities' of art critics on the page opposite as occurred in the publication of 'Op Art and/or Perceptual Effects'.

of erudition to their writing did not impress anybody, but perhaps confirmed the prejudices of those who already found Albers's work difficult to assimilate to prevailing expectations. Such commentaries made it seem as if Albers was caught in the trap his critics had walked into.

It is interesting that Albers did not spend any greater effort in encouraging friendly critics than he did in countering hostile ones. He thus left the former 'helpless', without a guide and probably less confident of their convictions than the writers who dismissed or attacked his work. Both groups were left more or less to their own devices, with more or less the same collection of assumptions and associations. This is no doubt the prerogative of a man who, by the time he got the attention of the art world, was already in his seventies. His pedagogy had been honed during a lifetime of teaching and he seems to have had little to add to the texts that stand as his testament. It is worth remembering that *Interaction of Colour* was dedicated, 'This book is my thanks to my students,' who, he wrote, had 'taught [him] more color than books on color.'[257]

Despite the failure of Albers's critics to adduce the meaning of his work (which is perhaps understandable in the light of my discussion), the contexts in which they struggled to understand it during the artist's lifetime are not irrelevant.

Albers always claimed to have been nobody's follower and the artists he admired he usually praised for their solitary dedication. Cézanne's name comes up most often. Even when he was not asked directly, he made the point, 'I'm asked all the time, what painters of today do you really respect? I say, I'm only interested in my own nonsense.'[258] But this is disingenuous. Albers always took an interest in his visual and artistic environment. I have already remarked on the wide range of media and applications with which he experimented during his Bauhaus years, under the influence of opportunity, circumstance and colleagues. His work of the late 1920s is close to Anni's and it may have been she that introduced Albers to the habit of designing on graph paper which, of course, had a practical significance for a weaver it would not obviously have had for someone working in glass as Albers was at the time. The artist's receptivity is further attested by his interest in photography, through which he recorded his immediate surroundings and companions as well as his travels and the interest he shared with Anni in pre-Columbian art and architecture. Albers collected postcards and press cuttings of images which interested him, including landscapes, buildings, paintings, diagrams, cartoons and picture puzzles. Though he insisted he owed them nothing, Albers was, it seems, quite happy if his name was mentioned alongside the 'masters' of European modernism. It is plausible to regard his late work not so much as the product or reduction of the modernist art that surrounded him before he emigrated to the United States, but as his answer to it; in this respect as a kind of 'late modernism' in which one can recognise an implicit critique of the pretensions of earlier modernists. Albers was not interested in polemics, but his work shows a subtly ironic humour which was as much in character as the

257 Albers *Interaction of Color*, p. 75.
258 Emil de Antonio and Mitch Tuchman, *Painters Painting: A Candid History of the Modern Art Scene 1940–1970* (New York: Abbeville, 1984), p. 146.

seriousness with which he approached his task as a teacher and his obsessions as a painter. One is reminded of one of Albers's favourite sayings, 'All art is a swindle,' which suggests a scepticism towards accepted notions of art, especially what Albers regarded as artistic fads, as well as an ironic shorthand for the sense he maintained that perception was synonymous with deception. What I called Albers's geometrical hoax is perpetrated against geometry as it is traditionally understood in the context of art. The deception is a play enacted by the viewer on a work that has nothing to hide. The prankish quality of the work—its apparent pointlessness—comes from its not laying claim to higher truth or authority over the viewer.

*Structural Constellations* seem to arouse expectations only to mock them. They prompt interpretations in depth, yet are adamantly superficial. Their forms are rigorously defined, yet disintegrate in a multitude of perceptual possibilities and contradictions. Their ambiguity asserts both the disappearance of meaning (if sense must be free of contradiction and every sign must have an object) and a poetics of polysemy. Benjamin wrote, 'Ambiguity is the figurative appearance of the dialectic, the law of the dialectic at a standstill.'[259] The work obtains its physiognomy and language only in dialectic, that is, in a play of opposing forces and a pattern of contradictions, but above all in conversation and disputation, under examination by the viewer for whom it waits, ready to renounce its autonomy.

To the list of negatives I quoted earlier, 'no smock, no skylight, no studio' etc., one might add no sermon, no prophecy. The object of the 'jeux illusionistes' that Damisch questioned is disillusionment.

259 Walter Benjamin, 'On Some Motifs in Baudelaire', trans. by Harry Zohn in *Illuminations*, ed. by Hannah Arendt (New York: Schocken Books, 1968), p. 171.

## I Reprise: Aesthetic Theory

The fragmentary character which Adorno's last work *Ästhetische Theorie* has in common with Benjamin's *Passagen-Werk* is that of a work interrupted by death. Adorno wrote, 'The fragment is the intrusion of death into the work. While destroying it, it removes the stain of semblance.'[1] In relation to Benjamin's work, *Aestheic Theory* is late as Albers's *Structural Constellations* are late in relation to the inter-war avant-gardes. The criterion often all too glibly associated with Adorno's name of writing 'after Auschwitz' perhaps overshadows a more intimate criterion: writing after Benjamin. With *Aesthetic Theory* Adorno faced the impossibility to which Benjamin had surrendered, namely the impossibility of accomplishing the Arcades Project except as an 'impermissible "poetic"' work. Adorno's book is adapted to its material to the extent that a *theory* of the aesthetic would not do; neither would an *aestheticised* theory, as if aesthetics were mere ornament on a neutral substrate or theory were an essence which needed to be clothed in appearance. Adorno recognised the impossibility while refusing to surrender to it. He refused to allow theory to be consumed by aesthetics–or as he feared for Benjamin's work–to allow the material to be consumed by its own aura.

An aesthetic theory would have to bind these two terms together, but without unifying them. Adorno's title *Aesthetic Theory* should probably be read as a miniature model of the paratactical structure of the book. The burden of the book's aesthetics—its literary form—is demonstration, but not by argument—not, so to speak, *more geometrico*. Adorno never accepted Benjamin's 'I have nothing to say, Only to show'[2] as the criterion of philosophical representation. Nonetheless, only saying that included not-saying and counter-saying in its enunciation would be capable of doing justice to its topic. Philosophy was not to acquiesce in the merely existing. It was not to 'portray reality as "meaningful" and thereby justify it.'[3] The muteness of things enjoins philosophy to interpretation and impugns the adequacy of the concepts philosophy can bring to bear on things. The non-identical is all there is to prevent the identity-principle from dissolving by its own means. For the sake of the non-identical, philosophy is to seek its own dissolution.

The scruples of representation Adorno encountered in the 'Epistemo-critical Prologue' to the *Trauerspiel* study were the lesson Benjamin's only pupil carried throughout his work. From my earlier discussion it is evident that the difficulties of aesthetic theory would have been clearly predicted by Adorno and he had indeed rehearsed them continually in his 'aesthetic writings', that is, his criticism of music and literature. Yet, well into the second draft, the work on *Aesthetic Theory* presented problems not anticipated by the writer. Adorno wrote in a letter:

1 Quoted in 'Editors' Afterword' to Theodor W. Adorno, *Aesthetic Theory*, ed. by Gretel Adorno and Rolf Tiedemann, trans. by Robert Hullot-Kentor (London: Athlone Press, 1997), p. 361.
2 See Part I, p. 18.
3 See Part I, p. 13.

> It is interesting that in working there obtrudes from the *content* [*Inhalt*] various implications for the form that I had long expected but that now indeed astonish me. It is simply that from my theorem that there is no philosophical first principle, it now also results that one cannot build an argumentative structure that follows the usual progressive succession of steps, but rather that one must assemble the whole out of a series of partial complexes that are, so to speak, of equal weight and concentrically arranged all on the same level; their constellation, not their succession must yield the idea.[4]

The result has been described as 'visibly antagonistic'. The wall of text presented by *Aesthetic Theory*, as a form of address, corresponds throughout with the way the work is addressed by Adorno's intended dedication of the book 'To Samuel Beckett'. In contrast with Adorno's previous works which displayed their structure as the articulation of parts, in sharply cut insights and the crystallisation of ideas, Nicholsen characterises *Aesthetic Theory* as 'a more fieldlike presentation in which the figurative language has virtually disappeared and been replaced by a flatter, almost compendiumlike dialectic without detail, in which one idea shifts into the next virtually without boundaries.'[5] Seemingly perhaps: it could be argued that what remains in *Aesthetic Theory* is *only* detail.

*Aesthetic Theory* is unquotable, even as it contains hardly any quotations. *Aesthetic Theory* has no passages. No clause or phrase from a sentence, no sentence from a paragraph can be extracted with its sense intact. The paragraphs moreover go on for pages and hardly tolerate any separation from one another. The sections of the book, divided by only the slightest caesura of a blank line, refuse to become chapters. At the same time as they are continuations of one another, they are also startings-over, repetitions.

What replaces argument in *Aesthetic Theory*—the exposition of concepts and premisses and their logical development—is the performance of a series of variations or permutations of a theme that is not stated. Adorno deploys a small number of rhetorical patterns to enact a multitude of intertwined dialectical reversals, contradictions and inversions which tumble and revolve in what, for the reader, is a vertiginous, airless text (in the words of its translator, 'almost too interesting to read').

The dominant figure is the *chiasmus*: a crossing, diagonal arrangement; an × of paradoxical symmetry in which the terms of parallel clauses are inverted. For Adorno, × marks the site of cancellation, of disenchantment (i.e. not the bewitched cross-roads where Adorno found his friend on 10 November 1938)[6] as well as the location of something buried (a treasure or a suicide). The chiasmus is not simply a crossing but, in the warp and weft of the text, a knot which binds concepts to their opposites, although it does not reconcile them. Thus, for example, subjectivity and objectivity, integration and disintegration, theory and critique,

4 Quoted in 'Editors' Afterword' to *Aesthetic Theory*, p. 364.
5 Shierry Weber Nicholsen, *Exact Imagination, Late Work, on Adorno's aesthetics*, (Cambridge, MA and London: MIT Press, 1997), p. 49.
6 See Part I, p. 23.

what exists and what ought to exist, encipherment and decipherment are not separated.

But Adorno is not a carpet weaver. A web of knots is a lace:

> 'the whole pattern is the fabric, and the fabric is the pattern', that is the working of the threads produces at the same time both the material and its patterning. This definition separates lace sharply from openwork embroidery in which patterning is added to the surface of an already-made material.[7]

A lace, moreover, is literally and figuratively a net, a noose or a snare which potentially entangles the hunter with his/her quarry; which embroils the one who knots it and the one who attempts to unpick it—that is, both the writer and the reader. A lace thus discloses the work of language.

Adorno's asceticism is not that of which he accused Benjamin in connection with the latter's reluctance to exercise theory in the Arcades. Adorno's asceticism—if not his technique—is that of Penelope: a dialectic of doing and undoing, inscription and erasure; a ruse of resistance to the *status quo*. The labour is not provisional or anticipatory, but insists the condition of its completion is not present. Adorno, however, would not necessarily have welcomed the return of the wily Odysseus whom he and Horkheimer portrayed in the *Dialectic of Enlightenment* as the prototype of the bourgeois individual, protagonist of the mutual implication of enlightenment and myth.[8] Adorno's technique, as he described in a letter while working on his second draft of *Aesthetic Theory*, was to manoeuvre himself into the position of the critic of his own work, the position he regarded as the most productive. He considered first drafts merely 'organised self-deception' necessary to achieve a position of critical reflection.[9] In the case of *Aesthetic Theory*, the second draft brought him only to a position of second reflection and occasioned a second critical revision, which, it seems, anticipated a third.

The term constellation is caught in the web of *Aesthetic Theory*, but is neither elaborated (as it was in *Negative Dialectics*) nor posited as an undefined term (which would be only logical). Constellation does not surface as a idea, nor, despite the efforts of various commentators, can it be convincingly excavated as a 'fundamental concept'. The idea of doing philosophy without 'first principles' may have always been a conceit, but that does not authorise the search for something lying beyond the text, as it were on the other side of the screen. As a provocation (such as it was introduced in 'The Actuality of Philosophy')[10] or, as Adorno refers to it ironically, his 'theorem', it says no more than what came to be accepted as 'philosophical principles' are nothing other than mirages of language—as Wittgenstein thought, grammatical mistakes. The idea expresses Adorno's commitment to doing philosophy with language, in language, against language.

7 Earnshaw 1983.
8 *Dialectic of Enlightenment* does not mention Penelope.
9 Quoted in 'Editors' Afterword' to *Aesthetic Theory*, p. 363.
10 See Part I, p. 12.

In the text, Adorno elicits no metaphors or similes from constellation although there is more than a hint, confirmed by the letters, that it governs the whole project. The remark in the draft introduction, 'Aesthetics is not obliged to set off on the hopeless quest for the primal archetype of art, rather it must think such phenomena in historical constellations,' may or may not have survived Adorno's projected revisions. The word 'constellation' appears from time to time in *Aesthetic Theory* in various contexts without any gloss. So do the terms 'monad', 'magnetic field', 'enigma', 'nexus', 'cipher', which we might assume to be among the numbers whose combination would unlock the thought theory had encircled in the hope of seeing it 'fly open', as Adorno had suggested in *Negative Dialectics*.[11] Except that the tantalising 'object' at the centre is now 'aesthetics' and we cannot be sure the hope is intact.

The efforts of commentators to reconcile *Aesthetic Theory* with the earlier constellation metaphors by providing visual analogies tend to underline the absence of the images which I documented and interrogated in my first essay. *Aesthetic Theory* does not suggest the illuminated figures of *Sternbilder*—illuminated, that is, in consideration of the stars which shine from the vault of the sky or in consideration of the graphic elaborations on maps and atlases which mediate their sign-character. Neither does *Aesthetic Theory* suggest the momentary conjunctions which flash across the horoscope in an act of interpretation. Adorno scholars could not be expected to consider an analogy with Argelander's BD charts which my study suggested were a form of constellation under a ban on images[12] and, as has been remarked of *Aesthetic Theory*, 'without boundaries'.

Adorno, it seems, no longer required a visual analogy for his structural constellation of the conduct of aesthetics.

11 See Part I, p. 28.
12 See Part II, p. 70.

## Appendices

IN THIS VOLUME

**A Original texts of translations from the German cited in Part I**

**B Original texts of translations from the French cited in Part II**

**C A comparison of Constellation Boundaries**

**D A comparison of Constellation Figures**

**E Original texts of translations from the French cited in Part III**

IN VOLUME TWO

**F Structural Constellations: Catalogue of Unpublished Drawings in the Collection of the Josef and Anni Albers Foundation, Connecticut**

## A Original texts of translations from the German cited in Part I

*Universal history has no theoretical armature …*

**Page 1**

Der Historismus gipfelt von rechtswegen in der Universalgeschichte. Von ihr hebt die materialistische Geschichtsschreibung methodisch vielleicht deutlicher als von jeder anderen ab. Die erstere hat keine theoretische Armatur. Ihr Verfahren ist additiv: sie bietet die Masse der Fakten auf, um die homogene und leere Zeit auszufüllen. Der material istischen Geschichtsschreibung ihrerseits liegt ihr konstruktives Prinzip zugrunde. Zum Denken gehört nicht nur die Bewegung der Gedanken sondern ebenso ihre Stillstellung. Wo das Denken in einer von Spannungen gesättigten Konstellation plötzlich einhält, da erteilt es derselben einen Chock, durch den es sich als Monade kristallisiert. Der historische Materialist geht an einen geschichtlichen Gegenstand einzig und allein da heran, wo er ihm als Monade entgegentritt. In dieser Struktur erkennt er das Zeichen einer messianischen Stillstellung des Geschehens, anders gesagt, einer revolutionären Chance im Kampf für die unterdrückte Vergangenheit. Er nimmt sie wahr, um eine bestimmte Epoche aus dem homogenen Verlauf der Geschichte herauszusprengen; so sprengt er ein bestimmtes Leben aus der Epoche, so ein bestimmtes Werk aus einem Lebenswerk.

Walter Benjamin, 'Über den Begriff der Geschichte', in *Gesammelte Schriften* I/2, ed. by Rolf Tiedemann and Hermann Schweppenhäuser (Frankfurt am Main: Suhrkamp,1974), pp. 702-703.

*The immobilisation of thought is as much a part of thinking …*

**Page 1**

Zum Denken gehört ebenso die Bewegung wie das Stillstellen der Gedanken. Wo das Denken in einer von Spannungen gesättigten Konstellation zum Stillstand kommt, da erscheint das dialektische Bild. Es ist die Zäsur in der Denkbewegung. Ihre Stelle ist da natürlich keine beliebige. Sie ist, mit einem Wort, da zu suchen, wo die Spannung zwischen den dialektischen Gegensätzen am größten ist. De[m] nach ist der in der materialistischen Geschichtsdarstellung konstruierte Gegenstand selber das dialektische Bild. Es ist identisch mit dem historischen Gegenstand; es rechtfertigt seine Absprengung aus dem Kontinuum des Geschichtsverlaufs.

Walter Benjamin, 'Das Passagen-Werk', in *Gesammelte Schriften* V/1-2, ed. by Rolf Tiedemann and Hermann Schweppenhäuser (Frankfurt am Main: Suhrkamp, 1982), p. 595.

*Ideas are to objects …*

**Page 5**

Die Ideen verhalten sich zu den Dingen wie die Sternbilder zu den Sternen.

Walter Benjamin: 'Ursprung des deutschen Trauerspiels', in *Gesammelte Schriften* I/1, ed. by Rolf Tiedemann and Hermann Schweppenhäuser (Frankfurt am Main: Suhrkamp, 1974), p. 214.

*The more clearly mathematics demonstrate …*

**Page 6**

Wie deutlich es Mathematik belegt, daß die gänzliche Elimination des Darstellungsproblems, als welche jeden streng sachgemäße Didaktik sich gibt, das Signum echter Erkenntnis ist, gleich bündig stellt sich ihr Verzicht auf den Bereich der Wahrheit, den die Sprachen meinen dar.

'Ursprung des deutschen Trauerspiels', p. 207.

*Ideas are displayed without intention.*

**Page 7**

Wie die Ideen intentionslos im Benennen sich geben, so haben sie in philosophischer Kontemplation sich zu erneuern.

'Ursprung des deutschen Trauerspiels', p. 217.

*If representation is to stake its claim …*

**Page 7**

Wenn Darstellung als eigentliche Methode des philosophischen Traktates sich behaupten will, so muß sie Darstellung der Ideen sein.

'Ursprung des deutschen Trauerspiels', p. 209.

*Self representation of truth does not derive from a coherence …*

**Page 7**

Diesem Besitztum ist Darstellung sekundär. Es existiert nicht bereits als ein Sich-Darstellendes. Gerade dies aber gilt von der Wahrheit. Methode, für die Erkenntnis ein Weg, den Gegenstand des Innehabens—und sei's durch die Erzeugung im Bewusstsein—zu gewinnen, ist für die Wahrheit Darstellung ihrer selbst und daher als Form mit ihr gegeben. Diese Form eignet nicht einem Zusammenhang im Bewusstsein, wie die Methodik der Erkenntnis es tut, sondern einem Sein.

'Ursprung des deutschen Trauerspiels', p. 209.

*A representational impulse …*

**Page 7**

In der Wahrheit ist jenes darstellende Moment das Refugium der Schönheit überhaupt.

'Ursprung des deutschen Trauerspiels', p. 211.

*[Only Eros] can bear witness …*

**Page 7–8**

Und nur dieser [Eros] kann es bezeugen, daß Wahrheit nicht Enthüllung ist, die das Geheimnis vernichtet, sondern Offenbarung, die ihm gerecht wird.

'Ursprung des deutschen Trauerspiels', p. 211.

*For ideas are not represented …*

**Page 8**

Denn nicht an sich selbst, sondern einzig und allein in einer Zuordung dinglicher Elemente im Begriff stellen sich Dinge dar. Und zwar tun sie es als deren Konfiguration.

'Ursprung des deutschen Trauerspiels', p. 214.

*[The idea is the ] objective virtual arrangement …*

**Page 8**

Denn in Ideen sind die Phänomene nicht einverleibt. Sie sind in ihnen nicht enthalten. Vielmehr sind die Ideen deren objektive virtuelle Anordung.

'Ursprung des deutschen Trauerspiels', p. 214.

*The value of fragments …*

**Page 8**

Der Wert von Denkbruchstücken ist umso entscheidender, je minder sie unmittelbar an der Grundkonzeption sich zu messen vermögen und von ihm hängt der Glanz der Darstellung im gleichen Maße ab, wie der des Mosaiks von der Qualität des Glasflusses.

'Ursprung des deutschen Trauerspiels', p. 209.

*Ideas are timeless constellations …*

**Page 9**

Ideen sind ewige Konstellationen und indem die Element als Punkte in derartige Konstellationen erfaßt werden, sind die Phänomene aufgeteilt und gerettet zugleich.

'Ursprung des deutschen Trauerspiels', p. 215.

*Ideas subscribe to the law …*

**Page 9**

Und so bekennen die Ideen das Gesetz, das da besagt: Alle Wesen existieren in vollendeter Selbständigkeit und Unberührtheit, nicht von den Phänomenen allein, sondern zumal voneinander.

'Ursprung des deutschen Trauerspiels', p. 217.

*It is not surprising that the philosopher of the Monadology …*

**Page 9**

Von der Aufgabe einer derartigen Versenkung aus betrachtet scheint es nicht rätselhaft, daß der Denker der Monadologie der Begründer der Infinitesimalrechnung war.

'Ursprung des deutschen Trauerspiels', p. 229.

*The ideas is a monad …*

**Page 10**

Die Idee ist Monade—das heißt in Kürze: jede Idee enthält das Bild der Welt.

'Ursprung des deutschen Trauerspiels', p. 229.

*Plainly put: the idea of science is research …*

**Page 12**

Schlicht gesagt: die Idee der Wissenschaft ist Forschung, die der Philosophie Deutung. Dabei bleibt das Große, vielleicht das immerwährende Paradoxon: daß Philosophie stets und stets und mit dem Anspruch auf Wahrheit deutend verfahren muß, ohne jemals einen gewissen Schlüssel der Deutung zu besitzen; daß ihr mehr nicht gegeben sind als flüchtige verschwindende Hinweise in den Rätselfiguren des Seienden und ihren wunderlichen Verschlingungen.

Theodor W. Adorno, 'Die Aktualität der Philosophie', in *Gesammelte Schriften*, 1, ed. by Rolf Tiedemann (Frankfurt am Main: Suhrkamp 1973), p. 334.

*The text, which philosophy is given to interpret …*

**Page 12**

[M]ögen immer unsere Wahrnehmungsbilder Gestalten sein, die Welt in der wir leben und die sich anderkonstituiert als aus bloßen Wahrnehmungsbildern, ist es nicht; der Text, den Philosophie zu lesen hat, ist unvollständig, widerspruchsvoll und brüchig und vieles daran mag der blinden Dämonie überantwortet sein.

'Die Aktualität der Philosophie', p. 334.

*Philosophy must always begin anew …*

**Page 12**

[D]arum muß sie [die Philosophie] stets von neuem anheben; darum kann sie doch des geringsten Fadens nicht entraten, den die Vorzeit gesponnen hat und der vielleicht gerade die Lineatur ergänzt, die die Chiffern in einen Text verwandeln können.

'Die Aktualität der Philosophie' p. 334.

*Just as riddle solving is constituted …*

**Page 13**

Und wie Rätsellösungen sich bilden, indem die singulären und versprengten Elemente der Frage so lange in verschiedene Anordnungen gebracht werden, bis sie zur Figur zusammenschiessen, aus der die Löung hervorspringt, während die Frage verschwindet—, so hat die Philosphie ihre Elemente, die sie von der Wissenschaft empfängt, so lange in wechselnde Konstellationen, oder, um es mit einem minder astrologischen und wissenschaftlich aktuelleren Ausdruck zu sagen: in wechselnde versuchsandordungen zu bringen.

'Die Aktualität der Philosophie', p. 335.

*The task of philosophy is …*

**Page 13**

Aufgabe der Philosophie ist es nicht, verborgene und vorhandene Intentionen der Wirklichkeit zu erforschen, sondern die intentionslose Wirklichkeit zu deuten, indem sie kraft der Konstruktion von Figuren, von Bildern aus den isolierten Elementen der Wirklichkeit die Frage aufhebt, deren prägnante Fassung Aufgabe der Wissenschaft ist;

'Die Aktualität der Philosophie', p. 335.

*The function which the traditional philosophical inquiry expected …*

**Page 13**

Nämlich dies, daß die Funktion, die die herkömmliche philosophische Frage von übergeschichtlichen, symbolisch bedeuteten Ideen erwartet, von innergeschichtlich konstituierten und unsymbolischen geleistet wird. Damit aber wäre auch das Verhältnis von Ontologies und Geschichte prinzipiell anders gestellt, ohne das man darum des Kunstgriffes bedürfte, Geschichte als Totalität, in Gestalt bloßer 'Geschichtlichkeit' zu ontologisieren, wobei jede spezifische Spannung zwischen Deutung und Gegenstand verloren und lediglich ein maskierter Historismus zurückgeblieben wäre. Stattdessen wäre nach meiner Auffassung Geschichte nicht mehr der Ort, aus dem die Ideen aufsteigen, selbständig sich abheben und wieder verschwinden, sondern die geschichtlichen Bilder wären selber gleichsam Ideen, deren Zusammenhang intentionslos Wahrheit ausmacht, anstatt daß Wahrheit als Intention in Geschichte vorkäme.

'Die Aktualität der Philosophie', pp. 337–338.

*The interpretation of given reality …*

**Page 14**

Die Deutung der vorgefundenen Wirklichkeit und ihre Aufhebung sind aufeinander bezogen. Nicht zwar wird im Begriff die Wirklichkeit aufgehoben; aber aus der Konstruktion der Figur des Wirklichen folgt allemal prompt die Forderung nach ihrer realen Veränderung.

'Die Aktualität der Philosophie', p. 338.

*The historical images do not lie …*

**Page 14**

Denn die geschichtlichen Bilder, die nicht den Sinn des Daseins ausmachen, aber dessen Fragen lösen und auflösen—, diese Bilder sind keine bloße Selbstgegebenheit. Sie liegen nicht organisch in Geschichte bereit; es bedarf keiner Schau und keiner Intuition ihrer Gewahr zu werden, sie sind keine magischen Geschichtsgottheiten, die hinzunehmen und zu verehren wären. Vielmehr: sie müssen vom Menschen hergestellt werden und legitimieren sich schliesslich allein dadurch, daß in schlagender Evidenz die Wirklichkeit um sie zusammenschließt.

'Die Aktualität der Philosophie', p. 341.

*Speaking purposely of grouping …*

**Page 14**

Bei der Handhabung des Begriffsmaterials durch Philosophie rede ich nicht ohne Absicht von Gruppierungen und Versuchanordungen, von Konstellation und Konstruktion.

'Die Aktualität der Philosophie', p. 341.

*This book, of course was certainly not …*

Page 15

Nun war dieses Buch gewiß nicht materialistisch, wenn auch bereits dialektisch.

Walter Benjamin, *Briefe*, ed. by Gershom Scholem and Theodor W. Adorno (Frankfurt am Main: Suhrkamp, 1966), p. 523.

*An object of history is that …*

**Page 16**

1) Gegenstand der Geschichte ist dasjeninge, an dem die Erkenntnis als dessen Rettung vollzogen wird. 2) Geschichte zerfällt in Bilder, nicht in Geschichten. 3) Wo ein dialektischer Prozess sich vollzieht, da haben wir es mit einer Monade zu tun […]

'Das Passagen-Werk', pp. 595–596.

*A highly remarkable and extremely precarious essay …*

**Page 17**

Wenn ich die Arbiet, mit der ich augenblicklich, vorsichtig, provisorisch beschäftigt bin – den sehr merkwürdigen und äußerst prekären Versuch 'Pariser Passagen. Eine dialektische Feerie' so oder so (denn nie habe ich mit solchem 'Risiko des Mißlingens' geschrieben) beendet habe, so wird für mich ein Produktionskreis—der der 'Einbahnstraße'—in ähnlichem Sinn geschlossen sein, wie das Trauerspielbuch der germanistischen abschloß. Die profanen Motive der 'Einbahnstraße' werden da in einer höllischen Steigerung vorbeidefilieren. Verraten kann ich im übrigen von dieser Sache noch nichts, habe noch nicht einmal eine genaue Vorstellung vom Umfang. Immerhin ist das eine Arbeit von wenigen Wochen.

*Briefe*, p. 455.

*Method of this project …*

**Page 18**

Methode dieser Arbeit: literarische Montage. Ich habe nichts zu sagen, nur zu zeigen.

'Das Passagen-Werk', p. 574.

*A screen placed in front of the* Paris Arcades *…*

**Page 18**

In der Tat ist diese Arbeit ein Paravent vor den 'Pariser Passagen'—und ich habe manchen Grund was dahinter vorgeht geheim zu halten.

*Briefe,* p. 491.

*No face is surrealistic in the same degree …*

**Page 18**

Und kein Gesicht ist in dem Grade surrealistisch wie das wahre Gesicht einer Stadt. Kein Bild von Chirico oder Max Ernst kann mit den scharfen Aufrissen ihres inneren Forts sich messen [...].

Walter Benjamin, 'Der Sürrealimus. Die letzte Momentaufnahme der europäischen Intelligenz' in *Gesammelte Schriften*, II/1, ed. by Rolf Tiedemann and Hermann Schweppenhäuser (Frankfurt am Main: Suhrkamp, 1977), p. 300.

*In what way is it possible to conjoin …*

**Page 19**

Auf welchem Weg es möglich ist, gesteigerte Anschaulichkeit mit der Durchführung der marxistischen Methode zu verbinden. Die erste Etappe dieses Weges wird sein, das Prinzip der Montage in die Geschichte zu übernehmen. Also die großen Konstruktionen aus kleinsten, scharf und schneidend konfektionierten Baugliedern zu errichten. Ja in der Analyse des kleinen Einzelmoments den Kristall des Momentgeschehens zu entdecken.

'Das Passagen-Werk', p. 575.

*These [i.e. 'the minimal','the 'little', the'few'] are dimensions …*

**Page 19**

Das sind Maßstäbe, die schon lange in den Konstruktionen der Technik und Architektur zur Geltung gekommen sind ehe die Literatur Miene macht, ihnen sich anzupassen. Im Grunde handelt es sich um die früheste Erscheinungsform des Prinzips der Montage. Über den Bau des Eiffelturms: 'So schweigt hier die lastische Bildkraft zugunsten einer ungeheuren Spannung geistiger Energie, welche die anorganische stoffliche Energie in die kleinsten, wirksamsten Formen bringt und diese miteinander in der wirksamsten Weise verbindet…Jedes der 12 000 Metallstücke ist auf Millimeter genau bestimmt, jeder der 2 1/2 Millionen Niete … Auf diesem Werkplatz ertönte kein Meisselschlag, der dem Stein die Form entringt; selbst dort herrschte der Gedanke über die Muskelkraft, die er auf sichere Gerüste und Kräne übertrug.'

'Das Passagen-Werk', p. 223.

*To encomapss both Breton and Le Corbusier …*

**Page 19**

Breton und Le Corbusier umfassen—das hieße den Geist des gegenwärtigen Frankreich wie einen Bogen spannen, aus dem die Erkenntnis den Augenblick mitten ins Herz trifft.

'Das Passagen-Werk', p. 573.

*[W]hereas Aragon persists with the realm of dreams …*

**Page 19**

Während Aragon im Traumbereich beharrt, soll hier die Konstellation des Erwachens gefunden werden.

'Das Passagen-Werk', p. 571.

*Constellation of the real …*

**Page 20**

Nicht also wäre danach das dialektische Bild als Traum ins Bewußtsein zu verlegen, sondern durch die dialektische Konstruktion wäre der Traum zu entäußern und die Bewußtseinsimmanenz selber als eine Konstellation des Wirklichen zu verstehen.

*Briefe,* p. 673.

*It is up to us to polarise and dissolve …*

**Page 20**

An uns ist es, dies 'Bewußtsein' nach Gesellschaft und Einzelnem dialektisch zu polarisieren und aufzulösen und nicht es als bildliches Korrelat des Warencharakters zu galvanisieren.

*Briefe,* p. 675.

*Dialectical images as models …*

**Page 20**

Noch möchte ich hier ergänzen: dialektische Bilder sind als Modelle keine gesellschaftlichen Produkte, sondern objektive Konstellationen, in denen der gesellschaftliche Zustand sich selbst darstellt.

*Briefe,* p. 678.

*How apt [Adorno's] definition of the dialectical image …*

**Page 20**

[W]ie zutreffend mir Wiesengrunds Bestimmung des dialektischen Bildes als 'Konstellation' erscheint—und wie unveräußerlich mir gleichwohl gewisse Elemente dieser Konstellation scheinen, auf die ich hinwies: nämlich die Traumgestalten. Das dialektische Bild malt den Traum nicht nach—das zu behaupten lag niemals in meiner Absicht. Wohl aber scheint es mir, die Instanzen, die Einbruchsstelle des Erwachens zu enthalten, ja aus diesen Stellen seiner Figur wie ein Sternbild aus den leuchtenden Punkten erst herzustellen. Auch hier also will noch ein Bogen gespannt, eine Dialektik bezwungen werden: die zwischen Bild und Erwachen.

Theodor W. Adorno and Walter Benjamin, *Briefwechsel 1928-1940*, ed. by Henri Lonitz (Frankfurt am Main: Suhrkamp, 1994), p. 157.

*Is awakening perhaps the synthesis …*

**Page 21**

Sollte Erwachen die Synthesis sein aus der Thesis des Traumbewusstseins und der Antithesis des Wachbewusstsein? Dann wäre der Moment des Erwachens identisch mit dem 'Jetzt der Erkennbarkeit', in dem die Dinge ihre wahre—surrealistische—Miene aufsetzen.

'Das Passagen-Werk', p. 579.

*A historian […] stops telling the sequence of events …*

**Page 21**

Der Historiker, der davon ausgeht, hört auf, sich die Abfolge von Begebenheiten durch die Finger laufen zu lassen wie einen Rosenkranz. Er erfaßt die Konstellation, in die seine eigene Epoche mit einer ganz bestimmten früher getreten ist. Er begründet so einen Begriff der Gegenwart als der 'Jetztzeit', in welcher Splitter der messianischen eingesprengt sind.

'Über den Begriff der Geschichte', p. 704.

*If the object of history is to be blastedout of the continuum …*

**Page 22**

Daß der Gegenstand der Geschichte aus dem Kontinuum des Geschichtsverlaufes herausgesprengt werde, das wird von seiner monadologischen Struktur gefordert. Diese triff erst am herausgesprengten Gegenstand zu Tage. Und zwar tut sie dies in Gestalt der geschichtlichen Auseinandersetzung, die das Innere (und gleichsam die Eingeweide des historischen Gegenstandes ausmacht und in die sämtliche historischen Kräfte und Interessen in verjüngtem Maßstabe eintreten. Kraft dieser monadologischen Struktur des historischen Gegenstandes findet er in seinem Innern die eigene Vorgeschichte und Nachgeschichte repräsentiert.

'Das Passagen-Werk', p. 594.

*Motifs are assembled but they are not developed …*

**Page 22**

Es werden die Motive versammelt aber nicht durchgeführt. […] Kann aber diese Verfahrensweise auf den Komplex der Passagen übertragen werden? Panorama und 'Spur', Flaneur und Passagen, Moderne und immer Gleiches *ohne* theoretische Interpretation—ist das ein 'Material, das geduldig auf Deutung warten kann, ohne daß es von der eigenen Aura verzehrt würde?

*Briefwechsel 1928-1940,* p. 365.

*The 'mediation' I miss and find …*

**Page 23**

Die 'Vermittlung', die ich vermisse und verdeckt finde durch materialistisch-historiographische Beschwörung, ist nun aber nicht anders als eben die Theorie, die Ihre Arbeit ausspart.

*Briefwechsel 1928-1940*, p. 368.

*The theological motif of calling things by their names …*

**Page 23**

[d]as theologische Motiv, die Dinge beim Namen zu nennen, schlägt tendenziell um in die staunende Darstellung der bloßen Faktizität. Wollte man sehr drastisch reden, so könnte man sagen, die Arbeit sei am Kreuzweg von Magie und Positivismus angesiedelt. Diese Stelle ist verhext. Nur die Theorie vermöchte den Bann zu brechen: Ihre eigene, die rücksichtslose, gut spekulative Theorie. Es ist deren Anliegen allein, das ich gegen Sie anmelde.

*Briefwechsel 1928-1940*, p. 368.

*The translation of the language of things …*

**Page 23**

Die Übersetzung der Sprache der Dinge in die des Menschen ist nicht nur Übersetzung des Stummen in das Lauthafte, sie ist die Übersetzung des Namenlosen in den Namen.

Walter Benjamin, 'Über Sprache überhaupt und über die Sprache des Menschen', in *Gesammelte Schriften*, II/1, ed. by Rolf Tiedemann and Hermann Schweppenhäuser (Frankfurt am Main: Suhrkamp, 1977), p. 151.

*As inquirers into the old tradition …*

**Page 24**

Wir müssen nämlich als Erforscher der alten Überlieferungen damit rechnen daß sinnfällige Gestaltung, mimetischer Objektcharakter bestanden habe, wo wir ihn heute nicht einmal zu ahnen fähig sind. Zum Beispiel in den Konstellationen der Sterne.

Das zu erfassen wird man vor allem einmal das Horoskop als eine originäre Ganzheit, die in der astrologischen Deutung nur analysiert wird, begreifen müssen. (Der Gestirnstand stellt eine charakteristische Einheit dar und erst an ihrem Wirken im Gestirnstand werden die Charaktere der einzelnen Planeten erkannt.) Man muß, grundsätzlich, damit rechnen, daß Vorgänge am Himmel von früher lebenden, und zwar sowohl durch Kollektiva als durch Einzelne, nachahmbar waren: ja, daß diese Nachahmbarkeit die Anweisung enthielt, eine vorhandene Ähnlichkeit zu handhaben. In dieser Nachahmbarkeit durch den Menschen, bezw. dem mimetischen Vermögen, das dieser hat, muß man wohl bis auf weiteres die einzige Instanz erblicken, welche der Astrologie ihren Erbaungscharakter gegeben hat. Wenn aber wirklich das mimetische Genie eine lebensbestimmende Kraft der Alten gewesen ist, dann ist es kaum anders möglich, als den Vollbesitz dieser Gabe,

insbesondere die vollendete Anbildung an die kosmische Seinsgestalt, dem Neugeborenen beizulegen.

Der Augenblick der Geburt, der hier entscheiden soll, ist aber ein Nu. Das lenkt den Blick auf eine andere Eigentümlichkeit im Bereich der Ähnlichkeit. Ihre Wahrnehmung ist in jedem Fall an ein Aufblitzen gebunden. Sie huscht vorbei, ist vielleicht wiederzugewinnen, aber kann nicht eigentlich wie andere Wahrnehmungen festgehalten werden. Sie bietet sich dem Auge ebenso flüchtig, vorübergehend wie eine Gestirnkonstellation. Die Wahrnehmung von Ähnlichkeiten also scheint an ein Zeitmoment gebunden. Es ist wie das Dazukommen des Dritten, des Astrologen zu der Konjuktion von zwei Gestirnen, die im Augenblick erfaßt sein will. Im andern Fall kommt der Astrologe trotz aller Schärfe einer Beobachtungswerkzeuge hier um seinen Lohn.

Der Hinweis auf Astrologie mag schon genügen, den Begriff von einer unsinnlichen Ähnlichkeit verständlich zu machen. Es ist, wie sich von selbst versteht, ein relativer: er besagt, daß wir in unserer Wahrnehmung dasjenige nicht mehr besitzen, was es einmal möglich machte, von einer Ähnlichkeit zu sprechen, die bestehe zwischen einer Sternkonstellation und einem Menschen. Jedoch auch wir besitzen einen Kanon, nach dem die Unklarheit, die dem Begriff von unsinnlicher Ähnlichkeit anhaftet, sich seiner Klärung näher bringen läßt. Und dieser Kanon ist die Sprache.

Walter Benjamin, 'Lehre vom Ähnlichen', in *Gesammelte Schriften*, II/1, ed. by Rolf Tiedemann and Hermann Schweppenhäuser (Frankfurt am Main: Suhrkamp, 1977), pp. 206-207.

*This [i.e. learning language] ...*

**Page 25**

Das sind die vollständigen Prolegomena einer jeden rationalen Astrologie.

Walter Benjamin, 'Zur Astrologie', in *Gesammelte Schriften*, VI, ed. by Rolf Tiedemann and Hermann Schweppenhäuser (Frankfurt am Main: Suhrkamp, 1985), p. 193.

*It is non-sensuous similarity ...*

**Page 25**

Kurz, es ist unsinnliche Ähnlichkeit, die die Verspannungen nicht nur zwischen dem Gesprochenen und dem Gemeinten sondern auch zwischen dem Geschriebenen und Gemeinten und gleichfalls zwischen dem Gesprochenen und Geschriebenen stiftet.

Walter Benjamin, 'Über das mimetische Vermögen', in *Gesammelte Schriften*, II/1, ed. by Rolf Tiedemann and Hermann Schweppenhäuser (Frankfurt am Main: Suhrkamp 1977, p. 212.

*The attempt to procure ...*

**Page 26**

Versuch einer Anschauung von der Astrologie sich unter Ausschaltung der magischen 'Einfluß' -Lehre, der 'Strahlenkräfte' u.s.w. zu verschaffen.

'Zur Astrologie', p. 192.

*A particularly striking confirmation of that general process …*

**Page 26**

[…] eine besonders bedeutsame Bestätigung des Umschmelzungsprozesses zu sehen, der die ganze, ursprünglich metaphysisch bewegte Gedankenmasse einem Aggregatszustand entgegengeführt hat, in dem die Welt der dialektischen Bilder gegen alle Einreden gesichert ist, welche die Metaphysik provoziert.

*Briefwechsel 1928-1940*, p. 119.

*Dialectics—literally: language as the organon of thought …*

**Page 27**

Dialektik, dem Wortsinn nach Sprache als Organon des Denkens, wäre der Versuch, das rhetorische Moment als kritisch zu erretten: Sache und Ausdruck bis zur Indifferenz einander zu nähern. Sie eignet, was geschichtlich als Makel des Denkens erschien, seinen durch nichts zu zerbrechenden Zusammenhang mit der Sprache, der Kraft des Geschehens zu.

Theodor W. Adorno, 'Negative Dialektik', in *Gesammelte Schriften*, 6, ed. by Rolf Tiedemann (Frankfurt am Main: Suhrkamp, 1973), p. 66.

*The name of dialectics says no more …*

**Page 27**

Ihr Name sagt zunächst nichts weiter, als das die Gegenstände in ihrem Begriff nicht aufgehen, daß diese in Widerspruch geraten mit der hergebrachten Norm der adäquatio. Der Widerspruch ist nicht, wozu Hegels absoluter Idealismus unvermeidlich ihn verklären mußte: kein herakliteisch Wesenhaftes. Er ist der Index der Unwahrheit von Identität, des Aufgehens des Begriffenen im Begriff.

'Negative Dialektik', p. 17.

*The determinable flaw in every concept makes …*

**Page 27n**

Der bestimmbare Fehler aller Begriffe nötigt, andere herbeizuzitieren; darin entspringen jene Konstellationen, an die allein von der Hoffung des Namens etwas überging.

'Negative Dialektik', p. 62.

*Concepts enter into a constellation …*

**Page 28**

Das einigende Moment überlebt, ohne Negation der Negation, doch auch ohne der Abstraktion als oberstem Prinzip sich zu überantworten, dadurch, daß nicht von den Begriffen im Stufengang zum allgemeineren Oberbegriff fortgeschritten wird, sondern sie in Konstellationen treten. Diese belichtet das Spezifische des Gegenstands, das dem klassifikatorischen Verfahren gleichgültig ist oder zu Last. Modell dafür ist das Verhalten

der Sprache. Sie bietet kein bloßes Zeichensystem für Erkenntnisfunktionen. Wo sie wesentlich als Sprache auftritt, Darstellung wird, definiert sie nicht ihre Begriffe. Ihre Objektivität verschafft sie ihnen durch das Verhältnis, in das sie die Begrifre, zentriert um eine Sprache, setzt. Damit dient sie der Intention des Begriffs, das Gemeinte ganz auszudrücken. Konstellationen allein repräsentieren, von außen, was der Begriff im Inneren weggeschnitten hat, das Mehr, das er sein will so sehr, wie er es nicht sein kann. Indem die Begriffe um die zu erkennende Sache sich versammeln, bestimmen sie potenziell deren Inneres, erreichen denkend, was Denken notwendig aus sich ausmerzte.

'Negative Dialektik', pp. 164 –65.

*Becoming aware of the situation …*

**Page 28**

Der Konstellation gewahr werden, in der die Sache steht, heißt soviel wie diejenige entziffern, die es als Gewordenes in sich trägt. Der Chorismos von draußen und drinnen ist seinerseits historisch bedingt. Nur ein Wissen vermag Geschichte im Gegenstand zu entbinden, das auch den geschichtlichen Stellenwert des Gegenstandes in seinem Verhältis zum anderen gegenwärtig hat; Aktualisierung und Konzentration eines bereits Gewußten, das es verwandelt. Erkenntnis des Gegenstandes in seiner Konstellation ist die des Prozesses, den er in sich aufspeichert. Als Konstellation umkreist der theoretische Gedanke den Begriff, den er öffnen möchte, hoffend, daß er aufspringe etwa wie die Schlösser wohlverwahrter Kassenschränke: nicht nur durch einen Einzelschlüssel oder eine Einzelnummer sondern eine Nummerkombination.

'Negative Dialektik', pp. 165–166.

*[Benjamin's] admission of surrender …*

**Page 29**

Benjamin, dessen ursprüngliche Passagenentwurf unvergleichlich spekulatives Vermögen mit mikrologischer Nähe zu den Sachverhalten verband, hat sich in einer Korrespondenz über die erste, eigentlich metaphysische Schicht jener Arbeit später geurteilt, sie sei nur als 'unerlaubt 'dichterische' ' zu bewältigen. Diese Kapitulationserklärung designiert ebenso die Schwierigkeit von Philosophie, die nicht abgleiten will, wie den Punkt an dem ihr Begriff weiterzutreiben ist. Sie wurde gezeitigt wohl von der gleichsam weltanschaulichen Übernahme des dialektischen Materialismus mit geschlossenen Augen. Daß aber Benjamin zur endgültigen Niederschrift der Passagentheorie nicht sich entschloß, mahnt daran, daß Philosophie nur noch dort mehr als Betrieb ist, wo sie dem totalen Mißlingen sich exponiert, als Antwort auf die traditionell erschlichene absolute Sicherheit.

'Negative Dialektik', pp. 29–30.

## B Original texts of translations from the French cited in Part II

*If I have departed from the ordinary route …*

**Page 61**

Si je me suis écarté de la route ordinaire dans la manière de représenter les constellations, ce n'est point à dessein de heurter les usages reçus jusqu'à présent; l'utilité seule a paru devoir m'y engager.

Robert de Vaugondy, *Uranographie: ou, description du ciel en deux hémisphères* (Paris: Antione Boudet, 1763), p. iii.

*I consider the constellations as celestial provinces …*

**Page 61**

Je considère ces constellations comme des provinces célestes désignées sous leurs noms propres, & dont les étoiles portent aussi chacune leurs caractères. Des couleurs appliquées au contour de chacune de ces contrées, procurent surement plus de facilité dans l'étude des astres, que ces figures dont les traits qui se croisent, jettent souvent en erreur, & font prendre pour des étoiles ce qui n'en est pas. De plus l'on n'a point d'inquiétude de sçavoir à quelle constellation attribuer des étoiles qui on reçu le nom d'informes, de ce que la proportion requise dans le dessein d'une figure ne permet pas de les y renfermer.

Vaugondy, *Uranographie*, p. vi.

*The figures of men and animals which are still found traced on [Bode's Uranographia] …*

**Page 68**

Dans le premier [Bode], les figures d'hommes et d'animaux qui s'y trouvent encore tracées nuisent beaucoup à l'aspect des constellations en rendent la configuration difficile à saisir. […] Le deuxième [Harding], qui contient une immense quantité d'étioles jusqu'à la dixième grandeur, est le travail le plus complet qui ait jamais été publié. Tout y est représenté avec une étonnante exactitude: les configurations, la grandeur des étioles, etc. Plus on le compare avec le ciel, plus on reconnaît combien son auteur a droit a la reconnaissance des astronomes. […] Il est à regretter que la partie graphique de cet ouvrage ne réponde pas à l'exactitude des données: les signes représentant les étoiles peu différents, il est difficile de juger de leurs grandeurs relatives; les constellations se trouvent toujours comprises dans plusieurs feuilles: le Taureau, par exemple, est divisé en trois planches, la Vierge en cinq, etc., ce qui est quelquefois embarassant; la projection est tracée degré par degré et uniformément ; rien ne distingue, par exemple, les lignes horaires, ce qui peut occasioner des erreurs dans les positions que l'on voudrait déterminer, vu surtout la grandeur du format […]

Charles Dien, *Atlas du Zodiaque* (Paris: Bachelier, 1841), pp. 5–6.

*The plates are organised in such a way …*

**Page 68**

Les planches sont disposées de manière à donner toujours les constellations entières [...] Les noms des constellations sont, par des chiffres de renvoi, placés en dehors du cadre, pour ne nuire que le moins possible à l'effet des étoiles.

*Atlas du Zodiaque*, p. 7.

*I also traced geometric figures …*

**Page 69**

J'ai aussi tracé des figures géométriques liant de la manière la plus naturelle les principales Étoiles de chaque constellation afin d'en faciliter l'étude.

Charles Dien, *Atlas Céleste* (Paris: Mallet-Bachelier, 1865), *Advertissement.*

*The figures of men and animals that the ancients assigned to the constellations …*

**Page 76**

Les figures d'hommes & d'animaux que les anciens on assigné aux constellations pour distinguer les divers grouppes d'étoiles qui se remarquent dans le ciel, n'ont, comme l'on fait, aucun rapport avec la configuration respective de ces étoiles; elles aident à la vérité la mémoire, mais ne peuvent servir à reconnoître les Constellations, à celui qui, pour la première fois, tourne les yeux vers le ciel, il a beau chercher cet Orion, cette Andromède, cet Hercule, dont rien le lui offre la moindre ressemblance, ni le moindre rapport avec ces presonnages.

J'ai pensé qu'il n'y avoit pas de manière plus simple & plus facile d'enseigner à connoître le ciel, que de substituer à ces figures fantanstiques les triangles, quarrés, poligones, ou autres figures Géometriques que présentent réellement à la vue des divers grouppes d'étoiles, en supposant les plus brillantes d'une même Constellation liées ensemble par des lignes.

Alexandre Ruelle, *Nouvelle Uranographie: ou, Methode très facile pour apprendre à connoître les constellations par les configurations des principales étoiles entre-elles* (Paris: de la Marche, 1786), p. 1.

*The Great Bear, of which the seven brightest stars suggest …*

**Page 79**

La Grande *Ourse*, dont les sept plus belles étoiles offrent par leurs dispositions la forme d'un parallelograme, dont un côté est prolongé & recourbé. A ce côté prolongé, il peut attacher l'idée de la queue de l'ourse, dont le parallelograme représentera le corps.

Le *Cygne*, dont les cinq plus belles étoiles figuren assez bien une croix allongé, les quatres extrémités peuvent être regardées comme le bout des ailes, du bec & de la queue de l'oiseau.

*Orion*, une des plus belles constellations dont les cinq plus brillantes étoiles étant jointes par des lignes, forment deux cônes renversés, & rappellent l'idée d'un grand sâblier.

Le *Scorpion*, dont les plus belles étoiles liées ensemble par des lignes, représentent assez la forme d'un cer-volant.

Le *Corbeau*, dont les quatres principales étoiles forment un véritable trapèze.

*Nouvelle Uranographie*, p.4.

*To render these groups or constellations recognisable …*

**Page 79**

Pour rendre ces grouppes ou ces constellations reconoissables, je n'ai lié par un trait noir que les étioles les plus frappantes à la vue, celles qui au premier coup d'œil offrent un assemblage & et une figure facile à saisir; ce sont ces étoiles que les Astronomes appelent de *première, seconde* & *triosième grandeur*, les autres plus petites ne sont jointes que par des lignes ponctuées; elles s'aperçoivent difficilement dans le crépuscule ou dans le clair de Lune.

*Nouvelle Uranographie*, p.2.

*It is for this reason that we have preferred not to draw the figures …*

**Page 82**

C'est pour cela que nous avons préféré ne pas dessiner ces figures dans les cartes, qui eussent été plus confuses sans profit pour l'instruction, et qui, peut-être, eussent été d'un usage incommode, en présentant à l'esprit des images fausses.

Louis-Benjamin Francœur, *Uranographie: ou, traité élémentaire d'astronomie à l'usage des personnes peu versées dans les mathématiques* (Paris: Béchet, 1812), p. 216.

*It is very difficult to give the explanation of these figures …*

**Page 82**

Mais il est bien difficile de donner à l'explication des ces figures le caractère de vérité qui en fait le seul mérite et le charme. Ce ne peut être par un accord unanime entre ces interprétations, que par des rapprochemens vrais avec les usages des peuples créature de cette sorte langue, qu'on peut s'assurer d'être à l'abri de l'erreur. Combien d'homme célèbres se sont trompés sur ce suject épineux! combien d'opinions adoptées légèrement et défendues sans mesure! craignons donc de substituer des erreurs à d'autres. Mais s'il n'est pas possible d'avoir une démonstration mathématique dans les suppositions de cette nature, ne renonçons pas à recevoir celles qui réunisssent un haut degré de probabilité, seule preuve que les vérités historiques puissent offrir.

Francœur, *Uranographie*, p. 216.

*A few comments are necessary on the way in which the constellations have been drawn …*

**Page 84**

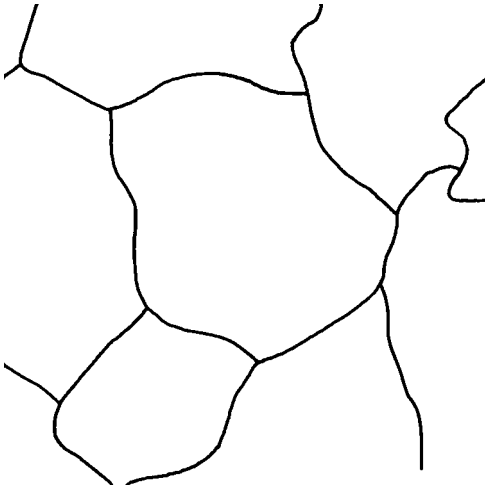
Quelques commentaires s'imposent sur la façcon dont ont été dessinées les constellations. Il y a environ deux-mille ans que nos ancêtres subdivisèrent la voûte céleste en nombreux secteurs, grossièrement délimtés, auxquels on donna le nom de «constellations» ou

d'«astérismes». Dans leur imaginations féconde, ils prétendaient y voir, en raison de l'ordonnance des principales étoiles, des figures mythologiques ou allegoriques, que des artistes s'efforcèrent de dessiner tant bien que mal, sans tenir d'ailleurs exagérément compte des étioles qui devaient normalement servir de repères. Aujourd'hui, on se contente de réunir entre elles les étoiles les plus brillantes, mais comme cette manière de faire présente un nombre considérable de solutions, on en trouve pour ainsi dire autant qu'il y a d'auteurs de cartes célestes. Il faut malheureusement déplorer ce manque de standardisation, qui n'est certes pas de nature à aider les amateurs; ceux-ci verraient au contraire leur besogne singuièrement facilitée si les dessins figurant dans les atlas étaient ceux qui se présentaient logiquement et instinctivement à leurs yeux au sein de la voûte étiolée. C'est ce point de vue qui a primé dans cet ouvrage et c'est aussi la raison pour laquelle certaines figures de constellations sont assez différentes de celles qu'on trouve dans d'autres cartes célestes.

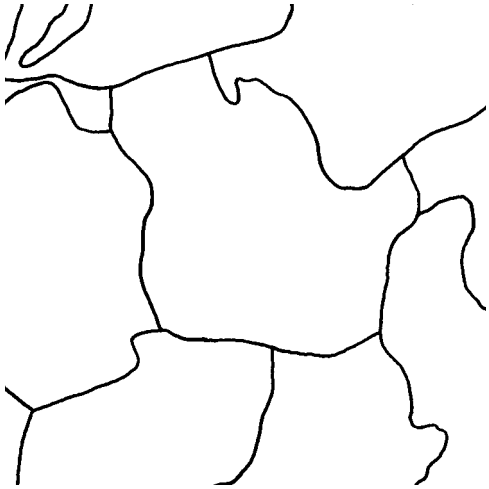
Vincent de Callataÿ, *Atlas du Ciel* (Brussels: Visscher, 1955), p. 14.

## C A comparison of constellation boundaries

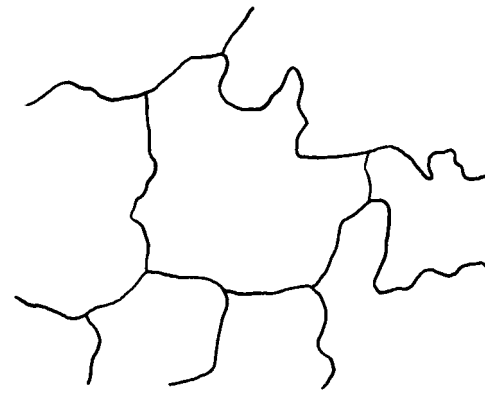
Each of the following drawings shows the pattern of boundaries around the zodiacal constellation Gemini. I have adjusted the drawings to conform to roughly the same scale, but they are not corrected to conform to the same map projection. I have rendered the constellation boundaries by a uniform solid line. The surrounding constellations are more or less complete depending on the portions of sky available on the original plates.



**Robert de Vaugondy, *Uranographie*, Paris, 1763**

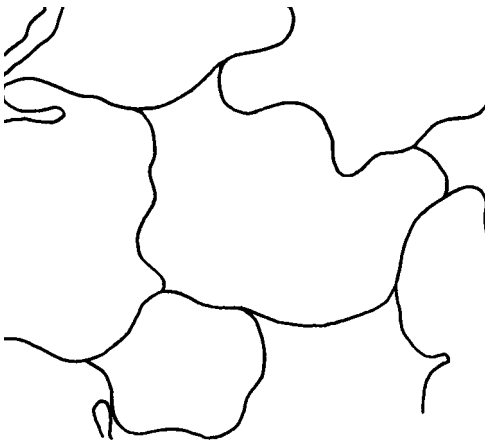


**Noël André, *Planisphère Céleste*, Paris, 1778**

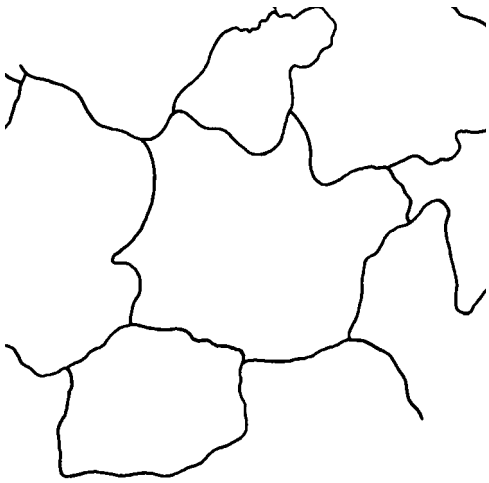


**C. F. Goldbach, *Neuester Himmels-Atlas*, Weimar, 1799**

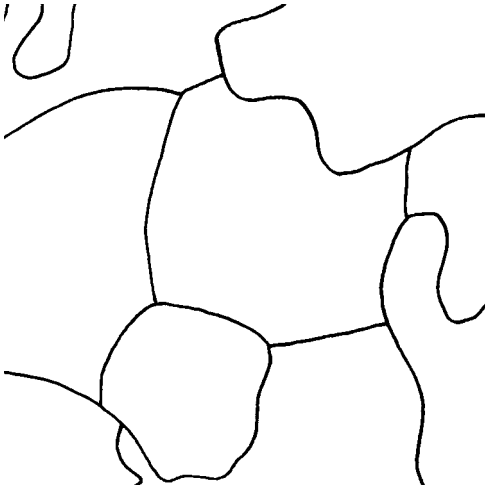
**Johann Elert Bode, *Uranographia*, Berlin, 1801**



**M. Wollaston, *Celestial Hemispheres*, London 1809**



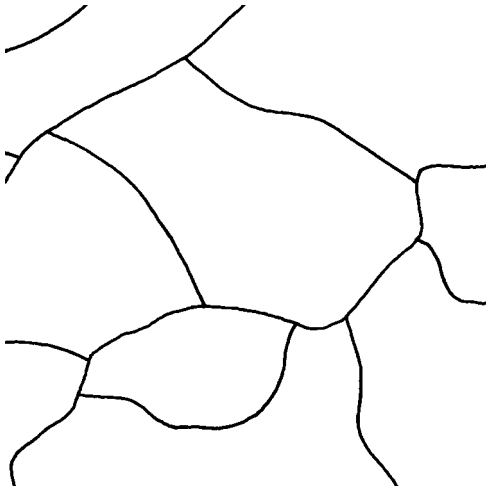
**R. D. Dawson et al, *A Planisphere of the Stars in the Northern Hemisphere*, London, 1830**



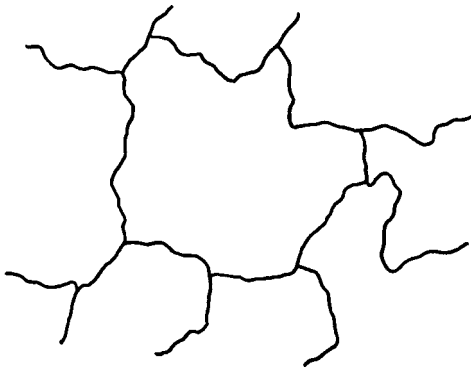
**G. Rubie, *British Celestial Atlas*, London, 1830**

**Elijah H. Burrit, *Atlas Designed to Illustrate the Geography of the Heavens*, New York, 1835**

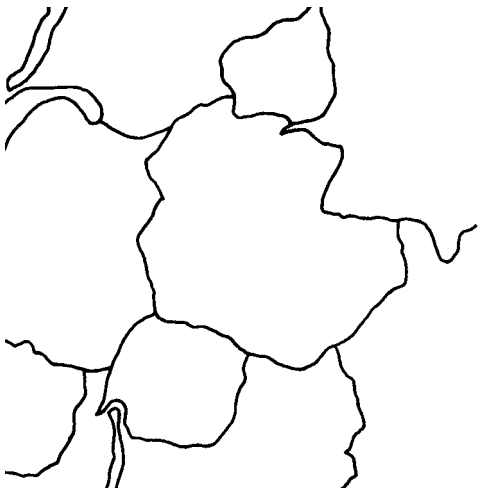
**Charles Dien, *Atlas du Zodiaque* (main map), Paris, 1841**



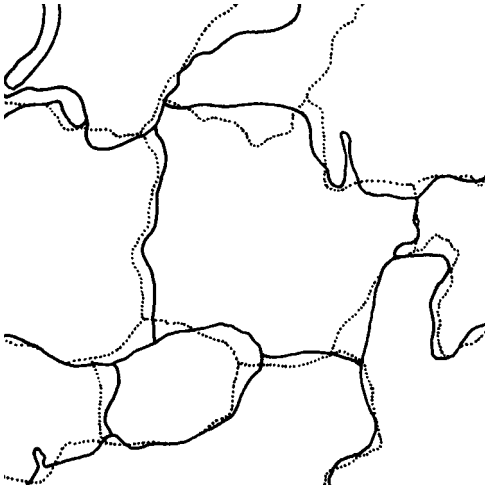
**Charles Dien, *Atlas du Zodiaque* (index map), Paris, 1841**



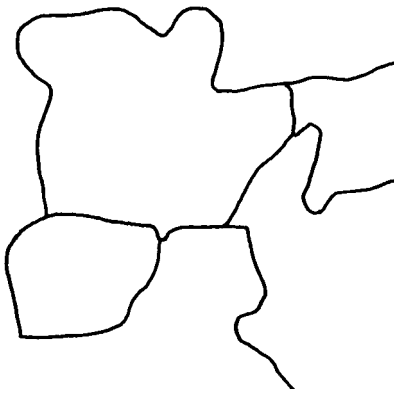
**Karl Friedrich Vollrath Hoffmann, *Himmels-Atlas*, Stuttgart, 1842**



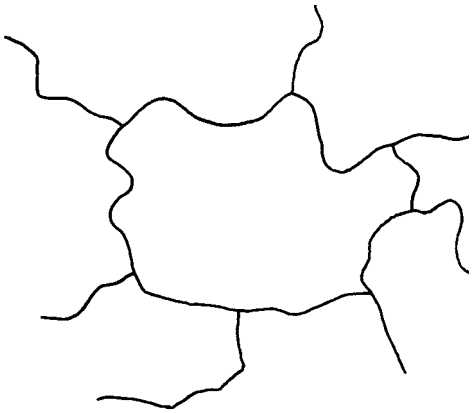
**J. Middleton, *Celestial Atlas*, London, 1842**



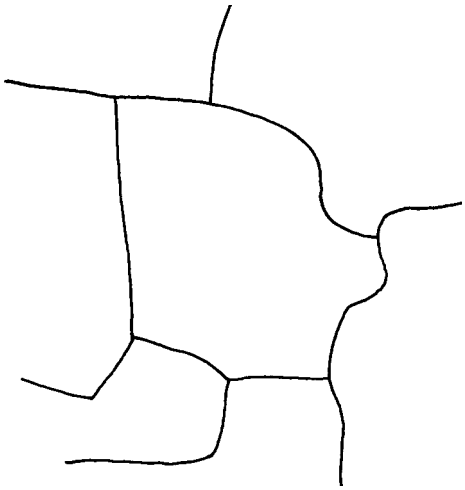
**G. Schwink, *Mappa Coelestis*, Leipzig, 1843**



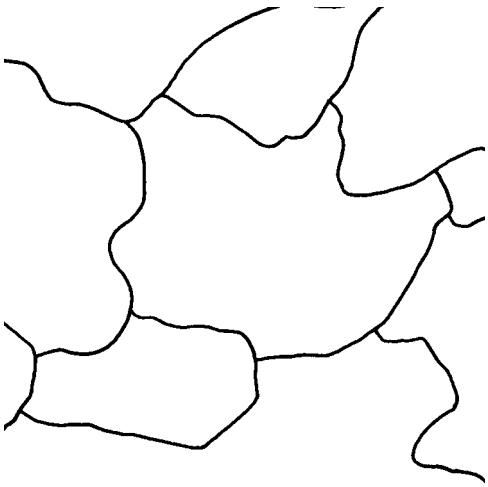
**F. W. A. Argelander, *Uranometria Nova*, Berlin, 1843**



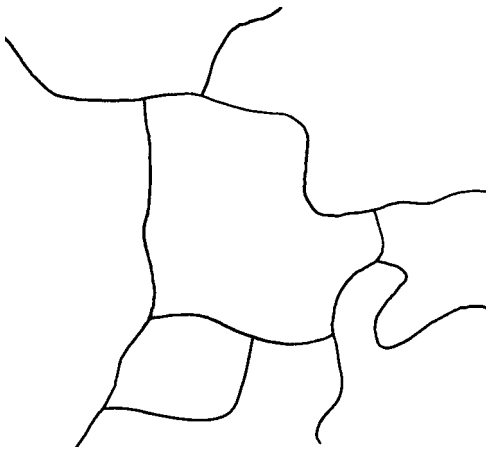
**E. Otis Kendall, *Uranography or a Hescription of the Heavens*, Philadelphia, 1844**



**John William Lubbock, *The Stars in Six Maps*, London, 1844**

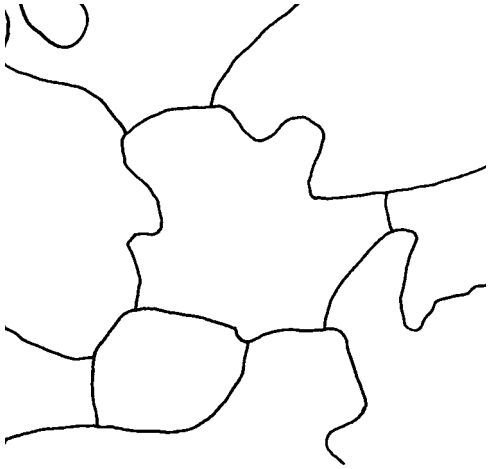


**Fr. Braun, *Himmels-Atlas in transparenten Karten*, Stuttgart, 1855**

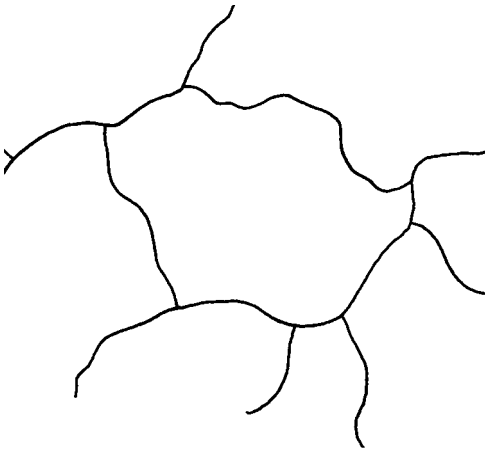


**Alexander Keith Johnston, *School Atlas of Astronomy*, Edinburgh, 1855**

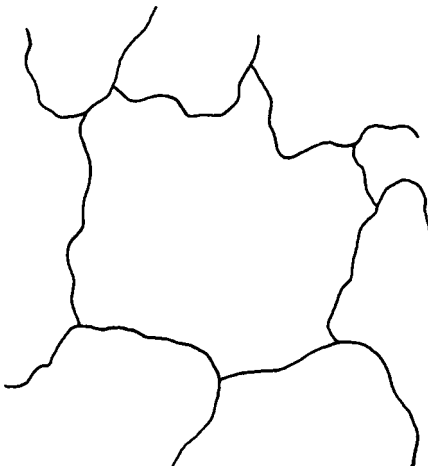
**Charles Dien, *Atlas Céleste*, Paris, 1865**



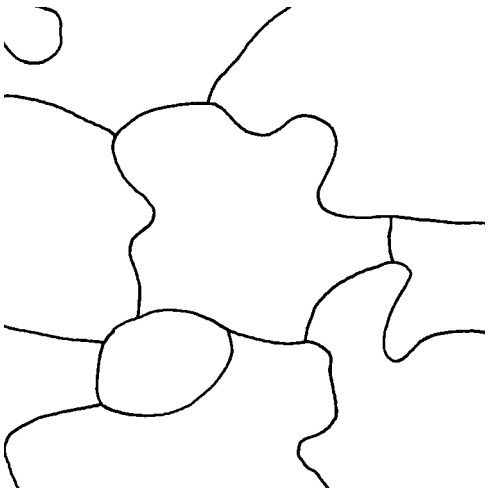
**Eduard Heis, *Atas Coelestis Novus*, Cologne, 1872**



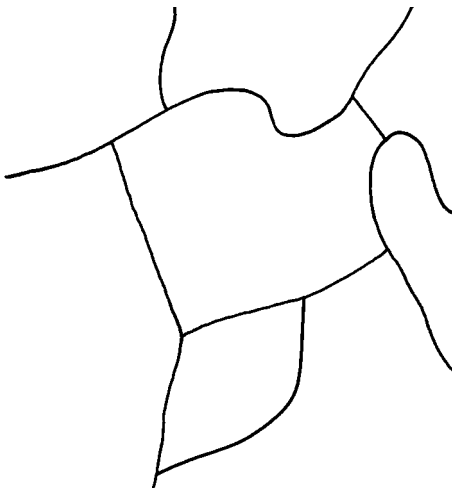
**J. Müller, *Atlas zum Lehrbuch der kosmischen Physik*, Braunschweig, 1875**



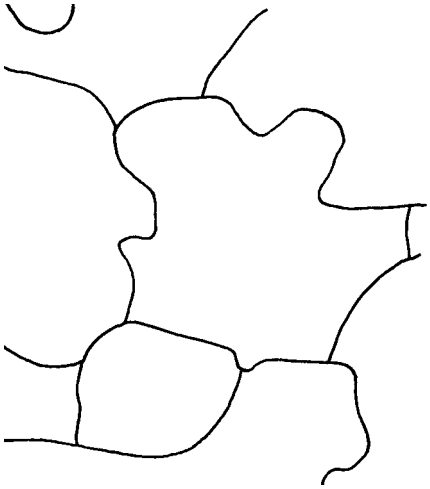
**Adolf Stieler, *Hand Atlas*, Gotha, 1877**



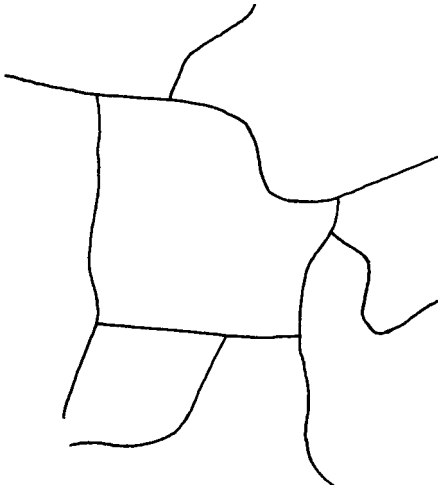
**Eduard Heis, *Atas Coelestis Eclipticus*, Ashendorff, 1878**



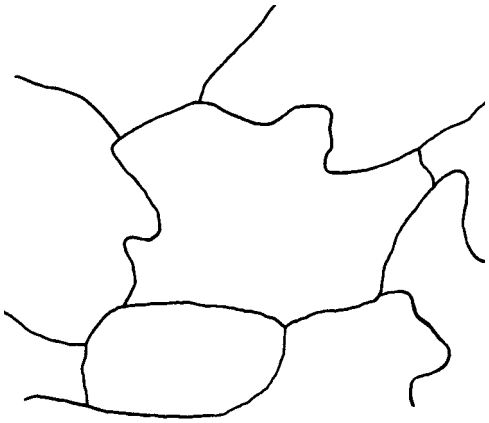
**Richard A. Proctor, *The Stars in their Seasons*, London, 1883**



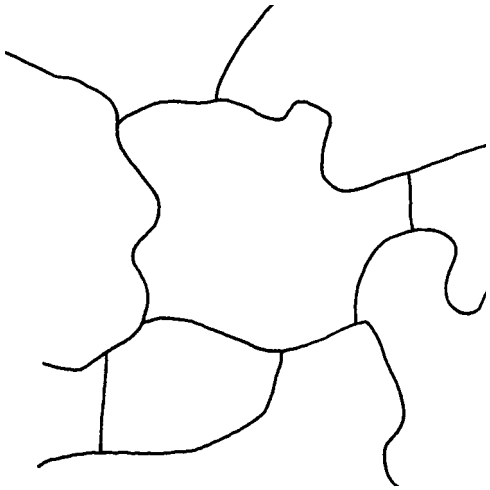
**Jacob Messer, *Stern-atlas für Himmels-beobachtungen*, St. Petersburg, 1888**



**William Peck, *A Popular Handbook and Atlas of Astronomy*, London, 1890**



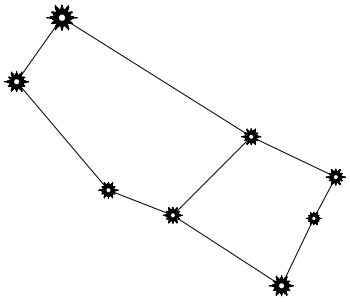
**Amand Schweiger-Lerchenfeld, *Atlas der Himmelskunde*, Vienna, 1898**



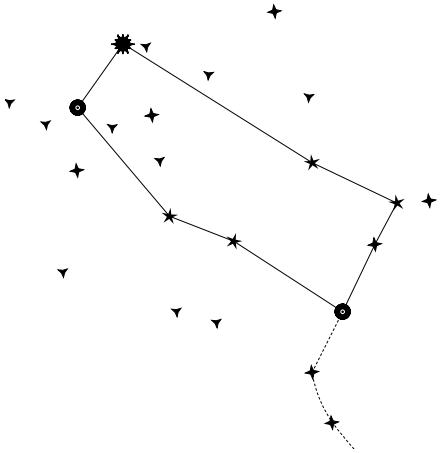
**Samuel G. and WM. H. Barton, *A Guide to the Constellations*, New York, 1928**

## D A comparison of constellation figures

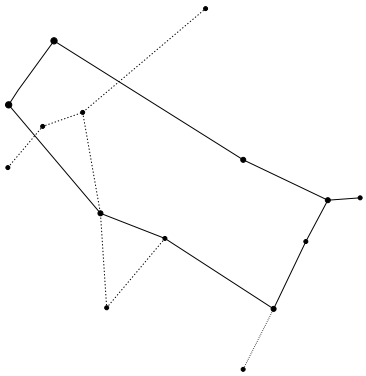
Each of the following drawings shows the configuration of the zodiacal constellation Gemini. I have adjusted the drawings to conform to the same scale and the same map projection. I have followed the original notation as closely as possible in my transcriptions.



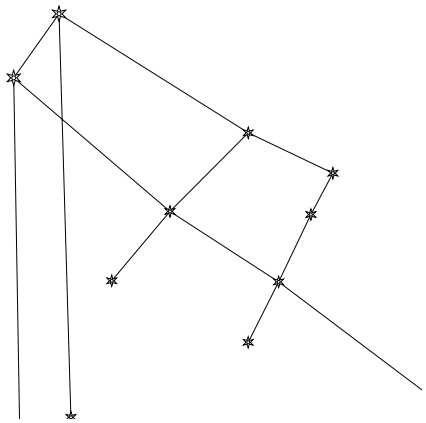
**Alexandre Ruelle, *Nouvelle Uranographie*, Paris, 1786**



**Louis-Benjamin Francœur, *Uranographie ou traité élémentaire d'astronomie*, Paris, 1812**



**Charles Dien, *Uranographie*, Paris, 1830**



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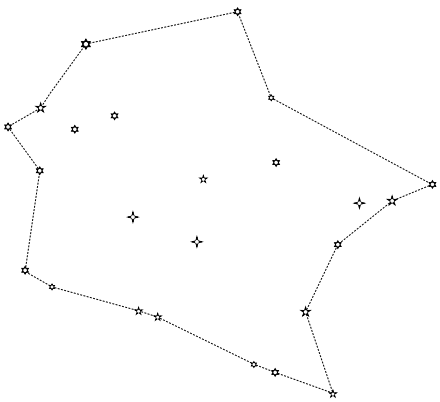

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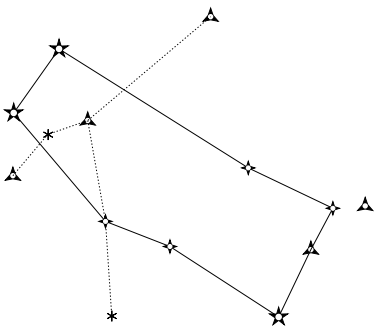

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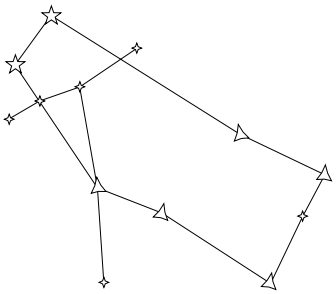

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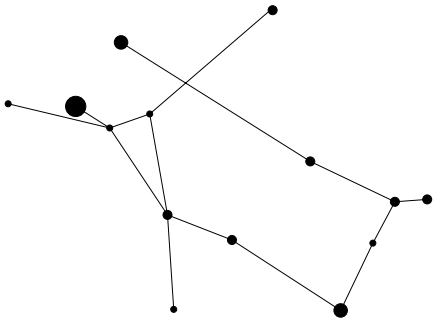

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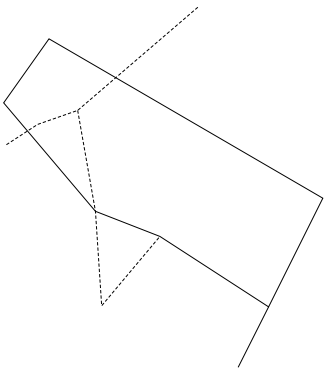

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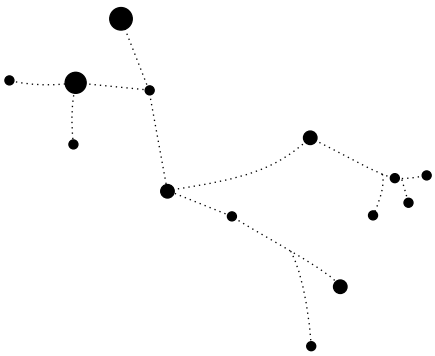

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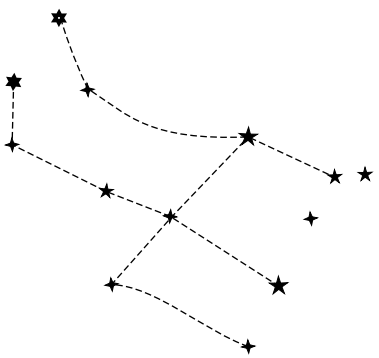

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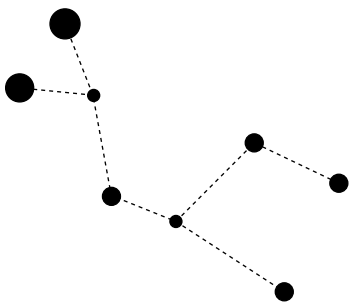

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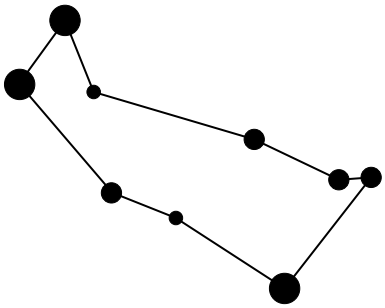

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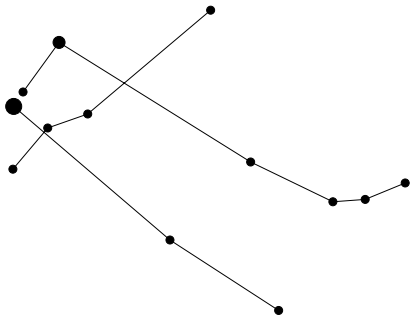

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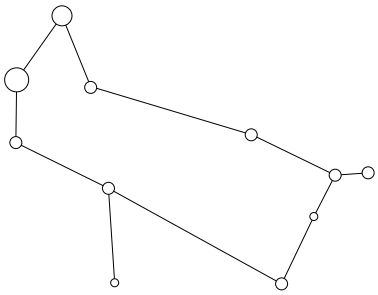

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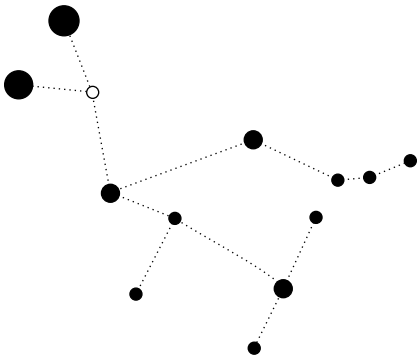

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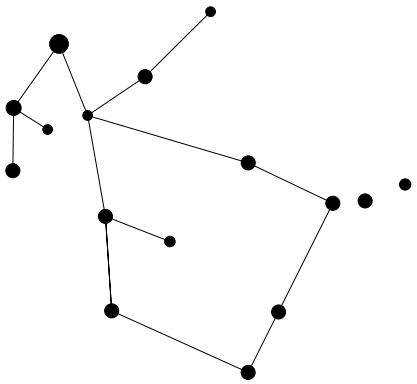

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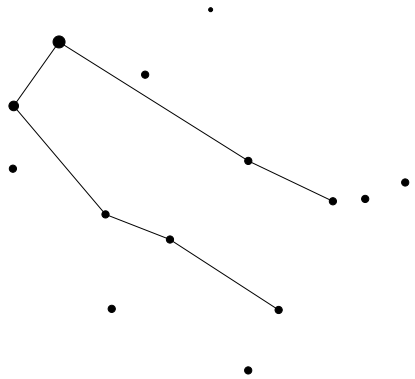

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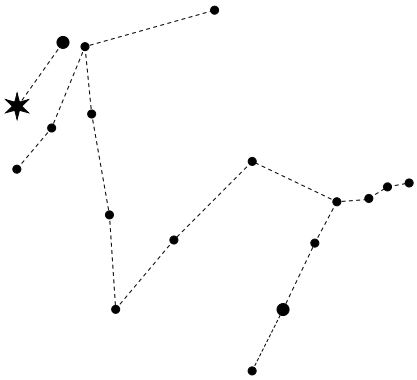

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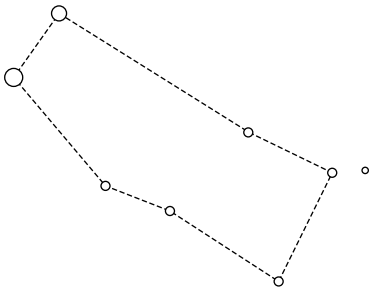

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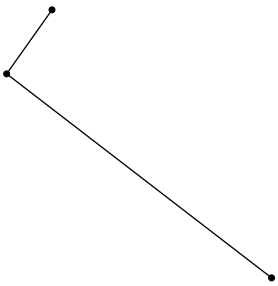

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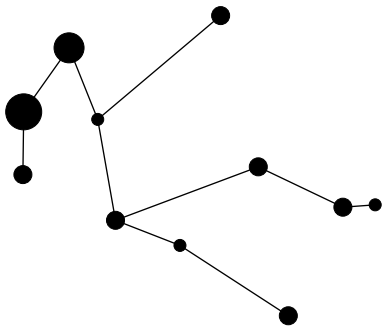

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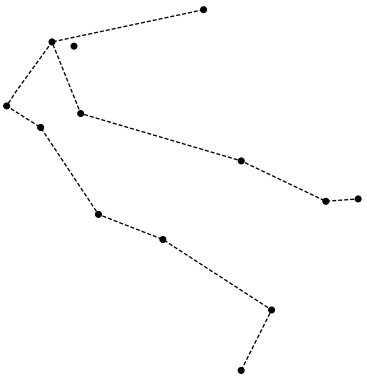

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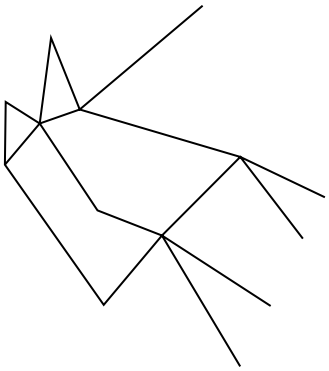

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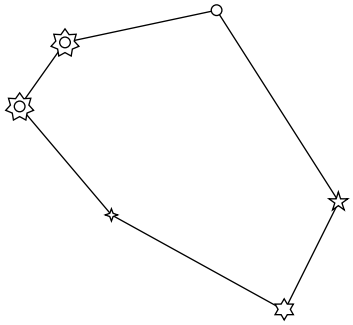

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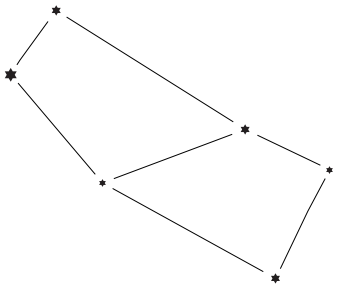

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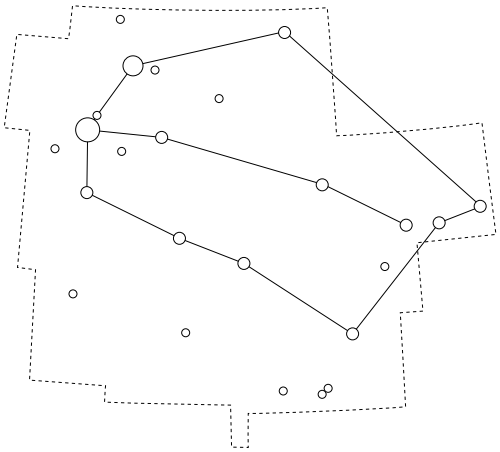

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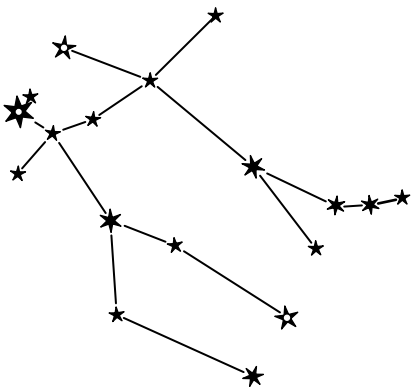

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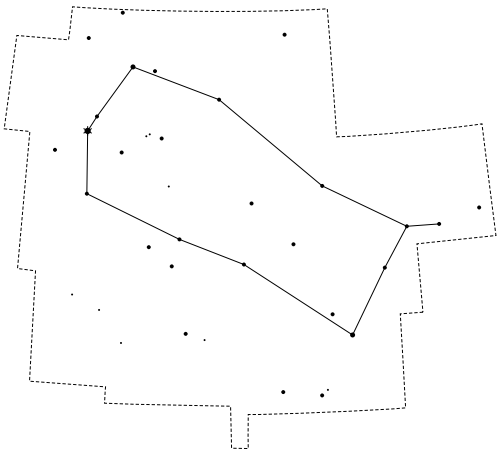

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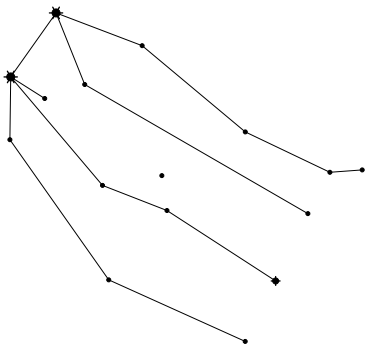

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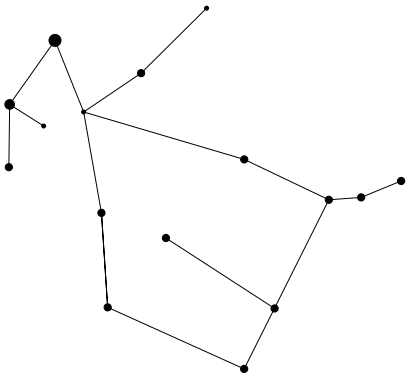

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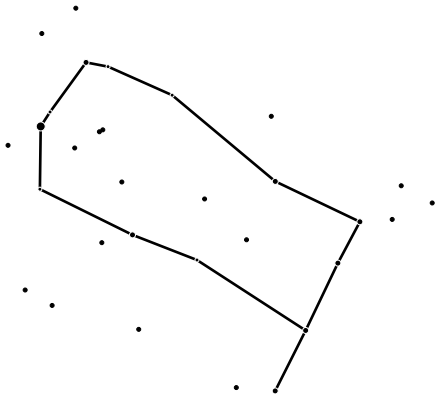

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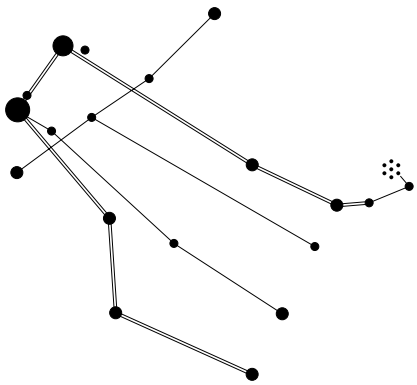

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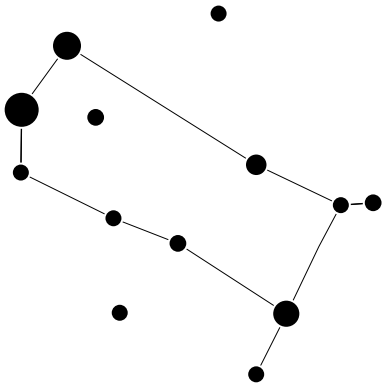

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## E Original texts of translations from the French cited in Part III

*To free the French nation …*

**Page 118**

Pour tirer la nation française de la dépendance où elle a été jusqu'à présent de l'industrie étrangère.

Gaspard Monge, *Géométrie descriptive* (Paris: Baudouin, 1799), p. 1.

*Among the different applications …*

**Page 118**

Parmi les différentes applications que l'on peut faire de la méthode des projections, il y en a deux qui sont remarquables, et par leur généralité, et par ce qu'elles ont d'ingénieux: ce sont les constructions de la perspective, et la détermination rigoureuse des ombres dans les dessins.

*Géométrie descriptive*, p. 3.

*Thus the analysis of a vault into voussoirs …*

**Page 118**

Ainsi la décomposition d'une voûte en voussoirs exige donc absolument la considération des plans tangens et des normales à la surface courbe de la voûte.

*Géométrie descriptive*, p. 31.

*Monge insists on the character at once rational and practical ….*

**Page 119**

Monge insiste sur le caractère à la fois rationnel et practique de sa géométrie descriptive plus que sur sa nouveauté.

Yves Deforge, *Le Graphisme technique: son histoire et son enseignement* (Seyssel: Champ Villon, 1981), p. 189.

*Descriptive geometry has two objectives …*

**Page 19**

La géométrie descriptive a deux objets: le premier, de donner les méthodes pour représenter sur une feuille de dessin qui n'a que deux dimensions, […], tous les corps de la nature, qui en ont trois […] pourvu néanmoins que ces corps puissent être définis rigoureusement

Le second objet est de donner la manière de reconnoître d'après une description exacte les formes des corps, et d'en déduire toutes les vérités qui résultent et de leur forme et de leurs positions respectives.

*Géométrie descriptive*, p. 5.

*It is not without a point that we make the comparison here …*

**Page 119**

Ce n'est pas sans objet que nous comparons ici la géométrie descriptive à l'algèbre; ces deux sciences ont les rapports les plus intimes. Il n'y a aucune construction de géométrie descriptive qui ne puisse être traduite en analyse; et lorsque les questions ne comportent pas plus de trois inconnues, chaque opération analytique peut être regardée comme l'écriture d'un spectacle en géométrie. Il seroit à desirer que ces deux sciences fussent cultivées ensemble: la géométrie descriptive porteroit dans les opérations analytiques les plus compliquées l'évidence qui est son caractère, et, à son tour, l'analyse porteroit dans la géométrie la généralité qui lui est propre.

*Géométrie descriptive*, p. 16.

*The correspondence between the operations of analysis …*

**Page 119n**

La correspondance entre les opérations de l'analyse et les méthodes de la géométrie descriptive, ne se borne pas à ce que nous venons de rapporter; elle existe par-tout. Si dans l'espace, pour opérer des générations quelconques, on fait mouvoir des points, des lignes courbes, des surfaces, ces mouvemens peuvent toujours être dictés par des opérations analytiques; et les objets nouveaux auxquels ils donnent lieu, sont exprimés par les résultats mêmes des opérations. Réciproquement, il n'y a aucune opération d'analyse en trois dimensions, qui ne soit l'écriture d'un mouvement opéré dans l'espace et dicté par elle. Pour apprendre les mathématiques de la manière la plus avantageuse, il faut donc que l'élève s'accoutume de bonne heure à sentir la correspondance qu'ont entre elles les opérations de l'analyse et celles de la géométrie; il faut qu'il se mette en état, d'une part, de pouvoir écrire en analyse tous les mouvemens qu'il peut concevoir dans l'espace, et, de l'autre, de se représenter perpétuellement dans l'espace le spectacle mouvant dont chacune des opérations analytiques est l'écriture.

*Géométrie descriptive*, p. 62.

*Technical drawing is not the offspring of descriptive geometry.*

**Page 123**

Le dessin technique n'est pas l'enfant de la géométrie déscriptive.

*Le Graphisme technique*, p. 214.

*In the arts, one represents objects in two ways …*

**Page 127n**

'Dans les arts on représente les objets de deux manières, ou perspectivement, ou géométralement.

'Par la perspective, on represente les objets tels qu'ils nous paraissent et suivant l'impression qu'ils font sur nos yeux. Ce genre de dessin ne donne que les formes apparantes des corps, tout y est vu en raccourci et aucune des dimensions no sont exactes: on ne peut, par consequent, s'en servir dans l'industrie, ou il est nécessaire de faire connaître les dimensions des objets jusque dans leurs moindres détails afin qu'on puisse les exécuter.
'Le dessin géométral, connu plus généralement sous le nom de Projections, a pour objet de représenter la figure des corps susceptibles de définitions exactes sur des surfaces données de formes et de position.

L'Espace n'ayant pas de limites, on ne peut déterminer la position d'un objet qu'en le rappprtant à deux plans perpendiculaires entre eux et appelés Plans de projéction: l'un est horizontal et l'autre est vertical, leur ligne d'intersection ou de rencontre se nomme Ligne de terre. [...]

Pour rendre les opérations des projections d'une exécution facile, on suppose que les lignes qui émanent d'un corps, sont des droites parallèles entre elles et perpendiculaires à chacun des plans de projection.

Pour être plus facilement compris, déterminons les projections du point A [...] Supposons que le spectateur regarde ce point pardessus, de telle façon que le rayon visuel qui émane de son oeil et passe par le point A, soit perpendiculaire au plan horizontale [...] en se déplaçant on vient a regarder le point A en face, de manière que le rayon visuel, passant encore par A, soit perpendiculaire au plan verticale.'

F. Arcadius, *Cours de dessin linéaire industriel* (Paris: Carles, 1853), plate 17.

*A spectator, observer or 'observer-projector' crops up …*

**Page 128**

Un spectateur, un observateur ou un 'observateur-projeteur' interviennent das la plupart des exposés du principe des projections, non sans quelque fantaisie ou incohérence.'

*Le Graphisme technique*, p 212.

*But most minerals, hidden in the cavities of the globe …*

**Page 129**

Mais la plupart des minéraux, cachés dans les cavités du globe, n'en sortent qu'à travers de nombreux débris, et en portant eux-mêmes les marques du fer destructeur qui les a arrachés de leurs gîtes: ils ne sont, pour le commun des hommes, que des masses brutes, sans physiognomie et sans langage, faites seulement pour être appropriées à nos besoins: on a peine à s'imaginer qu'ils piussent devenir l'object d'une science à part, et qu'il y ait une place pour le naturaliste, entre le mineur qui les extrait, et l'artiste qui les élabore.'

René Just Haüy, *Traité de la Minéralogie* (Paris: Louis, 1801), p. ii.

*The one by simple reasoning aided by drawings …*

**Page 130**

L'une par le simple raisonnement aidé de figures qui rendent sensible à l'oeil le mécanisme de cette structure, l'autre, dans un article séparé, à l'aide de l'analyse mathématique, en donnant aux résultats toute la généralité que comporte le sujet.

*Traité de la Minéralogie*, p. xlix.

*A kind of graphic treatise on the laws of structure.*

**Page 130**

Une espèce de traité graphique des lois auxquelles est soumise la structure.

*Traité de la Minéralogie*, p. li.

*The figures have been drawn according to the method of projection …*

**Page 130**

Les figures ont été tracées d'après la méthode des projections, en supposant le point de vue éloigné à l'infini.

*Traité de la Minéralogie*, p. lv.

*[Braque] constructs deformed metallic men …*

**Page 137**

[Braque] construit des bonshommes métaliques et déformés et qui sont d'une simplification terrible. Il méprise la forme, réduit tout, sites et figures et maisons, à des schémas géométriques, à des cubes.

*Gil Blas*, 14 November 1908, trans. by Jonathan Griffin in Edward F. Fry, *Cubism*, (London: Thames & Hudson, 1966), p. 50.

*Braque proceeds from a genetic* a priori *...*

**Page 138**

[Braque] procède d'un *a priori* génétique auquel il soumet tout le champ de sa vision, et il pense traduire la nature entière par les combinaisons d'un petit nombre de formes absolues. On a poussé des cris d'horreur devant ses figures de femmes: 'C'est hideux! C'est monstreux!' Où nous croyons chercher une figure féminine [...] l'artiste a vu seulement les harmonies géométriques. [...] Il à créé un alphabet personnel dont chaque caractère a une acception universelle.

*Mercure de France*, 16 December 1908, reprinted in Guillaume Apollinaire, *Les peintres cubistes: méditations esthétiques*, ed. by Leroy C. Breunig and J.-Cl. Chevalier (Paris: Hermann, 1965), pp. 147–8.

*Picasso brings us a material account of the real life in the mind ...*

**Page 139**

Picasso nous apporte une compte rendu matériel de la vie réelle dans l'esprit, il fonde une perspective libre, mobile, telle que le sagace mathématicien Maurice Princet en déduit toute une géométrie. [...]

Braque qui façonne avec joie de nouveaux signes, ne commet pas une faute de goût.

*Pan*, October–November 1910, reprinted in *Les peintres cubistes: méditations esthétiques* (1965), p. 155.

*If one wanted to connect the painters' space with some kind of geometry ...*

**Page 140**

Si l'on désirait rattacher l'espace des peintres à quelque géométrie, il faudrait en référer aux savants non euclidiens, méditer longuement certains théorems de Rieman [*sic*].

Albert Gleizes and Jean Metzinger, *Du 'cubisme'* (Paris: Figuière, 1912) p.17.

*Anytime [the artist] ventures into metaphysics, cosmogony or mathematics ...*

**Page 140**

Toutefois s'il aventure dans la métaphysique, dans la cosmogonie ou les mathématiques, qu'il se contente de leur dérober des saveurs et qu'il abstienne de leur demander des certitudes qu'elles ne possèdent pas.

*Du 'cubisme'*, p.43.

*Just as much as synchronic and simplistic images ...*

**Page 141**

À l'égal des images sychroniques et primaires, nous réprouvons les facilités de l'occultisme fantaiste; si nous condamnons l'usage exclusif des signes usuels ce n'est point que nous songions à les remplacer par des signes cabalistiques. Mème nous confessions volontiers qu'il est impossible d'écrire sans user de clichés, et de peindre en faisant abstraction totale des signes connus.

*Du 'cubisme'*, p.35.

*The new painters claim no more than their elders to be geometers …*

**Page 141**

Les nouveaux peintres, pas plus que leurs anciens ne se sont proposé d'être géomètres. Mais on peut dire que la géométrie est aux arts plastiques ce que la grammaire est a à l'art de l'écrivan. Or, aujourd'hui, les savants ne s'en tiennent plus aux trois dimensions de la géométrie euclidienne. Les peintres ont été amenés tout naturellement et, pour ainsi dire, par intution, a se préoccuper de nouvelles mesures possibles de l'entendue que dans le langage des ateliers modernes on désignait toutes ensemble et brièvement par le terme de *quatrième dimension*.

Guillaume Apollinaire, *Les peintres cubistes: méditations esthétiques* (Paris: Eugène Figuière, 1913), pp. 15–16.

*It represents the immensity of space …*

**Page 142**

Elle figure l'immensité de l'espace s'éternisant dans toutes directions à un moment déterminé. Elle est l'espace même, la dimension de l'infini; c'est elle qui doue de plasticité les objets.

*Les peintres cubistes: méditations esthétiques* (1913), p.53

*[The Cubists] aspire to the essence …*

**Page 143**

[Les cubistes] aspirent à l'essence, à l'idée pure, à une ivresse spéculative comparable à celle qui jaillit de l'étude des mathématiques. […] En ramenant à des corps géométriques définis la beauté du paysage ou la grâce de la femme, on est amené à préciser avec plus de vigeur les plans, à mieux établir la structure, à étudier plus sévèrement la partie constructive du monde, à pénétrer plus profondément les rapports de la forme et de la couleur.

*Les peintres cubistes: méditations esthétiques* (1965).

*The real problem which had seemed fundamental to Cézanne …*

**Page 145**

Le vrai problème qui avait paru primordial à Cézanne, qui allait former le but principal des recherches cubistes, à savoir la *répresentation, sur la toile à deux dimensions, des solides qui en ont trois*.

Daniel Henry Kahnweiler, *Juan Gris, sa vie, son oeuvre, ses écrits* (Paris: Gallimard, 1946), p. 148.

*[Cubism] endeavoured to penetrate to the very essence of an object …*

**Page 147**

[Le cubisme] entendait pénétrer jusqu'à l'essence de l'object en le représentant non comme on l'avait aperçu tel jour, a telle heure, mais tel qu'il se trouvait constitué en fin de compte dans la mémoire.

Daniel Henry Kahnweiler, *Juan Gris, sa vie, son oeuvre, ses écrits* (Paris: Gallimard, 1946), p. 149.

*Sometimes the emblems … signified the whole object …*

**Page 147**

Les embèmes qu'invente dorénavant Juan Gris, 'signifient' dans son ensemble l'objet qu'il entend représenter. […] ce ne sont pas les formes reassemblées dans la mémoire visuelle du peintre qui ressurgissent dans le tableau, mais biend des formes nouvelles, différentes des formes des objets 'réels' rencontrés dans le monde sensible, des formes qui ne sont véritable que des emblèmes, devenant objets dans l'aperception du spectateur seulement.

*Juan Gris, sa vie, son oeuvre, ses écrits*, pp. 179–80.

*This element, which we can neither define nor analyse …*

**Page 147**

Cet élément que nous ne pouvons définir ni analyser, mais que nous savons présent en face de nous, ne saurait être que la 'valeur' dont le génie de l'artiste a doué l'œuvre mystérieusement et à son insu, et que nous appelons le beau. On peut l'appleler selon la terminologie kantienne, 'l'être en soi' de l'œuvre, sa partie effective, stable, libre, mais inconnue, tandis que son autre partie, 'l'apparence' n'est ni libre, ni non plus gratuite, soumise qu'elle est à l'esprit du temps.

*Juan Gris, sa vie, son oeuvre, ses écrits*, p.55.

*It was negro sculpture …*

**Page 148**

C'est la *sculpture nègre* qui a permis à ces peintres de voir claire dans les problèmes que l'évolution de l'art européen avait embrouillés, et de trouver une solution qui, en évitant tout illusionisme, aboutissait à la liberté qu'ils ambitionnaient.

Daniel Henry Kahnweiler, 'L'art nègre et le cubisme', in *Confessions esthéthiques* (Paris: Gallimard, 1963), p. 232.

*The appellation table …*

**Page 148**

'L'appellation de table constitue *ce meuble lui-même*, dans son essence.'

Maurice Raynal, *Quelques intentions du Cubisme* (Paris: Editions de L'Effort Moderne, 1919), pamphlet without numbered pages.

*A sort of formula …*

**Page 149**

'une sorte de formule; pour dire plus, *un mot*. Il sera, en effet, aux objets qu'il represente, ce qu'est un mot à l'objet qui'il signifie.'

*Quelques intentions du Cubisme.*

*To conceive of an object …*

**Page 149**

Concevoir un objet est, en effet, vouloir le connaitre dans son essence, le représenter dans l'esprit, c'est-à-dire, dans ce but, le plus purement possible, à l'état de signe, de *totem*, si l'on veut, et absolument dégagé de tous détails inutiles tels que les aspects, accidents trop multiples et trop changeants. Les aspects, en effet, le situant dans le temps ou l'espace, d'une façon arbitraire, ne peuvent que déflorer sa qualité première. Et de même qu'il fixera sur la toile ou le marbre, non ce qui passe mais ce qui demeure, l'artiste ne situera pas l'objet dans un endroit déterminé, mais dans l'espace, qui est infini.

*Quelques intentions du Cubisme.*

*[It] was a geometry book …*

**Page 150n**

[C]'etait un précis de géométrie qu'il fallait attacher avec des ficelles sur le balcon de son appartement rue des ficelles sur le balcon de son appartement re de La Condamine; le vent devait compulser le livre, choisir lui-même les problèmes, effeuiller les pages et les déchirer.

Pierre Cabanne, *Dialogues with Marcel Duchamp* (London: Thames & Hudson, 1971), p. 61.

*Analysis shows …*

**Page 152n**

L'analyse montre que notre connaissance du monde se réfère au système géométrique, qui est une pure création de l'esprit: les jouissances plastiques ressortissent toutes au système de la géométrie. Le spectacle acutel est essentiellement géométrique. Nos sens et notre esprit en sont imprégnés; l'homme est un animal géométrique animé d'un esprit géométrique.

Amedée Ozenfant and Charles-Edouard Jeanneret, *La Peinture Moderne* (Paris: Crès, 1925), p. 11.

*We have examined the relation between space and time …*

**Page 161**

'Nous avons examiné le rapport entre l'espace de le temps et nous avons trouvé que l'apparition plastique de ces deux éléments *par la couleur* donnent une nouvelle dimension.'

'- [square] + $=R_4$' in *De Stijl,* VI/6–7 (1924), p. 91.

*Would painting have broken …*

**Page 207**

La peinture n'aurait-elle rompu avec la représentation que pour se complaire à des jeux illusionistes peut-être plaisants, mais strictement optiques, et sans aucune prise sur la réalité?

Cette question ne saurait recevoir de réponse réellement satifaisante dans le langage qui est celui de la critique, ou de l'histoire d'art.

Hubert Damisch, 'L'œil théoricien' in *Josef Albers* [exhibition catalogue] (Musée des Beaux Arts Tourcoing: Tourcoing, 1988) p. 11.

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