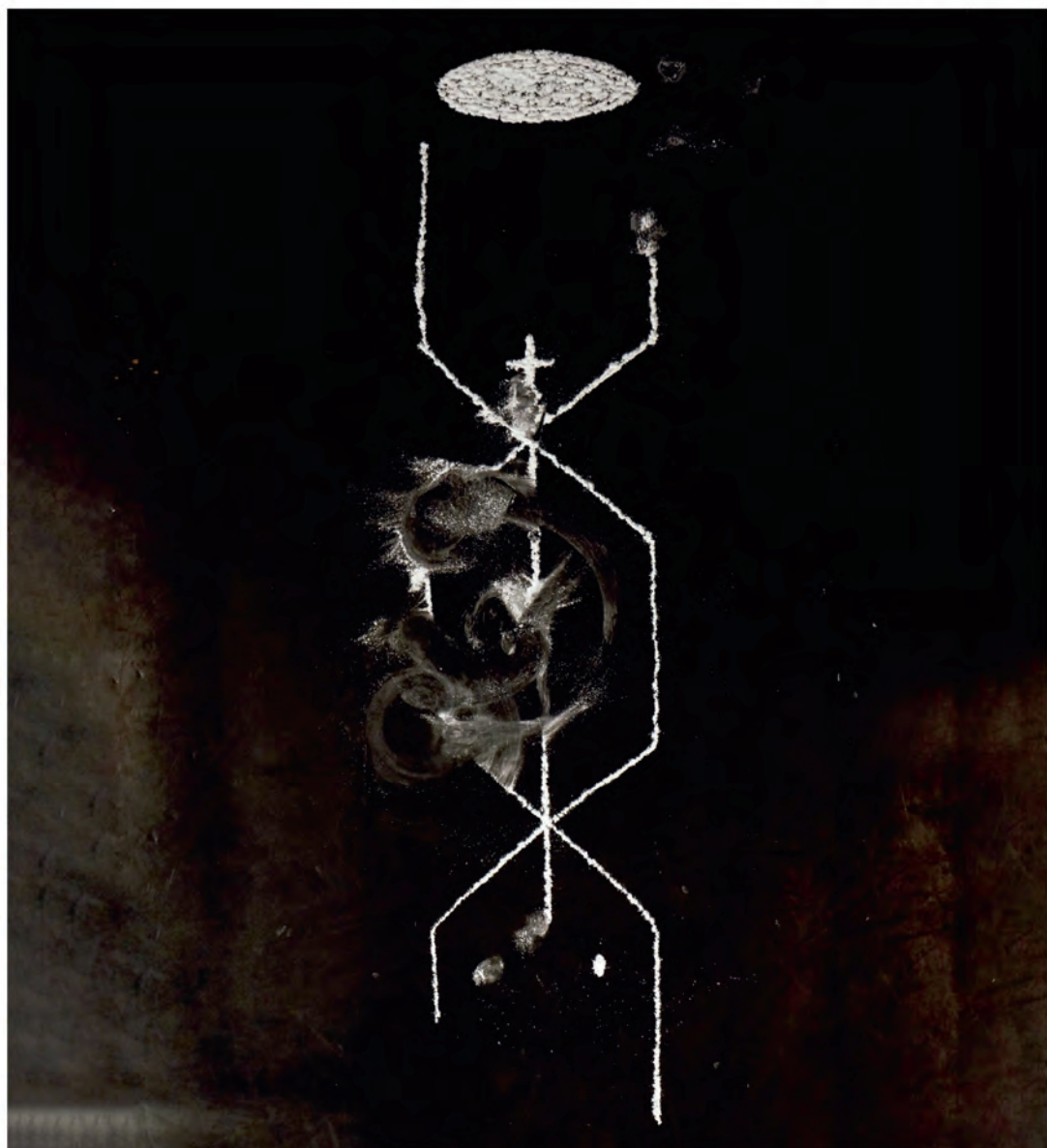


David Burrows, John Cussans, Dean Kenning & Mary Yacoob

DRAWING ANALOGIES

Diagrams in Art, Theory and Practice



B L O O M S B U R Y

DRAWING ANALOGIES

DRAWING IN

Series editors:

*Russell Marshall, Marsha Meskimmon and Phil Sawdon
Loughborough University, UK*

'Thinking through drawing' has become a ubiquitous trope across the arts, sciences and humanities. The rich vein of thinking, making and visualizing through drawing that is being developed across these diverse fields affords an opportunity for sustained intellectual dialogues to emerge within, between or without traditional disciplinary boundaries. The Drawing In series provides a space for new perspectives and critical approaches in the field of drawing to be brought together and explored.

In the series:

Drawing Difference, Marsha Meskimmon and Phil Sawdon

Drawing Investigations, Sarah Casey and Gerry Davies

Performance Drawing, Maryclare Foá, Jane Grisewood,
Birgitta Hosea and Carali McCall

Scenographic Design Drawing, Sue Field

Serial Drawing, Joe Graham

Reportage Drawing, Louis Netter

Anatomical Drawing, Sue Field

DRAWING ANALOGIES

Diagrams in Art, Theory and Practice

**DAVID BURROWS,
JOHN CUSSANS,
DEAN KENNING AND
MARY YACOOB**

BLOOMSBURY VISUAL ARTS
LONDON • NEW YORK • OXFORD • NEW DELHI • SYDNEY

BLOOMSBURY VISUAL ARTS
Bloomsbury Publishing Plc
50 Bedford Square, London, WC1B 3DP, UK
1385 Broadway, New York, NY 10018, USA
29 Earlsfort Terrace, Dublin 2, Ireland

BLOOMSBURY, BLOOMSBURY VISUAL ARTS and the Diana logo are trademarks
of Bloomsbury Publishing Plc

First published in Great Britain 2025

Copyright © David Burrows, John Cussans, Dean Kenning and Mary Yacoob, 2025

David Burrows, John Cussans, Dean Kenning and Mary Yacoob have asserted
their right under the Copyright, Designs and Patents Act, 1988,
to be identified as Authors of this work.

Cover design: Louise Dugdale
Cover image is John Cussans and Roberto N. Peyre *Voltigor: Ponto for
Swedish Youth (III)* 2014 (Photo: Anna Druvnik)

The images in this book are excluded from the book's Creative Commons license.
All rights in these images are reserved. For permission to re-use,
please contact the copyright holder.

This work is published open access subject to a Creative Commons Attribution-
NonCommercial-NoDerivatives 4.0 International licence (CC BY-NC-ND 4.0, [https://
creativecommons.org/licenses/by-nc-nd/4.0/](https://creativecommons.org/licenses/by-nc-nd/4.0/)). You may re-use, distribute, and reproduce
this work in any medium for non-commercial purposes, provided you give attribution to the
copyright holder and the publisher and provide a link to the Creative Commons licence.

Bloomsbury Publishing Plc does not have any control over, or responsibility for,
any third-party websites referred to or in this book. All internet addresses given in
this book were correct at the time of going to press. The author and publisher
regret any inconvenience caused if addresses have changed or sites have
ceased to exist, but can accept no responsibility for any such changes.

A catalogue record for this book is available from the British Library.

Library of Congress Cataloging-in-Publication Data

Names: Burrows, David, 1965 October 14- author. | Cussans, John, author. |
Kenning, Dean, author. | Yacoob, Mary, author.

Title: Drawing analogies : diagrams in art, theory and practice / David Burrows,
John Cussans, Dean Kenning and Mary Yacoob.

Description: London : Bloomsbury Visual Arts, 2025. | Series: Drawing in |
Includes bibliographical references and index.

Identifiers: LCCN 2024023546 (print) | LCCN 2024023547 (ebook) |
ISBN 9781350334731 (hardback) | ISBN 9781350334779 (paperback) |
ISBN 9781350334748 (pdf) | ISBN 9781350334755 (ebook)

Subjects: LCSH: Charts, diagrams, etc. | Analogy. | Design—Philosophy.

Classification: LCC NC715 .B87 2025 (print) | LCC NC715 (ebook) |
DDC 744.3/7—dc23/eng/20240823

LC record available at <https://lccn.loc.gov/2024023546>

LC ebook record available at <https://lccn.loc.gov/2024023547>

ISBN: HB: 978-1-3503-3473-1
ePDF: 978-1-3503-3474-8
eBook: 978-1-3503-3475-5

Series: Drawing In

Typeset by RefineCatch Limited, Bungay, Suffolk

To find out more about our authors and books visit www.bloomsbury.com
and sign up for our newsletters.

CONTENTS

List of Figures viii

Introduction 1

- The Aesthetic Life of Diagrams 2
- Artist as Ceiling Fan 13
- Drawing Analogies 17
- Anthropological Perspectives 20
- Diagrams and Technicity 24
- Chapter Summaries 26

PART ONE ONTOLOGIES AND EPISTEMES 33

1 Invisible Machines: Psychoanalytic Imaginaries and Paranoid Critical Theory *John Cussans* 35

- Idiotic Simplicity and Extravagant Cunning 35
- Into the Fields 39
- Social Apparatuses/Invisible Machines/Symbolic Operations 45
- Paranoid Critical Theory 50
- Symptom Instruments 57

2 The Diagrammatic Works of Hilma af Klint *Mary Yacooob* 61

- Introduction: 'A Pioneer of Abstraction' 61
- 'A Great Commission' 62
- Evolution, Optics and Esoteric Diagrams 65
- Peirce: Types of Signs 66
- Diagrams and Abstraction 68
- 'A Language of Symbols' 70
- Primordial Chaos 72
- The Tree of Knowledge* 77

Diagrammatic and Meditative Practice 79
 Conclusion: Fruitful Transmissions 81

3 Cosmo-Diagrams: Beyond the Bubble *David Burrows* 85

Introduction: A Dying Star/a Bright Red Giant, London 2020/Betelgeuse
 1320 85
 (How Long is) a Piece of String? Cape Town 2019 88
 A Manifesto for Cosmic Art, Paris 1936 91
 A Mobile (Universe), New York 1937 and New York 1959–63 91
 A Figure (that is of a Number), Pennsylvania 1948 94
 A Polka Dot and Infinity Nets, New York 1978 and New York 1959 97
 An Eye on the Letter U (that sees Quantum Foam), Texas 1978 99
A Time Base Spectrum/a Residency in Flat Time House, 01–10/London
 2021 100
 Conclusion: Community Futures Lab/Temporal Deprogramming,
 Philadelphia 2016/London 2019 104

4 Deleuze's Living Diagram Pt. 1: From Structural to Intensive Relations (the Biological Idea)

Dean Kenning 108
 Prologue: The Abstract Line 108
 Diagrams Peircean and Deleuzian 109
 Aristotle and Analogy 112
 Univocity – the Common Ground of Connection 115
 From Structuralist Abstraction to the Abstract Machine: Being as
 Becoming 118
 Reciprocal Determination and Intensive Relations 123
 Intensive Diagrams 126

PART TWO DIAGRAMS IN USE 131

5 Deleuze's Living Diagram Pt. 2: From Structural to Nervous Analogy (Francis Bacon) *Dean Kenning* 133

Introduction 133
 How to Trap a Fact 136
 Avoiding both Figurative and Abstract Form 139
 Analogical Language 140
 Resemblance by Non-Resembling Means 142

Capturing Forces 143
 Elements of Intensity 145
 Modulation 146
 Colour Knobs 147
 Diagram of a Diagram 149

6 Intersections between Art, Diagrams, Time and Technology *Mary Yacoub* 153

Introduction: Visualizing Time 153
Unknown Pleasures: 'Like "clocks" dotted throughout the galaxy' 154
 The Times of George Widener 162
 Ami Clarke – *The Underlying* 167
 Conclusion: 'Structured Speculation' 173

7 This is Not a Diagram: Applying General Semantics to Contemporary Arts Pedagogy *John Cussans* 175

Defining 'diagram' 175
 Time Binding 178
 The Structural Differential 183
 Using the SD 186
 'You are not an Identity': GS and Contemporary Cultural Theory 192
 Conclusion 196

8 Auraltechnics: Towards Audio Diagrams *David Burrows* 198

Introduction: Resonant Frequencies 198
 Two Tribes 201
 A Third Ear 205
 The Sonorous and the Audible 207
 Forever Lost, Forever Living 208
 Diagramming Listening and Listening as Diagramming 210
 Refrains of Listening 212
 Conclusion: Sitting in a Room, Listening for Audio Diagrams 213

Conclusion 219

Bibliography 239
 Index of Names 250
 Index of Works, Concepts and Topics 256

LIST OF FIGURES

All rights reserved

- | | | |
|------|---|----|
| 0.1. | John Cussans and Roberto N. Peyre, Installation view of <i>Voltigor: Ponto for Swedish Youth</i> , 2014, IMT Gallery, London. Photo by Anna Druvnik. | 6 |
| 0.2. | David Burrows, Installation view of <i>Diagram of the Event Horizon of a Black Hole</i> , 2018, exhibited in 'Future Landscapes' at Helsinki Contemporary, paper, card, foam, pigment, glitter, audio. | 9 |
| 0.3. | John Cussans and Roberto N. Peyre drawing <i>Vèvè Kunigundis</i> at documenta fifteen, Kassel, Germany, 2022. Photo by Guillermina De Ferrari. | 10 |
| 0.4. | Dean Kenning, <i>Making Sense</i> , colour lithograph, 2021. | 11 |
| 0.5. | Mary Yacoob, <i>Marcello Mind Maze</i> , vinyl on window, The Hospital Club, 2019. | 12 |
| 0.6. | Adelheid Mers, <i>The Artist as Ceiling Fan</i> , 2006. Courtesy of Adelheid Mers. | 14 |
| 0.7. | Didacus Valades, <i>The Great Chain of Being</i> , from <i>Rhetorica Christiana</i> , 1579. | 22 |
| 1.1. | Rosalind E. Krauss, Figure/Ground Graph 1994. | 35 |
| 1.2. | 15th Century Square of Opposition. | 37 |
| 1.3. | Semiotic square (after Greimas circa 1966). | 37 |
| 1.4. | Piet Mondrian, <i>Pier and Ocean (Composition No. 10)</i> , 1915. | 40 |
| 1.5. | Mary Miss, <i>Perimeters/Pavilions/Decoys</i> 1978 Courtesy of Mary Miss. | 42 |
| 1.6. | Quilting Point graphic (after Lacan 1955–66). | 43 |
| 1.7. | Schema L (after Lacan 1958–60). | 44 |
| 1.8. | Optical Schema/Inverted Bouquet Diagram (after Lacan 1954–55). | 44 |
| 1.9. | A detail from the lower portion of James Tilly Matthews' illustration of the Air Loom featured in John Haslam's <i>Illustrations of Madness</i> , 1810, an early example of the influencing machine delusion. | 46 |

1.10. The Mental Apparatus from <i>New Introductory Lectures on Psychoanalysis</i> (after Freud 1933).	48
1.11. Salvador Dalí, <i>Morphology of the Skull</i> of Sigmund Freud 1938 © Salvador Dalí, Fundació Gala-Salvador Dalí, DACS, 2023.	53
1.12. Completed Graph of Desire (after Lacan 1958–60).	58
1.13. The Borromean Knot.	59
2.1. Hilma af Klint, <i>The Evolution, No. 16, The WUS/Seven-Pointed Star Series</i> , Group VI, 1908. Courtesy of The Hilma af Klint Foundation.	62
2.2. Hilma af Klint, <i>The Ten Largest, Group IV, Adulthood</i> , 1907. Courtesy of The Hilma af Klint Foundation.	64
2.3. Hilma Af Klint, <i>Primordial Chaos, Group I, The WU/Rose Series</i> , 1906–1907, Courtesy of The Hilma af Klint Foundation.	73
2.4. Hilma af Klint, <i>Tree of Knowledge, No. 3, The W Series</i> , 1913 – 1915. Courtesy of The Hilma af Klint Foundation.	78
2.5. Hilma af Klint, <i>Violet Blossoms with Guidelines</i> , Series I, 1919. Courtesy of The Hilma af Klint Foundation.	80
2.6. Hilma af Klint, <i>Flowers, Mosses and Lichen</i> , 1919. Courtesy of The Hilma af Klint Foundation.	81
3.1. David Burrows, Diagram of sightline between Earth and Betelgeuse, 2020.	88
3.2. David Burrows, Diagram of a function of a mobile by Calder as analogy for a universe, and for Calder's experience of seeing the Moon and Sun in the sky, with the viewer occupying the perspective point of Earth, 2024.	92
3.3. David Burrows, Basic Structure of a Feynman Diagram, 2024.	95
3.4. David Burrows, Diagram of a function of an <i>Infinity Room</i> by Yayoi Kusama (room of mirrored walls and hanging lights), overlaid with stars, planets, raindrops and molecules, 2024.	97
3.5. David Burrows, Diagram of a function of John Latham's <i>Time-Based Roller with Graphic Score</i> , presenting the relation of non-extension and existence, and locating the event of the viewing of Latham's work within the cosmos, 2024.	102
4.1. Dean Kenning, Difference represented (Deleuze's tree analogy), 2023.	111
4.2. Dean Kenning, Difference as oppositional branching in Aristotle, 2023.	113
4.3. Dean Kenning, Difference making itself, 2023.	116
4.4. Dean Kenning, Block of becoming, 2023.	120
4.5. Dean Kenning, The biological Idea – genetic consistency across species, 2023.	125

5.1.	Dean Kenning, Colour knobs, 2023.	148
5.2.	Dean Kenning, Figure at a Washbasin diagram, 2023.	150
6.1.	Harold D. Craft Jr., <i>Successive pulses from the first pulsar discovered, CP 1919</i> , published in <i>The Cambridge Encyclopaedia of Astronomy</i> , Jonathan Cape, 1977.	155
6.2.	Peter Saville with Joy Division, <i>Unknown Pleasures</i> , Joy Division, 1979.	158
6.3.	George Widener, <i>Blauer Montag</i> , ink on paper, 17 × 15 inches, 2006, abcd collection.	163
6.4.	George Widener, <i>V.A.L.I.S.</i> , mixed media on paper, 50 × 102.9 cm, 2014.	166
6.5.	Ami Clarke, <i>Lag Lag Lag</i> (detail) arebyte gallery, 2019. Part of the body of work: <i>The Underlying</i> by Ami Clarke. Commissioned by arebyte gallery 2019. Video interface with live sentiment analysis. Courtesy of the artist.	168
6.6.	Ami Clarke, <i>Lag Lag Lag</i> (detail) London Open, Whitechapel Gallery, 2022. Part of the body of work: <i>The Underlying</i> by Ami Clarke. Commissioned by arebyte gallery 2019. Video interface with live sentiment analysis. Courtesy of the artist.	169
7.1.	Alfred Korzybski, <i>The Anthropometer (Structural Differential) School Set Prototype</i> , 1925.	177
7.2.	Author unknown. Image courtesy of The Korzybski Literary Estate. Alfred Korzybski, circa 1947.	179
7.3.	Arithmetical Evolution of the so-called “social” sciences accelerated by violent jumps – Non-peaceful social progress from <i>Manhood of Humanity</i> , 1921 (after Korzybski)	181
7.4.	Diagram of the three classes of life (after Korzybski).	182
7.5.	The Structural Differential (two dimensional version) with index (after Korzybski).	184
7.6.	DIY Structural Differential made by the author and used for teaching n.d.	186
7.7.	Additional image layer added to the SD n.d.	188
7.8.	Rene Magritte, <i>The Treachery of Images</i> , 1929 © ADAGP, Paris and DACS, London 2023.	190
7.9.	Three stage zoom into digital photograph of plastic ball n.d.	191
7.10.	John Cussans, ‘You are Not an Identity’ diagram, 2023.	192
7.11.	The four major orders of complexity (after Wilden).	194

INTRODUCTION

'Diagrams are in a degree the accomplices of poetic metaphor. But they are a little less impertinent – it is always possible to seek solace in the mundane plotting of their thick lines – and more faithful: they can prolong themselves into an operation which keeps them from becoming worn out. Like the metaphor, they leap out in order to create spaces and reduce gaps: they blossom with dotted lines in order to engulf images that were previously figured in thick lines. But unlike the metaphor the diagram is not exhausted.'

GILLES CHÂTELET, *Figuring Space: Philosophy, Mathematics and Physics* (2000)

'Deduction consists in constructing an icon or diagram the relations of whose parts shall present a complete analogy with those of the parts of the object of reasoning, of experimenting upon this image in the imagination, and of observing the result so as to discover unnoticed and hidden relations among the parts.'

CHARLES SANDERS PEIRCE, 'On the Algebra of Logic' (1992)

'The lower order is a mirror of the higher; the forms of the earth correspond to the forms of Heaven; the spots on one's skin are a chart of the incorruptible constellations.'

JORGE LUIS BORGES, 'Three Versions of Judas' in *Labyrinths* (2000)

'As an operational drawing principle, [diagrams] escape the insoluble dialectic of absence and presence which pervades the play of representation . . . As tools of thought and forms of representation, however, they have no status as art per se, but they nevertheless serve to crystallise repeated formulations of the concept of art in the 20th/21st centuries.'

SUSANNE LEEB, 'A Line with Variable Direction, Which Traces No Contour, and Delimits No Form' (2011)

'In art historical terms, the diagram is refuge and refugee, a universal visual bridge between the written and the seen, without a home in either.'

MATTHEW RITCHIE, *The Temptation of the Diagram* (2017)

The Aesthetic Life of Diagrams

In the early 1970s the German artist and environmental activist Joseph Beuys travelled around the UK giving a series of lecture-performances called Information Actions that involved drawing explanatory diagrams on blackboards illustrating his utopian vision for direct democracy and the role of art in that process. A student from the Ruskin School of Art in Oxford was accompanying the artist on his tour in 1980 and acting as an assistant. At the end of a talk in Edinburgh, as the audience were leaving, the student-assistant, to the horror of the gallery owner who saw the finished blackboards as valuable artworks in their own right, took a cloth to the blackboard and began to wipe it clean. The anecdote illustrates a thread running through our book, and the conversations its authors have been having for several years: what is the difference between a diagram presented as an aesthetic artefact and the diagram performed as a pedagogical and explanatory device?

Susanne Leeb has identified two opposing ways of understanding the term diagram across the many fields that use them. Some regard them above all as aids to systematization that automatically facilitate understanding within a specific field of knowledge, while others see them in more exploratory terms as 'proliferators of a process of unfolding' (Leeb 2011: 31. See in this volume Burrows Ch. 8). From the *systematic* perspective, most evident in visualizations of classification structures, statistical data and operational sequences, diagrams are valued for their capacity to order existing, often complex information into manageable forms. From the *open* perspective, more characteristic of graphic experiments carried out as a process of real-time thinking, non-instrumental artistic forms, and 'logic machines' (Gardner 1958), capable of use across diverse fields of enquiry, diagrams are valued for their capacity to reveal, foreground, and produce previously unrecognized relations. These relations are traced between objects, persons, shapes, words and worlds and, in some instances, extend into aesthetic, metaphoric and other registers.

From our perspective, it is less interesting to draw up two definitive lists and label the diagrams, pertinent to specific disciplines, as being either 'systematic' (those from science or social sciences such as economics) or 'open' (those from the arts, psychoanalysis, etc). Rather, we see systematic and exploratory approaches to the diagram as options open to and made use of by practitioners and theorists from any discipline. Furthermore, there will be systematic and open aspects in all diagrams because, on the one hand, the *practice* of constructing diagrams will mean that various options, including unforeseen ones, will present themselves for even the most sober plotting of information points (potentially even the most 'hands-off' methods of construction, including by computer code); whilst, on the other hand, the more speculative, exploratory or aesthetic 'unfolding' that Leeb describes as 'maps of movement' (Leeb 2011: 31) demands

a certain logical coherence if figures of thought are to 'prolong themselves into an operation which keeps them from becoming worn out' (Châtelet 2000). This, however, is not to say that there are not strong tendencies of approach in various disciplines and according to the subject or object under diagrammatic investigation.

As practicing artists, embedded in art educational and art theoretical contexts, the authors of this book are interested in what an art perspective can bring to the theory and practice of diagrams rather than in an analytic focus on logical inference or the popular aesthetic focus of predominantly statistical diagrams as art (infographics). But, as we shall see, against any quantitative-analytic vs. qualitative-sensory dualism, it is in some ways precisely the 'not-art' and 'anti-aesthetic' conceptual and didactic connotations of diagrams which have made a diagrammatic approach appealing to artists. Alongside Beuys' drawing-as-pedagogy example, we can think of Marcel Duchamp's *Large Glass* as an iconic avant-garde case of what Duchamp was trying to achieve in moving plastic art away from the solely 'retinal' mode of address. Furthermore, it is the transdisciplinary and hybrid nature and promise of diagrams that has energized artists. Primarily, it is through an engagement with the diagrammatic as a non-instrumental studio practice of experimental and autodidactic *making* that a dialectic of the aesthetic can unfold – one in which an aesthetic approach holds potential for diagramming more generally, whilst the diagrammatic holds potential for art beyond a merely formalist or autonomous aesthetics.

Do artists approach the theory and philosophy of diagrams and the diagrammatic differently than scholars in other fields? There are a number of reasons why this might be the case. Perhaps the most important of these is how contemporary artists are taught and how they work. Like other practitioners, artists learn to work within established constraints and conventions, use particular materials, techniques and technologies, and develop theories and historical knowledge to help explain the values, purposes and effects of arts. Firstly, built into contemporary arts teaching and practice, perhaps to a greater degree than in other disciplines, is the imperative to challenge, question and experiment with those conventions and paradigms, to search out innovation and to find new modes of expression and new frameworks of value and validity. Because the frameworks of judgement are less tangibly inscribed within the study of fine art, they are more open to challenge and metamorphosis. It is even precisely such challenges which constitute what is judged 'good' (providing a certain consistency and logic is evident). Secondly (and relatedly), from the sixties onwards, as the class composition of further and higher education slowly began to change, art school teaching in the UK increasingly broke free of the fine art academy model and started on a trajectory whereby 'theory' became less focused on art-specific conventions of technical practice (the learning of perspective, colour theory, etc.) or traditional art history (Greek, Renaissance, Romantic, Modern, etc.). Whilst

unevenly distributed amongst institutions, an extraordinary range of intellectual thinking was introduced, far beyond the normal remit of artistic study, including texts and ideas from continental philosophy (phenomenology etc.), analytic philosophy, critical theory, psychoanalysis, sociology and cybernetics. These resources flowed from seminars and lecture rooms into the studio. As a rule, the theoretical turn was not envisaged as a means of turning art students into philosophers. Rather, they became material producers whose exploratory practices were legitimately able to pull in ideas from other disciplines as well as from popular, esoteric and sub-cultural realms. We can describe such art school pedagogy – the experience of which has been formative to our own approach to diagramming and diagram theory – in terms of what John Roberts has called ‘techniques of indiscipline’ (Roberts 2020). Indiscipline is not necessarily opposed to the inter- or transdisciplinary but it places the emphasis less on the formally academic and more on the autodidactic character of individual and group-based research. Furthermore, it implies an attitude of negation or challenge, but one which, as Roberts is keen to emphasize, is less about ‘resistance’ and more about ‘creativity’ (resistance being as easily commodified in the contemporary art world as it is in pop/rock music – which is the subject of Roberts’ book). In spite of its ideological use as an expression of pure positivity (see McRobbie: 2015), creativity challenges and negates staid conventions and habits through new forms and methods of production. In this way the artistic turn to the diagrammatic is not only a creative ‘anti-aesthetic’ rejection of representational images and formalist compositions *within art*, but, at the same time, an aesthetically informed contribution to the wider academic, professional, amateur and everyday usage of diagrams and diagrammatic modes of engagement with the world. The modus operandi of this diagrammatic turn is, of course, the aesthetic as a matter of form, figuration, tonal resonance, etc. But this is, mostly, very different from the appreciation of infographics as ‘beautiful’, because, through their pedagogical training, artists come equipped with critical and material resources which call into question the instrumental use of aesthetics, e.g. for the efficient communication of data. What art can offer to the field of diagrammatology relies on the way artistic methods can utilize, detour, subvert and extend the techniques and possibilities immanent to diagrams and diagramming. Not constrained by usefulness or efficiency, artists can pick out and experiment with those moments of a diagram’s logic, function and mode of construction which may otherwise get passed over.

As highlighted above, an artist’s engagement with the diagrammatic takes place as part of an artistic practice. Within this practice the act of drawing continues to be a foundational technique, moving between free expression, careful observation, ad hoc diagrammatic experimentation and technical processes. Whether a contemporary artist works primarily in visual, sculptural or performative ways, their work involves drawing in the widest and most general sense of the term: i.e. the creative configuration of elements in space and time

using line, tone and gesture. This leads artists to appreciate the aesthetic character and potential of diagrams from the perspective of the drawn and made, one that values and is attentive to their construction and form independently of the functions they serve in specific situations and academic fields.

Artists working within the museum and gallery system are broadly required to produce artefacts valued and appreciated on their own aesthetic terms relative to a history of similar objects. The activities artists engage in alongside the production of art – activism, curating, debate, research, teaching, writing – are often seen as secondary or supplementary to this primary aesthetic function. But it is usually in these complementary practices that diagrams and diagramming play their most important role, as the Beuys example illustrates. Diagrams then, in the context of contemporary visual arts, can be understood from both an aesthetic and a discursive-pedagogical perspective, with each dynamically informing the other.

Diagrams have become part of the repertoire of visual tools [or ‘technical objects’ – see below] used by contemporary artists and arts collectives, who use them in their own idiosyncratic ways towards particular aesthetic, conceptual and political ends.¹ Given the nature of the contemporary art world, there is no mechanism for definitive consensus building between artists, curators or institutions about the meaning of the concepts or tools they work with or how they are used. Moreover, due to the generally autodidactic character of a contemporary artist’s appropriation and use of knowledge, learning and methods from other fields, the application of diagrams is likely to be ‘undisciplined’ (or indisciplined) relative to its formal, academic context. One can however discern, very broadly, four different ways of working with diagrams amongst contemporary artists. While Julie Mehretu and Jorinde Voigt, for example, incorporate diagrammatic elements into formal, two- and three-dimensional artworks made for gallery exhibition and aesthetic contemplation, diagramming forms part of the expanded practices of artists like Nikolaus Gansterer and Adelheid Mers, who use diagrams across their gallery works, physical performances and teaching. In recent years the move towards collaborative, socially engaged and critical art practices has led many artists and artist groups to use diagrams as a form of social mapping, revealing power structures as part of public dialogue about them. This trend was particularly evident in the 2022 documenta fifteen, curated by the Indonesian artist collective runagrupa, which brought together artist collectives from around the world, many of whom used social diagrams in this way.² Finally, there is a diagrammatic current running through artists and groups like Forensic Architecture who use statistics, data-analytics and infographics in a more functional, investigatory way to intervene in significant social and economic issues.

We work across the first three of these modes. At documenta fifteen, for example, John Cussans, working collaboratively with Roberto N. Peyre as part of the Atis-Rezistans-Ghetto Biennale community, created *Veve Kunigundis*, a

large-scale floor drawing made in real time during the opening ceremony of the exhibition that was obliterated during the party that followed. *Veves* are ritual diagrams drawn in powder during Haitian Vodou ceremonies that represent the cosmic signatures of the loa, the pantheon of Vodou spirits. In this context, *veves* are part of an operational sequence in a complex ritual system, their function and meaning relatively 'closed' to those outside the religion. Cussans and Peyre, who met at the 2nd Ghetto Biennale in Port-Au-Prince, Haiti in 2011, have been making their own *veves* since 2012 after recognizing the close correlations between Vodou ceremonies, the Black Atlantic musical subcultures each were involved with, and other traditions of performative, ephemeral drawing, such as the Tamil tradition of *kolams* or *muggus* [see Figure 0.1]. The design of each new *veve* is based on a trans-cultural language of esoteric symbolism and myth that responds to local spirits and resonant cultural traditions and patterns observed by the artists in the development of the performance.³

By transposing diagrams from a 'closed' and often mis-represented⁴ religious practice into an 'open' contemporary arts context, and obliterating them through dance, the performances remind audiences of the ritual, ceremonial and performative character of contemporary art worlds, the history of colonialism with which they are entangled and their relationship to creative practices that exist beyond the gallery and museum context. In so doing they draw analogies between the use of diagrams in Western anthropology and science and the ritual practices of cultures that have been subject to them, in ways that trouble the closed meaning of diagrams within different cultural systems.⁵

Disciplines tend to approach diagrams as tools whose utility is given, functioning as iconic supports for specific academic and practical concerns (how something works; displays of quantitative data; the visual manifestation of a proof, etc.). An arts-based approach is cognizant of a diagram's functional and discursive specificity. But it is also sensitive to the making of, and aesthetic affect of, the diagram, as much as, if not more than, its instrumental function. A judgement upon diagrams in fields outside of art as ready-made and fixed –



Figure 0.1 John Cussans and Roberto N. Peyre, Installation view of *Voltigor: Ponton for Swedish Youth*, 2014, IMT Gallery, London. Photo by Anna Druvnik. All rights reserved.

visualizations of knowledge gained elsewhere, lacking any immanent knowledge-producing capacity – is overly reductive and untrue. But so far as diagrams are normally encountered and utilized as accessible illustrative devices, often playing second fiddle to the textual descriptions they illuminate and condense, they are rarely recognized or discussed on their own terms. Diagramming practices, as image-based techniques producing cognitive appendages for the production and extension of thought, engender (to varying degrees) a sensory and associative power that can affect both the maker and the viewer. This is the case, not only with respect to the bare-bone relations they set in place but through forms, gestures, figures, colours and tones, by means of which ‘abstract’ relations can come into being.

Exceptions to this rule can be found in the work of three writers who have had a significant influence on our thinking. The semiotician, mathematician and philosopher Charles Sanders Peirce developed a sophisticated theory of diagrams that was at the core of his philosophy (see Stjernfelt 2000) from which the authors derived their touchstone definition of diagram as ‘an icon of intelligible relations’. The mathematician and philosopher Gilles Châtelet’s book *Figuring Space: Philosophy, Mathematics and Physics* (2000) was an important inspiration for the authors, particularly because of its explicitly transdisciplinary approach to the field of diagrammatics and attention to the ‘hands-on’ and embodied character of scientific revelation (for an overview see Kenneth Knoespel’s ‘Diagrammatic Writing and the Figuring of Space’ in Châtelet 2000 and Kenning 2021). It is from Châtelet that we were inspired to share our understandings and appreciation of diagrams to experts in other fields. A crucial third figure (and clear influence upon Châtelet) is the philosopher Gilles Deleuze who (sometimes in collaboration with Félix Guattari) proposed a thorough, if highly idiosyncratic, diagram concept (see Dean Kenning’s two chapters in this volume). Departing from Peirce, Deleuze makes the case for a non-iconic, non-representational conception of diagrammatic abstraction capable of connecting seemingly distinct disciplinary fields, creative practices (arts and sciences) and instances and levels of physical, social and linguistic reality.

We find it helpful to distinguish ‘diagrams’, ‘diagramming’ and the ‘diagrammatic’. Broadly speaking, one view on this, drawn from the work of Alfred Korzybski, defines *diagram* as any artefact identified as such within a particular ‘semantic environment’ (see Cussans’ ‘This is Not a Diagram’ in this volume). It follows that *diagramming* then refers to the act of drawing or creating diagrams, recognized as such within a context, and *diagrammatic* refers to the quality of being a diagram-like object. A different reading is given by Burrows in his chapter ‘Auraltechnics: Towards Audio Diagrams’. Borrowing terms from Susanne Leeb, Burrows places emphasis on diagrammatic processes which do not separate a figure from its making and interpretation. This reading derives from Peirce’s notion of the ‘interpretant’ – the third factor constituting any sign,

operating alongside the ‘object’ (of representation) and the ‘representamen’ (how the sign manifests the object for an interpretant). By including interpretation as an unavoidable moment of signification, the diagram, for Peirce, takes on an active character, with a single diagrammer potentially also performing the role of interpreter in an iterative process of trial and error experimental reasoning whereby one can put questions ‘to the Nature of the relations concerned’ (Peirce 1906: 493. On the active and pragmatic character of Peirce’s diagrammatics see Kenning 2021). In this book we approach diagrams with a kind of double vision: one eye focused on their specific functional meaning in context, the other on their aesthetic properties and their potential to suggest new or multiple figures, subjects and functions. Do all diagrams function in the same way? Where do diagrams come from (the world; the mind; the hand, etc.)? Why do we create them? What is it like to create and draw a diagram? And why do we like them so much?

The authors of this book are all artists for whom drawing, and in particular the drawing of diagrams, is central to their practices. David Burrows works with diverse media and performance to make artworks and sonic presentations, individually and as part of the UK-based collaboration *Plastique Fantastique*. Through individual and collaborative artworks, Burrows makes diagrammatic presentations of universes and worlds in embodied, intensive and immersive forms [see Figure 0.2]. This approach is explored in the book he co-authored with Simon O’Sullivan *Fictioning: the Myth Functions of Contemporary Art and Philosophy* (2019) which addresses diverse practices in which the performance or presentation of fiction actualizes existing and alternative social organizations of life. Through numerous diagrams drawn by the two authors, the book examines various *fictioning* practices and their diagrammatic modes. This theme is further explored in the Châtelet-informed essay, ‘Science Fictioning Singularities: The Diagrammatic Imaginary of Physics’ (2020) and in individually-produced art installations of black holes in galleries and other artworks derived from scientific and cybernetic presentations, exploring how diagrams are *fictioning* devices. Related to this, in ‘Science Fiction Devices’ (2022), Burrows and O’Sullivan have explored literature and art presenting diverse, multiple and alien perspectives through the creation of fictional avatars and devices, which is also explored through the exhibitions, objects and performances of *Plastique Fantastique*.

John Cussans is an artist, writer and educator who trained in sign painting, graphic design and illustration before developing a collaborative, informal and transdisciplinary arts practice that draws on the legacies of anthropology, Surrealism and revolutionary politics in contemporary culture. Diagrams entered his work through an academic engagement with critical theory, continental philosophy and psychoanalysis in the 1980s and ’90s as ways to represent the abstract systems and processes in which the individual is embedded [see Figure 0.3].



Figure 0.2 David Burrows, Installation view of *Diagram of the Event Horizon of a Black Hole*, 2018, exhibited in 'Future Landscapes' at Helsinki Contemporary, paper, card, foam, pigment, glitter, audio. All rights reserved..

Dean Kenning makes kinetic, robotic and sonic sculptures and installations, mechanisms that have an agitated 'feeling of life' and which aim for pathos and nervous attention, and a desublimating humour, through repetitive movement, sensor-based responsiveness, and the use of materials with a bodily feel. Aligned to this is a diagramming practice, stemming from an autodidactic impulse, and taking the form of artworks (drawings, prints, paintings, performance-lectures) and pedagogical workshops and seminars. Diagrammatic artworks such as *Metallurgy of the Subject* (2009–10), *Making Sense* (2021) [see Figure 0.4], *Diagramming Politics* (2017), *Signs & Signals* (2021) and the drawings and animations made for *Capital* (developed as part of the Capital Drawing Group, 2013–19) are constructed as a way to explore political, philosophical, scientific and other matters. Kenning uses diagramming methods in his teaching as a form of close reading of philosophical and theoretical texts, and has delivered diagram-based workshops at many institutions, with a wide range of students, researchers and educators. These include the *Plato's Caves* and the *Social Body Mind Mapping* workshops (on the latter, see Kenning 2015). His essay 'Exploratory Diagramming and Diagram Theory: Greimas, Peirce and Châtelet' (2021) examines the diagram's potential for practical and speculative usage through the lens of three key thinkers in order to advocate active diagramming against the



Figure 0.3 John Cussans and Roberto N. Peyre drawing *Vèvè Kunigundis* at documenta fifteen, Kassel, Germany, 2022. Photo by Guillermina De Ferrari. All rights reserved.

consumption of data visualization/infographics. Kenning has recently written about his diagramming practice for the website *Contemporary British Drawing* (Kenning 2022).

Mary Yacoob is an artist whose work encompasses ink on paper, printmaking, wall drawings, large-scale vinyl artworks and light boxes. Yacoob's work appropriates visual languages from architectural plans, cartography, electrical and engineering schematics, alphabetical systems, and musical notation. Her working method involves the researching of primary visual source material, which is then re-deployed and transfigured. She is interested in how taking diagrams out of their original context can transform functional tools into mysterious,

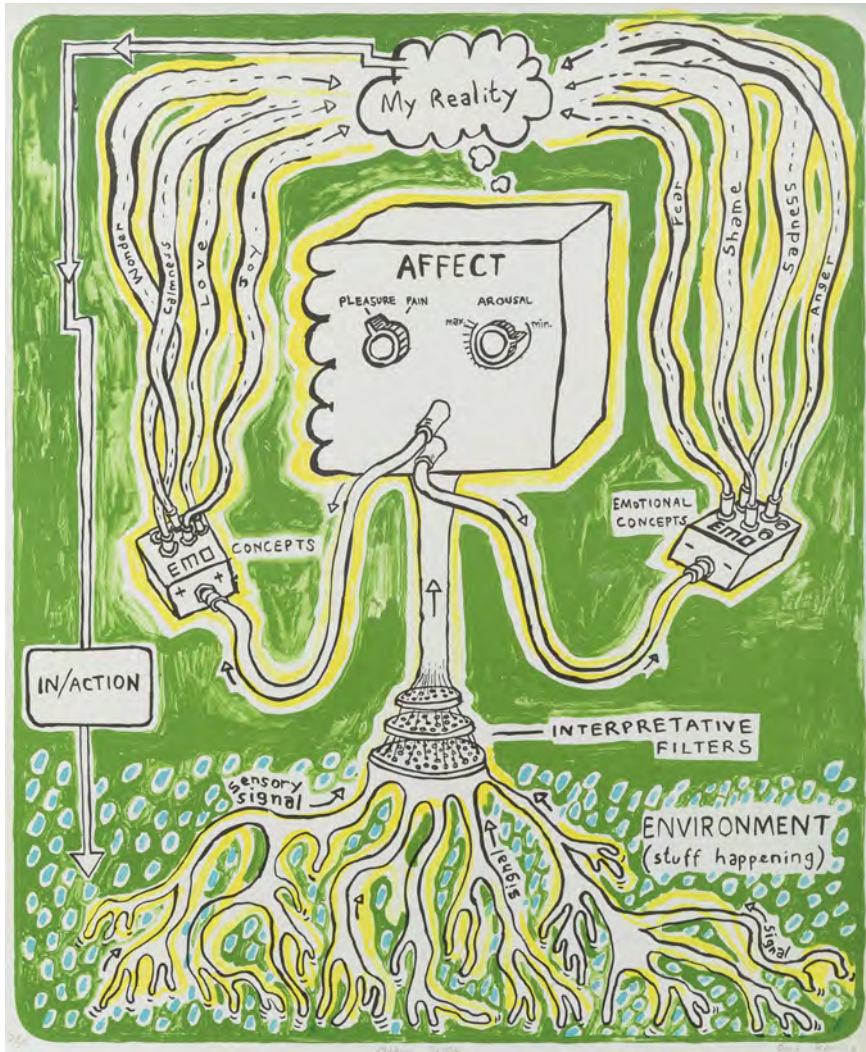


Figure 0.4 Dean Kenning, *Making Sense*, colour lithograph, 2021. All rights reserved.

architectural, spatial or monumental ciphers for the imagination that create new connections across disciplines [see Figure 0.5]. The hand-made gesture, repetition, rhythm, and systems employing order and chance, are all key aspects of her work. Yacoub’s work encourages an intimate relationship with the viewing public. Spatial forms unfold in time, revealing an intricate depth of detail. Yacoub also makes site-specific works that reimagine architectural spaces, creating propositional drawings that reconsider what was, or what could be, based on existing structures and patterns.



Figure 0.5 Mary Yacoob, *Marcello Mind Maze*, vinyl on window, The Hospital Club, 2019. All rights reserved.

As makers of diagrams, the authors share a fascination with the aesthetic and affective quality of diagrams in general, a tendency the artist Matthew Ritchie has called ‘the temptation of the diagram’ (2017). This led Burrows, Cussans and Kenning to create DRUGG (Diagram Research Use and Generation Group) with their colleagues Ami Clarke, Andy Conio and David Osbaldeston in 2012, which hosted two symposia and organized a group exhibition *Plague of Diagrams* at the Institute of Contemporary Art, London in 2015. Later they would go on to form SMRU (Social Morphologies Research Unit) with colleagues from the anthropology department at UCL, creating a collaborative exhibition *Morphologies of Invisible Agents* and a programme of workshops at Space Studios, London in 2019. DRG (Diagram Research Group) began during the Covid lockdown in April 2020 when Kenning and Yacoob invited Burrows and Cussans to join an online reading group that began with Sybille Krämer and Christina Ljungberg’s *Thinking with Diagrams: The Semiotic Basis of Human Cognition* (2016). The group met regularly over the next few months, eventually undertaking an online residency at Flat Time House, the former home and studio of the artist John Latham, now his archive and a gallery space. Latham’s own persistent and autodidactic diagrammatic engagement with cosmology and post-Einsteinian physical theories of time presented the foundational context whereby we were able to extend our own diagrammatic practices speculatively into questions of space, time and the physical universe.⁶

Artist as Ceiling Fan

Adelheid Mers’ *The Artist as Ceiling Fan* (2006) [see Figure 0.6] represents the multiple facets of a contemporary arts practice as the blades of a ceiling fan. When the fan is active and ‘doing its job’ the individual blades work in unison and cannot be seen. Only when the fan has come to rest can we parse out the different functions of the device. While making remains the main blade of contemporary art practice (indicated by the darkened tone), writing, teaching, and curating are complementary expertizes that an artist is likely to need to function professionally today.

Despite decades of anti-aesthetic, critical, conceptual, performative and socially engaged challenges to the paradigm, the ideal of an artwork as a durable artefact whose meaning is bound to its aesthetic qualities and form, contemplated at an appropriate distance by individuals in specially created spaces, still dominates the institutional practices of contemporary art. As mentioned above, a reason for this is the museum and gallery system’s requirement that an artwork should be self-contained, complete and ‘autonomous’, a requirement which is closely bound up with the work’s potential market value. The gallerist’s panic when the student-assistant started to wipe Beuys’s blackboard shows how,

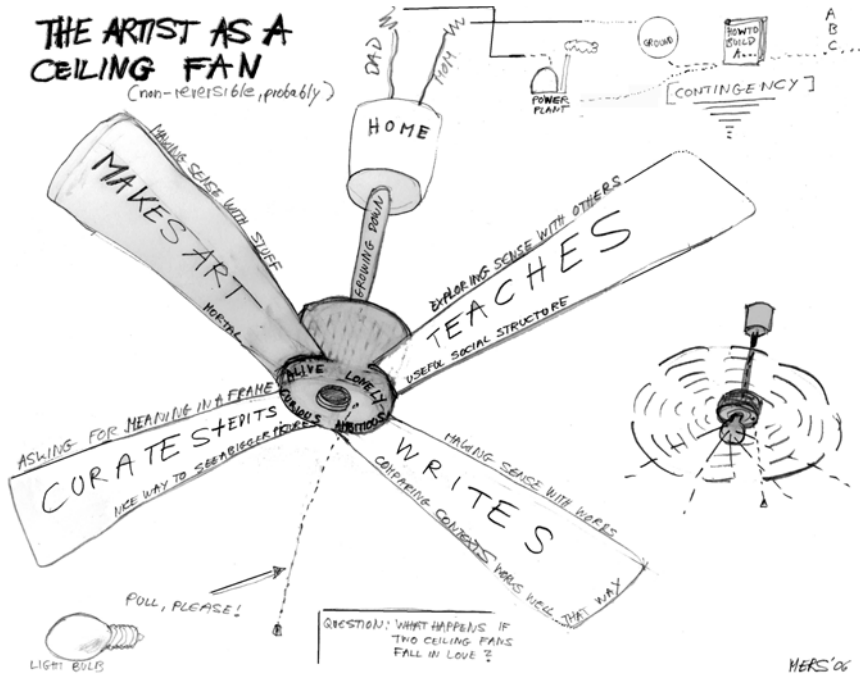


Figure 0.6 Adelheid Mers, *The Artist as Ceiling Fan*, 2006. All rights reserved.

whatever the social, critical or political meaning of the diagrams, in order to function as contemporary art they cannot still be 'in process', i.e. there must be a stopping point if the object is to acquire the status of art. Perhaps one of the reasons diagrams aren't ordinarily associated with contemporary art has to do with this ideal of the completed and self-contained artefact that has no utility beyond the artistic. Unlike a functional diagram, an artwork is conventionally understood as serving no purpose beyond itself. A diagram, generally understood, always serves an extrinsic purpose, however elusive. This may help us understand why some of our own uses of diagrams relate more closely to the curating, teaching and writing blades of Mer's ceiling fan. But if the aestheticization required for the production of cultural and market value limits the capacities of the diagram to some degree, it may also be that the aesthetic and non-utilitarian tradition of art can also prevent diagrams from being 'used up' either as 'rigorous' axiomatic servants of science, or as the plotting of pre-existing data for consumption: a mixed blessing then.

Although they could not be described as part of the general stock-in-trade for contemporary artists, diagrams are a relatively familiar mode of formal and conceptual production encountered in galleries today. If Suzanne Treister's esoteric sci-fi works run in a tradition of af Klint, then Jeremy Deller's flowchart-

cum-mind-map *The History of the World* (1997–2004) and Nolan Oswald Dennis' *No compensation is possible (working diagram)* (2018) both adopt something of the pedagogical approach and aesthetic of Beuys, whilst tapping into the systems-style of politically informed conceptual art à la Hans Haacke. For us, diagrammatic production is central to what we do, and crucially this production takes place on all four blades of Mer's ceiling fan. Though each blade requires a particular set of skills and competences, each is approached with a sensibility derived from the primary activity of art making and drawing. Artists work within and between visual, semiotic and performative registers with the particular sensibility we are calling 'aesthetic'. Diagrams are hybrid, meaning they can operate across the thresholds of these different registers. They also have the potential to bridge the different components of a wider practice.

The tendency of much European modern and avant-garde art in the early twentieth century to move away from pictorial representation or, more radically, away from the 'retinal' and towards function (Bauhaus; Constructivism), abstraction (Cubism; De Stijl) and alternatives to the bourgeoisie institutional framing of high culture (Dada), brought artists into the orbit of the diagrammatic. If we consider the pseudo-technical diagrammatic approaches of Dada artists such as Duchamp and Francis Picabia, it is evident that the technical and the machinic become resources for the avant-garde to attack or 'negate' the formalist and humanist aesthetics of early twentieth-century Post-Impressionism. For both these artists, it is precisely the associations of diagrams with non-expressionistic commercial technical drawing, and with instrumental purpose, that makes the diagrammatic such a tempting 'anti-aesthetic' mode. Later, Antonin Artaud's own machine-human anatomical hybrids take on a less parodic, less ironic and more affective and subjective intent – an intense outpouring of precise expressions produced in notebooks combining drawing and text – works which were to have a profound influence on Deleuze's conception of the diagram as an intensive, 'abstract machine' (see below).

It was also at this time that artists began to look to other fields for inspiration and explanation of what art does (physics, psychology, psychoanalysis, spiritualism, etc.) and that artists and critics began to speculate upon the wider socio-economic conditions that made art possible and shaped its evolution (critical theory). As Burrows shows in 'Cosmotronics: Beyond the Bubble' and Yacoub in 'The Diagrammatic Works of Hilma af Klint', a diagrammatic tendency was evident in the work of many early avant-garde artists. In the case of the signatories to Charles Sirató's *Dimensionist Manifesto* (1936), this impulse was derived primarily from developments in the physical sciences, notably the theory of general relativity, the positing of a fourth dimension and the concept of spacetime. In the case of Hilma af Klint the inspiration came from the occult sciences of Theosophy and anthroposophy as well as scientific illustration (af Klint was trained in botanical illustration).

One could argue that the history of Western art, from the pre-modern to the present, is marked by *diagrammaticity*. For the pre-modern consider mathematically derived perspective, or the allegorical puzzle piece which is Dürer *Melancholia* (which sits parallel to the Renaissance tradition of alchemical prints – a rich body of highly diagrammatic work combining various belief systems, which exists outside of standard histories of Western visual art). For the early modern Romantic period we can consider Goethe's transdisciplinary *Theory of Colours* first published in 1810 (Goethe 1970), which took a phenomenological and deeply aesthetic approach to the science of colour in an effort to go beyond Newton's optics. Alongside its influence upon leading scientists and philosophers of the nineteenth and twentieth centuries, we cannot underestimate its cumulative influence upon artists, from Turner to af Klint, Kandinsky and beyond. It is the visual mix, without hierarchy, of scientific method, taxonomy and aesthetic experience evident in the rich visuals at the heart of Goethe's book that makes it so appealing as an approach which *extends* the possibilities of art through an engagement with science, rather than art being something which is seen as an aesthetic-subjective *alternative* to science as such.⁷ In the modern period, diagrammaticity in art relates to a politicization and psychologizing of art that brings art practice into close proximity and engagement with other fields of learning. By the middle of the twentieth century, artists were also looking towards other fields of knowledge to understand, explain and inform what they did. By the 1960s, as the politics of anti-imperialism, environmentalism, feminism and the New Left began to affect the range of practices on offer to contemporary artists (film, happenings, performance, protest art, etc.), artists became increasingly engaged with and critical of the structures of power and influence within which they operated. It was at this time that conceptualism (a form of art based primarily on philosophically inflected propositions and recipes of production) and structuralism (a tendency within the human sciences exploring the relationship between the rules governing communication and meaning and those governing social systems) came to the fore. It is arguably these two tendencies that ultimately led to what Kenneth Rogers had described as the 'diagrammatic turn' in contemporary art (Ritchie 2016: 15). Due also to the seepage of transdisciplinary cybernetics into art, a more systems, feedback and algorithmic approach certainly came to the fore with the conceptual and process art of the '60s and '70s, marking a shift away from the optical-formalist focus of abstract painting, where geometry and colour relations dominated for symbolic as well as purely aesthetic purposes. This visually 'ascetic' approach became a powerful aesthetic in itself. The conceptual approach has remained strong in contemporary art today, although without the necessary strictures on the affective and imaginative powers of material form, narrative, identity and symbols.

As contemporary artists versed in art history, art theory, psychoanalysis, critical theory etc, and highly conscious of the wider social context in which art is

produced, exhibited, discussed and exchanged, we are very aware of both the internal and external systems and structures in which our activity operates. It is important to acknowledge that this engagement can be highly informal and undisciplined. Artists, in the way they produce works, have a playful, open, non-deterministic approach to words, symbols, images, patterns, and structures that, although ostensibly aesthetic, clearly partake of the diagrammatic. An artistic approach to diagrams and diagramming, understood as an active, practice-based, indeterminate and (generally) non-functional exploration of forms, figures and schemas common to many disciplines, offers a way of giving new life to diagrams by exploring their interdisciplinary potential. Given the importance of the non-deterministic emphasis on the drawing of diagrams in some art practices and the multiple aesthetic, formal and historical perspectives art can bring to diagramming, an arts-led approach to diagrams may have insights to offer academics and practitioners working in other fields.

Drawing Analogies

Some preliminary explanation about the choice of title may help readers when engaging with a key concern of our book: the ways in which diagrams explore relations through analogies. The expression 'drawing analogies' is a common term to describe ways of finding a likeness between different things. For analogies to be meaningful, this likeness must produce an understanding of the referents of an analogy. More precisely then, analogy refers to an inference formed when a meaningful idea is conceived in the correlation between something that happens in one area of experience and something that happens in a very different one. But why do we use the term 'drawing' to describe this process? We use this term to refer to the marking out or tracing of correspondences between forms or ideas. Through analogy, a correlation is affirmed by asserting a perceptual resemblance or correspondence of qualities between things, or else by finding a more abstract equivalence or connection when comparing the structures, functions and underlying mereological relations of things (i.e. the relation of parts to wholes).

Analogy is something common not only to diagrammers engaged in university discourses but also in everyday life and thought. In *Surfaces and Essences: Analogy as The Fuel and Fire of Thinking* (2015) Douglas Hofstadter and Emmanuel Sander argue that analogy-making is the core of cognition. Without it we would not be able to identify similar things with single words or create categories by which to order their abundance and variety. Though primarily a cognitive or intelligible process (i.e. something that happens in the mind), the capacity to make correlations depends upon being able to perceive *formal* similarities between one situation and another (i.e. two different events or objects

are recognized as having characteristics in common). The basic ability required for the creation of mental categories then is the creative capacity to perceive resemblance and difference within our sensual environments, something artists are particularly well placed to represent. One could even argue that art-making, in the widest anthropological sense, begins with demarcations of sensory similarity and difference. Following this line of reasoning, the ‘drawing’ of analogies is itself an analogy, i.e. a cognitive event (analogy) is understood via an intuitive resemblance with a technical process of physical inscription (drawing).

Our brief account of the term analogy will hopefully aid the reader’s understanding of the different perspectives on diagramming and analogical thinking taken up by the chapters of this volume. It is perhaps Aristotle who has had the greatest influence on analogical modes of thinking. Aristotle claimed there were two main types of analogy, which the Scholastic philosopher St Thomas Aquinas distinguished with the terms ‘analogy of proportion’ and ‘analogy of proportionality’ (see Kenning’s chapter ‘Deleuze’s Living Diagram Pt. 1: From Structural to Intensive Relations (the Biological Idea)’). Analogos, meaning ‘proportionate’, suggests that different things partake to some degree in a likeness. But whereas analogy of proportion occurs when two or more things stand in relation to a shared factor (e.g. as healthy food or healthy complexion both stand to health), analogy of proportionality refers to a structural correspondence (a is to b as c is to d, wings are to birds, as fins are to fish). The similarity here is not found in the objects themselves, but in the ratio or relation which constitutes each pairing (see Danby-Smith 1969). In *A Thousand Plateaus* Deleuze and Guattari (1987) will link this first type of analogy – what they call ‘resemblances that differ’ – to perceptual resemblance and the faculty of imagination, and the second type of analogy – what they call ‘differences that resemble’ – to a structural resemblance and the faculty of understanding. Structural isomorphism is associated with modern science’s impulse to abstraction, and the breaking of the perceptual correspondences that hold the pre-modern universe together in a ‘great chain of being’ (Deleuze and Guattari 1987: 273–6).

Following the argument of Hofstadter and Sander, analogy correlates, through intuitive resemblance, two different kinds of experience. From this perspective, although analogies aren’t necessarily diagrams in themselves, without the capacity of the mind to imagine correlations between different things, diagrams would be meaningless. We can put this another way by returning to the interpretant. If we follow Peirce’s proposition, a diagram is an iconic sign conveying intelligible relations which, if it is to be a sign, requires an interpretation by a sentient agent (what Peirce calls a ‘quasi-mind’). That is, the meaning of a diagram does not reside in the diagram alone – the resemblance the diagram holds to the object it represents requires a third element: the interpretant. The analogy the diagram makes to the object it signifies must be drawn by the interpretant as another diagram (one inscribed on the mind or understood

intuitively). It is here that the role of symbols and indices are crucial in determining the degree to which rules fix the meaning and function of the diagram for any possible interpreter-user. There is always the possibility not merely for 'wrong' interpretation, but for new meanings to come into view, including in the mind of the diagrammer. In this way, by means of further analogies, 'symbols grow' (Peirce 1998a: 10).

Whether we 'draw', 'make' or 'map' analogies, the emphasis for us is on the active, creative and inventive foundation of the process, which is the basis of our professional lives as artists, writers and arts educators. In art classes we often say, 'there is no right answer'. To this end, although the authors share many concerns they also recognize they have different perspectives and approaches to diagramming, which together instantiate a practical and discursive field of possibilities for artistic diagramming. For John Cussans, it is the crucial connection between the acts of drawing and thinking, seeing and making, of showing and telling, through which diagrams have come to be understood as 'drawing analogies'. For Dean Kenning, it is possible to think of the diagram not only in terms of an analogy of structural relations but as a way in which immediate connections can be made between things which have been rendered separate – a mode of connection that is closer to the analogue. For Mary Yacoob, the diagramming processes of scientists and artists are often similar in their analogical presentations of the invisible and the temporal. And for David Burrows, diagrams, diagrammatic artworks and sonic presentations become compelling when analogies are pursued through embodiment and immersive presentation. For all the authors, a concern for analogy ties the practice of drawing to the practices engaged in thinking, perceiving, feeling and registering what is not apparent to us. And by extension, this ties the practices of art to those of science.

It is worth mentioning two other terms that have relevance for diagramming here: 'metaphor' and 'analogue'. 'Metaphor' constitutes for Peirce a third type of icon (after images and diagrams), one that is analogous to its object insofar as it represents a parallelism in something else, (i.e. it is a comparison between two things that are not alike in perceptual form or structure, but only by a leap of the imagination within a shared language). The term 'analogue' also indicates a correspondence between things, though correlation by analogy is different to analogue connection. Specifically, the term analogue refers to a physical, quantitative relation between continuously variable things, often identifiable with what Peirce calls an indexical sign, where the relation to the object is real rather than constructed (such as a photograph capturing reflected light, a needle registering sound by tracing bumps in the grooves of a vinyl record, or the tracks on a road left by a bicycle). Both metaphor and analogue may be a feature of diagrams, but they do not underpin diagramming in the way that analogy and the iconic sign do, at least not as conventionally understood. [For more on metaphor as a form of analogy, see the next section.]

The case may be more complicated if we bear in mind another kind of analogy, different in kind to the two types of analogy identified above, i.e. perceptual resemblance and structural resemblance. This third kind of analogy, which Dean Kenning explores in the second chapter of his two-part essay, comes from Deleuze's book on the painter Francis Bacon. What Deleuze names 'aesthetic analogy' (and what Kenning specifies as 'nervous analogy'), is more closely associated with the analogue, and yet is not identified with the indexical sign, which, for Deleuze, still pertains to resemblance, whilst not being a constructed representation. The type of relations that Deleuze is concerned with in his idiosyncratic concept of the diagram, are intensive, rather than purely structural relations, and are a case of reciprocity between two sets or series of relations which do not in themselves resemble one another. Operating on a common or 'univocal' plane of connection, actual forms and functions emerge from these intensive relations, to which they remain connected. Deleuze therefore rejects a structuralist approach which, whilst getting us beyond perceptual or imaginary appearance, remains, for Deleuze, not abstract enough.

Anthropological Perspectives

Anthropologists concerned with ontology have identified the development of Western scientific or Enlightenment knowledge with an ontology of naturalism, which differs from an ontology of analogism. Although none of our chapters address anthropology at any length, the writing of various anthropologists has been discussed when developing the DRG's thinking about diagramming and analogy. We engaged with anthropology not to develop an ethnography of diagramming as such; rather, we wanted to understand different epistemes and creative processes articulated through diagrams. That is, we wanted to understand how analogic thinking through diagramming engenders concepts and accounts of reality. Philippe Descola's book *Beyond Nature and Culture* (2013) is most relevant here for its discussion of analogism, which suggests that analogic thinking offers 'dizzying prospects' in comparison with three other ontologies: 'totemism', 'animism' and 'naturalism' (201). Why does analogism offer dizzying prospects? It is because analogy creates order in a chaotic world of many different things through resemblance and similarity, leading Descola to suggest that the world of analogism is elusive (205). Descola names two ways analogism brings order: the first is through identifying metaphorical links, which the anthropologist qualifies as similarity between terms; the second is metonymic links which relates to similarity in relations. The first order establishes connections in space and through proximity or closeness, which Descola further describes as affirming things, often with different scales, as mirror images of

each other. The second order of analogism seems to relate more directly to diagramming, in that, as Descola states, similarities concern the relations maintained by things, which the anthropologist identifies as 'analogy in the strict sense' (205).

Descola's model has echoes of Michel Foucault's discussion in *The Order of Things* (1989), where he describes the central role resemblance plays in constructing knowledge of Western culture during the Renaissance period. Analogical resemblance superimposes the bonds connecting adjacent things, and the emulations which double things across the distances of space. Analogy is particularly powerful because it moves beyond visible and substantial similitude to 'the more subtle resemblances of relations' (Foucault 1989: 24) which can extend and multiply almost infinitely. Foucault illustrates this point by listing some of the many analogies found during that period for the relation between the stars and the sky: 'between plants and the earth, between living things and the globe they inhabit, between minerals such as diamonds and the rocks in which they are buried, between sense organs and the face they animate, between skin moles and the body of which they are the secret marks' (24). Everything becomes a sign. You need only know how to read the resemblance: given its convoluted, brain-like appearance, the walnut should be taken to alleviate ailments of the brain. 'The sign of affinity, and what renders it visible, is quite simply analogy; the cipher of sympathy resides in proportion' (31). Resemblances multiply to confirm existing resemblances, with these accumulating signs ultimately all functioning, in their very multiplicity, to back up the truth of the Christian and classical texts. It is with the seventeenth century passage to rational and scientific knowledge that similitude and analogical mirroring becomes a source, not of divine knowledge, but of human error – something to be wary of, or to play with in the realms of art (56–7).

Following Foucault, Descola describes how analogism is found across the planet in many societies and in mediaeval Europe, which developed the idea of the great chain of being (mentioned above) as a hierarchical structure ordained by God, in which everything is connected [see Figure 0.7]. Descola is clear about Aristotle's part in the development of this concept and the influence this 'cosmological schema' has had on modern epistemology. Descola notes that hierarchies are introduced by Aristotle in which, 'the genera are fixed, the species are indivisible, and living creatures are arranged in accordance with the degree of their perfection'. The chain of being schema explains how 'the continuous and the discontinuous fit together' (Descola 2013: 202). It is this mediaeval analogism that interests us most here and which naturalism displaces (though perhaps not entirely) (201–5). Descola suggests naturalism is developed by the Enlightenment as a separation of nature and culture, or of nature from human culture. In this, the reality of nature becomes the object of modern science. The anthropologist writes (as a modern): 'For us, what differentiates humans from nonhumans is a



Figure 0.7 Didacus Valades, *The Great Chain of Being*, from *Rhetorica Christiana*, 1579.

reflective consciousness, subjectivity, ability to signify, and mastery over symbols and language by means of which we express those faculties . . .’ (173). What made the development of naturalism possible, Descola argues, is analogism’s pursuit of correspondence between human and cosmos, which engenders an Enlightenment privileging and elevation of humans as the seat of ‘a denser focus’ of correspondences (206), finding order in a seemingly chaotic universe. It follows for Descola that the Great Chain of Being gives way to a system of thought that separates physical nature from human and religious spheres, with nature becoming further divided into different scales and orders of reality. A question is whether something of the two ontologies can be found at work in diagramming. And if so, what purpose and ends does the combination of analogy and analogism and scientific or deductive reasoning serve? What tensions and orientations do different diagrams combining analogical, artistic approaches and scientific thinking explicitly or implicitly articulate or explore? And, as Dean Kenning explores in his chapters, is there a way for the diagram to move beyond both cosmic connections and classificatory separation, to constitute something more ‘rhizomatic’ (Deleuze and Guattari 1987) – a mode of becoming whereby the things that connect lose their status as separate, bounded entities, without, on that account, being subsumed within a larger whole? For DRG, these are questions pointing to the productive tensions of diagrams that, to repurpose a quote from Châtelet, unlike metaphors, will never be exhausted.

Those who possess firmly defined epistemic values may argue that analogy has a weak purchase on reality. Diagrams expressing analogic thinking and analogous relations may be thought inferior to scientific formula, equations or data, which bring mathematical rigour and precision to propositions and statements. This is something Peirce touches on in his comments on analogy, which he agrees has all the power of induction, and therefore analogy has all the uncertainty of induction too (1998d: 53). Peirce’s ‘existential graphs’ aim at producing a diagrammatic means for presenting logical expressions practically superior to (symbolic) algebraic formulations. It would seem the philosopher’s ambition was to create visual schemes governed by deduction and a logic of reduction. Beyond giving service to the imagination, however, Peirce couldn’t see how analogy provides any service to the sciences (1998e: 184–5). However, when addressing scientists who would label experience of qualities illusionary or as having no purchase on reality, Peirce argued that analogy has significance. Although there may be differences, Peirce contends humans share experiences of qualities. He gives the example of a man who is blind from birth comparing red to a trumpet’s blare, which is an analogy based on overhearing discussions of the colour red among sighted people (193). Peirce reasons that he too can understand redness as a trumpet’s blare, and that analogy has value for this reason. The philosopher speculates that a retort to his reasoning might be that this is not fact, it is poetry; Peirce states this is nonsense – bad poetry is false but

‘nothing is truer than true poetry’ (193). Again, Peirce hears his imaginary interlocutor questioning his thinking and he states:

I reply that every scientific explanation of a natural phenomenon is a hypothesis that there is something in nature to which the human reason is analogous; and that it really is so, all the successes of science in its applications to human convenience are witnesses. They proclaim that the truth over the length and breadth of the modern world (193).

Perhaps here, Peirce articulates not just why analogy might be important for diagramming but also the significance of analogy for the application and communication of scientific knowledge? There still seems to be, however, a tension between the analogical and mathematical (or deductive) operations of diagrams.

Diagrams and Technicity

This brings us to a consideration of diagrams as a technology for invention, thought and communication. A few words on technicity might further address the productive tension outlined above. Our book concerns, for the most part, modern European and American uses of diagrams in art, the sciences, psychoanalysis, philosophy and anthropology, which have their progenitors, one way or another, in geometry and the first diagrams of Ancient Greece, Mesopotamia and Egypt. We also acknowledge that religious, mystical and esoteric diagrams of the pre-modern era are important in providing something of a diagrammatic ground for diagrams of the modern period. And it is the development of diagrams in the Enlightenment era that has relevance for our book, as diagrams were designed and reproduced for common use in the publishing of figures and schemas to organize and share scientific, technical and other kinds of knowledge.

An encyclopaedia edited by Denis Diderot, Jean le Rond d’Alembert and others and compiled and published between 1751 and 1772 marks such a point in the use of diagrams in Europe. Diagrams are so numerous in the volumes that they appear as something of a symptom of the development of Enlightenment culture (over 1,800 illustrations alone were printed by engraver Robert Bénard, though later editions were printed without images to enable better circulation of the volumes). The full title of the twenty-eight-volume work by Diderot et al. is *Encyclopedia, or a Systematic Dictionary of the Sciences, Arts, and Crafts*. It was published as part of a secular project with the aim of democratizing knowledge. This commitment to reason and democratizing knowledge remains

a feature of diagramming today within and without the academy. It is a component of a technicity – a technological approach that defines human relations with nature and reality – that remains important to the inheritors of Enlightenment culture.⁸

The technicity of Enlightenment diagrams is something that we value as tools, as having the functionality of developing and sharing knowledge about the world. We are interested in diagrams with other kinds of technicity, other kinds of functions too. To return to the productive tension mentioned above, the authors value traditions and approaches beyond diagrams of the Enlightenment and the sciences. As already implied, this includes uses and functions of diagrams that are aesthetic, metaphysical, cosmological and, for want of better terms, spiritual or mystical. Through diagramming, and through means that might be employed in the sciences but for different ends, these other kinds of technics aim to realize or present what is transient, intensive, virtual, immanent, mobile and yet-to-come rather than to give an account of what might be physically or actually said to exist. This is evident in the diverse list of artists, philosophers, psychoanalysts and scientists that feature in our chapters, including: Halim El-Dabh, Gilles Deleuze, Jacques Lacan, Salvador Dali, C.S. Peirce, Hilma af Klint, Gregory Bateson, Susanne Leeb, Pauline Oliveros, Francis Bacon, Black Quantum Futurism, George Widener, Étienne Geoffroy Saint-Hilaire, Walter Jakob Gehring and Yayoi Kusama. In exploring the work of these theorists and practitioners, we are interested in diagramming as a technical *and* poetic activity registering the affective and semantic responses, alongside the material, abstract and cosmic.

In that we view diagrams as technologies and diagramming as a technical activity in many of the cases we examine, it becomes imperative for us to recognize that diagrams are ‘technical objects’. Technical objects are defined by Gilbert Simondon as mediators between humans and nature, or humans and the universe (1980: 1), and we note that diagrams as technical objects can have diverse and multiple functions as such mediators. In this, Simondon opposes his conception of technical objects to philosophies that would cast technology as the opposite of nature. He also writes that technologies are different to mere tools that have specific, utilitarian purposes, in that technology engenders invention (3–4). Likewise, and in that we claim diagrams are aesthetic or gestural machines, we do not see diagrams as merely meaningless processes or formations which operate towards specific ends. Rather, just as Simondon conceives of technologies, we approach diagrams as open or indeterminate, allowing humans to process information or attend to or produce worlds in different ways. In addressing this, the writing of Yuk Hui on technicity and specifically cosmotechnics is important for drawing attention to European or Western narratives – Promethean myths and Heideggerian critique – that present technology as having one history (referenced in David Burrows’ chapter on cosmo-diagramming). This is a story that casts technological development as

necessarily productive of a division between humans and nature, or that presents technology and science as necessarily distanced from concerns with the moral and the cosmic (Hui 2016). Hui, who is influenced by Simondon, points to other narratives concerning technology, including traditions in China in which Promethean transformation or technological alienation is not the key narrative. Throughout our group dialogues, we have spent time discussing diagrammatic technologies of Aztec cosmology, Egyptian language systems, Mayan calendars, and the veves of Haitian Vodou, which are examples that show the importance of diagrams across historical, geographical and cultural periods. However, as noted above, this book has a focus on particular European and North American diagramming practices of the twentieth and twenty-first centuries, in art, philosophy and science, and we examine cases that are emblematic of an intersection between the processes of reduction and abstraction of various Modernisms concerned with systems and technology, on the one hand, and invisible processes and worlds on the other. All of which is reflected in the paintings of Hilma af Klint, which Yacoob writes about, and the work of others from early to late twentieth-century art – from Dada to Conceptual and process art – and which continues to be reflected in contemporary art of this century. The authors attend to modern and contemporary diagrammatic innovations through case studies that relate to their individual practice-based research, and as such, the book is not a comprehensive survey of diagrammatic artistic practice as celebration or critique of the canons of art, science and philosophy. Rather, our concern has been to present cases in which diagrams are devices that enable different and varied bodies and traditions of knowledge to intersect.

Chapter Summaries

As will be evident from the chapters, the authors don't recognize traditional distinctions between 'theory' and 'practice' in the arts. Our perspectives on this owe much to the enduring legacies of conceptualism, critical theory and emancipatory politics in contemporary art since the 1960s, and indeed to the multidisciplinary cross-fertilizations that occurred in earlier twentieth-century movements such as Surrealism. Furthermore, the challenge to theory-practice distinctions, evident in the inclusion of our own diagrams in this volume, stems from our belief that arts pedagogy and art writing are modes of an expanded, socially engaged arts practice alongside the making of works for exhibition. We do, however, feel it useful for the reader to divide the book into sections – so long as it is understood that there is a good deal of slippage and crossover between the orientations and material covered in the two sections. The first, 'Ontologies and Epistemes', contains chapters that have a broadly art historical, philosophical

and speculative tone. The chapters in section two, 'Diagrams in Use' have what might be called a more 'applied' orientation.

Part One begins with 'Invisible Machines: Psychoanalytic Imaginaries and Paranoid Critical Theory' in which John Cussans draws analogies between the totalizing and systematic thought of paranoia and those of psychoanalytically inflected critical theory via the diagrammatic turn in postmodernist art theory. Taking the art historian Rosalind E. Krauss as an example, Cussans discusses how such diagrams operated in tandem with new understandings of contemporary subjectivity as schizophrenic and how these formulations correlate to a paranoid modality in postmodern culture and theory. Tracing the theory of paranoid knowledge from Jacques Lacan's immersion in the culture of Surrealism in the 1930s and his return to Freud in the seminars of the 1950s and '60s, the chapter discusses how the psychoanalytic idea of paranoia as a logically sustained systemic delusion bears an uncanny resemblance to the totalizing and deterministic character of Marxist critical theory when combined with structuralism and psychoanalysis. This analogy is explored through Lacan's development of a series of diagrams explaining how the Subject in psychoanalysis is expressed through the registers of Imaginary, Symbolic and Real. Cussans makes a case for paranoid-critical diagramming as having a creative and playful role in the 'adventure of the subject', enabling a visualization of the systems and structures that shape and give meaning to our lives without feeling oppressed or trapped by them.

In 'The Diagrammatic Works of Hilma af Klint' Mary Yacoob considers how the semiotics of Peirce can help us distinguish and analyse aspects of af Klint's sign processes. The chapter considers how af Klint's imaginative and sometimes cryptic works can help us reassess the relationships between abstraction and diagrams, and the roles of indexical and symbolic signs in diagrammatic artworks. Diagrams can facilitate the schematization of imaginary or sacred ideas. They can be the space in which we approach unknown entities by forming analogies with known entities. The abstractive quality of diagrams can make them a common ground upon which visual imagery and ideas from varied disciplines can correlate. Af Klint's works employ a range of diagrammatic strategies to explore the relationships between the visible and invisible and between matter and spirit. Although af Klint's art was rooted in her spirituality, it incorporated influences from botany, biology and geometry.

In 'Cosmo-Diagrams: Beyond the Bubble' David Burrows explores the diagrammatic works of artists informed by the concepts of physics and concerned with cosmology. The chapter compares the diagrams of astrophysicists Carlo Rovelli, Richard Feynman and John Wheeler with the work of Alexander Calder, Yayoi Kusama, John Latham and Black Quantum Futurism. Approaches to spacetime and the concept of time are examined in the work of both scientists and artists, which is a comparison informed and influenced by Yuk Hui's concept

of cosmotechnics, defined as the making of a relationship between cosmic and moral orders through technical activities. The concept cosmotechnics is repurposed to address modern and contemporary art and the ontological differences and similarities of the diagrams of artists and scientists, as well as to explore the ways in which embodied knowledge is in play within different diagrammatic presentations. A key question is whether the different diagrams examined in the chapter present the cosmos or humans as the ground of reality, which is to ask whether the different diagrams position the maker/viewer of the diagram within or at some point outside the cosmos.

Over two chapters, Dean Kenning traces Deleuze's concept of the diagram (also developed with Félix Guattari) back to a proto-diagram evident in Deleuze's major philosophical work *Difference & Repetition*. In 'Deleuze's Living Diagram Pt.1: From Structural to Intensive Relations (the Biological Idea)', Kenning explores Deleuze's critique of Aristotle's logic of difference, which divides up and organizes the world according to oppositions, identities, resemblances and analogies. This 'branching' method, so influential on subsequent classificatory and taxonomic systems, has the double disadvantage of i.) only displaying the differences between already existing things rather than showing how difference makes itself in a dynamic process of emergence; and ii.) establishing wide gulfs between major categories, bridgeable only by the abstract mechanism of analogical isomorphism ($A:B = C:D$). Rather than representing difference on an extensive plane (the arboreal diagram of classification), Deleuze problematizes the figure-ground relation, opting for a common or 'univocal' plane of being in the midst of which difference emerges as a plastic process of creation and destruction. This plane, which is not extensive but intensive, is the field of forces, movements and speeds through which the 'diagram' operates. Utilizing examples from embryology and genetics, Kenning shows how Deleuze's diagram synthesizes intensive relations between virtual elements, in order to actualize forms which correspond to those determining structures of elements, yet without resembling them. As these reciprocally generative relations take place on a common plane of existence and remain attached to the forms which they bring into empirical extensity, there can be no limit set on what can connect with what in a constant process of becoming.

Part Two of the book begins with Kenning's second chapter, 'Deleuze's Living Diagram Pt. 2: From Structural to Nervous Analogy (Francis Bacon)'. Here, Kenning extends his enquiry from Pt.1 to the field of painting. The chapter starts with an overview of Louis Hjelmslev's linguistic theory of 'double articulation', where a continuous and common 'thought mass' underlies the particular ways open for different languages to express meaning through combinations of, in themselves non-signifying, linguistic elements. As an example of actualization from a univocal field of intensity, Hjelmslev's model was taken by Deleuze and Guattari to develop their diagram concept. The rest of the chapter is an exploration

of Deleuze's diagram as set out in his book on the mid-twentieth-century painter Francis Bacon, an artist who wanted his singular figures to emerge 'from a river of flesh'. Bacon had described a technique of involuntary marking or scrubbing out of sections of the painting and then surveying the resulting distortions like a 'sort of graph'. By breaking apart narrative and figurative relations, and by suggesting new possibilities, Bacon's diagram offered him the means to 'trap' an image which he felt was closer to the nervous sense of lived reality. What is of particular note for Kenning is the way that Deleuze, in contrast to his earlier renunciations (as described in Pt. 1), adopts positive conceptions of 'resemblance' and 'analogy' as a way to account for Bacon's diagram. In order to achieve an intensive rather than representational appearance of reality, painting must find what Kenning calls a 'nervous analogy' in paint – the 'living' capacity of paint to generate new forms through contractions and expansions achieved in the relations of pure colour tones. By exploring and extending Deleuze's discussion of analogic communication and analogue synthesizers, and by drawing an iconic diagram of (Deleuze's description of) Bacon's *Figure at a Washbasin* (1976), Kenning shows how, for Deleuze, these relations between tonal elements can constitute, not a structural, but an intensive parallel with the pressurized and agitated bodies that are being captured in Bacon's art.

In 'Intersections between Art, Diagrams, Time and Technology' Yacoob examines the ways in which artists and graphic designers have used the properties of diagrams to visualize sequential, speculative and simultaneous conceptions of time. The chapter considers how these visualizations have been influenced by our relationships with technologies and their representations in science and science fiction. These ideas are discussed with reference to three examples from visual culture. The album cover for *Unknown Pleasures* by the band Joy Division features an appropriated diagram of pulse sequences from a rotating neutron star. The work presents an opportunity to discuss the relationship between clarity of information and the creative possibilities offered by ambiguity and metaphor. The ink drawings of the artist George Widener include calendrical charts combined with schematics of machines, drawings of cities, predictions of future events, and speculations about time travel. The artist Ami Clarke's artwork *The Underlying* deploys flows of simultaneous live data streams to explore the interactions between financial speculation, social media, and the environment. Ideas from cognitive research will be used to identify and analyse how these works communicate ideas and activate interpretative encounters through diagrammatic form.

In 'This is Not a Diagram' Cussans makes a case for the use of diagrams as explanatory devices in arts education and their capacity to function as a medium of transdisciplinary understanding using an example from his teaching practice. The Structural Differential is a device designed by the Polish-American mathematician and engineer Alfred Korzybski to make apparent and tangible the

abstracting processes of the human nervous system and to help students differentiate between the physical, visual, linguistic and cognitive levels of perception and thinking. The device helps students recognize that sensing the world and objects precedes any description of them, and that words are primarily conventional labels used by humans to identify the qualities, feelings and recognizable things we encounter and experience. Language subsequently enables us to generate and discuss concepts like ‘category’, ‘form’, ‘genre’, ‘idea’, ‘identity’, ‘matter’, ‘mind’, ‘truth’, etc. by which we can reflect upon and evaluate the nature of things, the processes they are embedded within and our thinking about them. This is particularly valuable in an educational context where feeling, making and sensing often take precedence over writing, thinking and discourse, and where students sometimes have anxieties about the latter.

In ‘Auraltechnics: Towards Audio Diagrams’ Burrows argues that diagrams exist without an isomorphic plane and through practices of sound-making and listening. He makes a seemingly implausible proposal – sound works and music as impermeant, invisible diagrams – and pursues a controversial argument. The chapter begins by discussing definitions of diagrams, including the notion of a diagram as a projection towards unknown vectors, and also a comparison of visual and sonic presentations. To develop the case for audio diagrams, and the aural technics that would produce them, the chapter discusses terms such as imprints and indexes, *musique concrète*, sound objects, sound marks and soundscapes, deep listening, passing and refrains which draw on François J. Bonnet’s *Order of Sounds* (2018), the scores and practices of Pauline Oliveros and the concepts of continental philosophers. The chapter ends with the examination of different sound and musical practices and theories to arrive at an example of an audio diagram. To this end, the theories of mathematician Marcus du Sautoy concerning Messiaen’s *Quartet for the End of Time* (1941), the drone music of La Monte Young and Brian Eno, the work of Audint, Éliane Radigue and Susan Stenger, and the theories of Edward George concerning ‘the strangeness of dub’ and Steve Reich’s *Different Trains* (1988) are explored as ideas and practices pointing towards different kinds of diagrammatic, sonic works.

For the conclusion, ‘Allusive Devices’, we return to the method that gave rise to the book: an open discussion between the authors. We have known each other for some time and meet regularly to talk about diagrams for no other reason than to enjoy, explore and understand diagrammatic practices. Our meetings usually begin by discussing a text, image or idea and then, through association and comparison, we collectively develop our understanding of the limits, relations and potential of diagrams and concepts. Our meetings are long and meandering, sometimes frustrating and sometimes exhilarating. It is important to all four of us that these sessions have no outcome in mind save sharing insights and comprehending how diagrams are everywhere, within and without the academy, produced to grasp what is mobile, invisible or not present

to us. There is much we disagree about. But that has never stopped us continuing our conversation.

It is from this ongoing conversation that the idea for a book sprung, as much to represent approaches to diagramming that we felt were not well understood as to produce definitive accounts of diagrams and their functions. In this sense, *Drawing Analogies* can be approached as itself a diagram of the entangled perspectives we formed through our meetings, and as a presentation of different but related perspectives on analogy. We are, like many artists, autodidacts and peripatetic when it comes to other disciplines, and this approach is a feature of our discussions (and of our chapters). Our trans- or interdisciplinary approach reflects how semiotics, psychoanalysis, anthropology, physics, philosophy, etc. have been co-opted into art practice and theory. We are convinced that our perspectives have much to contribute to diagrammatics in other fields and we are hopeful that others will think so too.

Gradually over time, and as we pieced the book together, common themes emerged that were not easily marshalled or rationalized into a sequence. The order of chapters and the titles for our two sections reflect this. We choose to divide the book into two sections to show how we are concerned with both epistemological and ontological questions raised by diagramming, and the application or use of diagrams in art, philosophy, social science and the sciences. It is hoped that the chapters collected together in our book and our conclusion retain something of an approach we might describe, after the book of that name by William S. Burroughs and Brion Gysin (1978), as the work of a 'Third Mind': the feeling that another, extra mind is at work when we come together, producing something more than might be produced individually. When is a Third Mind in the room? When no one can remember who authored an idea or question, when ideas seem to have arrived from nowhere, when sense emerges from confusion. So, although the book's chapters are ascribed to individuals, with singular styles, approaches and focus, *Drawing Analogies* is in a wider sense a collectively authored work that is more than the sum of the four individuals who wrote it. And this mirrors our understanding of diagramming as a gestural practice of making sense that is only actualized and extended through the gestures of others.

Notes

- 1 Notable examples include Minjeon An, Rosaire Appel, Abu Bakar, Steven Baris, Gianfranco Baruchello, Mark Bradford, Nelleke Beltjens, Bureau D'Études, Ami Clarke, David Osbaldeston, Fischli & Weiss, Nolan Oswald Dennis, Simon Denny, Daniel Martin Diaz, Forensic Architecture, Nikolaus Gansterer, Ingrid Koenig, Karla Knight, Julie Mehretu, Adelheid Mers, Lize Mogel, Loren Munk, Suzanne Treister, Mimi Gellman, Heather Kai Smith, Wadada Leo Smith, Sharmistha Ray, Marina Roy, Matthew Ritchie, ruangrupa, Danielle Tegender, Jorinde Voigt and George Widener.

- 2 Examples from documenta fifteen include Arts Collaboratory, Gudskul, ruangrupa and The Question of Funding. Renzo Martens work with CATPC (Cercle d'Art des Travailleurs de Plantation Congolaise) is another notable example.
- 3 *Voltigor: Ponto For Swedish Youth* (2014), for instance, combined elements of Nordic petroglyphs, the arm movements of Northern Soul and Ian Curtis' dancing (Joy Division), and the DNA helix. *Veve Kunigundis* (2022) was designed to represent the patroness of the church in which the artists were exhibiting, St Cunigunde of Luxembourg. An earlier design for the Afro-Celtic deity Banbha Mooira was adapted to include the symbolism of the red-hot ploughshares on which Cunigunde walked to prove her chastity and her imperial crown.
- 4 Cussan's book *Undead Uprising: Haiti, Horror and the Zombie Complex* (2017) is a scholarly overview of such misrepresentations, informed by his involvement with Atis Rezistans and the Ghetto Biennale.
- 5 Burrows, Cussans, Kenning and Yacoob are all members of SMRU (Social Morphologies Research Unit) a collaboration between artists and anthropologists investigating the use of diagrams in their practices.
- 6 Our four video presentations and diagrams are available on the FTHo archive: <http://flattimeho.org.uk/events/diagram-research-group/>
- 7 See also in this lineage the extraordinary illustrations in Annie Besant and C.W. Leadbeater's esoteric *Thought Forms* from 2020 (Besant and Leadbeater 1905).
- 8 For an investigation of some diagrams in the encyclopedia from a Peircean perspective, see Michael Marrinan 2016.

PART ONE

**ONTOLOGIES AND
EPISTEMES**

1

INVISIBLE MACHINES: PSYCHOANALYTIC IMAGINARIES AND PARANOID CRITICAL THEORY

John Cussans

Idiotic Simplicity and Extravagant Cunning

I do not think it is an exaggeration to say that behind every twentieth century grid there lies – like a trauma that must be repressed – a symbolist window parading in the guise of a treatise on optics.

ROSALIND E. KRAUSS, 'Grids' (1978)

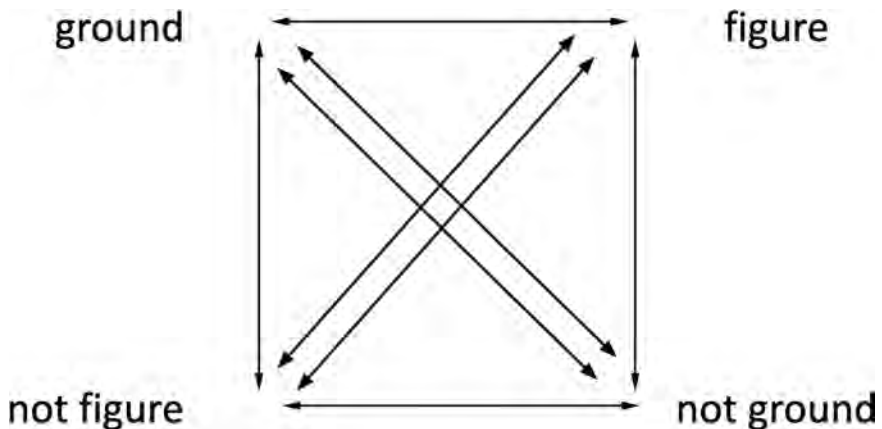


Figure 1.1 Rosalind E. Krauss Figure/Ground Graph 1994.

In the opening chapter of *The Optical Unconscious* (1994) the art historian Rosalind E. Krauss recounts the emergence of a diagram whose visualization facilitated the insights that gave rise to the book itself. The diagram came to the fore during Krauss's ongoing critical reflections on the received narrative of modern art's development as one of gradual optical purification through which the elements that comprise artworks are stripped of any illusory reference to things outside themselves. It is a narrative closely associated with Clement Greenberg, the influential American art critic, whose notions of aesthetic formalism, medium-specificity and artistic autonomy dominated debates about modern art in America in the 1950s and '60s, and from whose pervasive legacy Krauss sought to extricate herself.

The book's title is an explicit reference to the literary historian Fredric Jameson's work *The Political Unconscious* (2002) with which it is in a kind of structuralist dialogue, Krauss's perspectives on optical art finding equivalence with Jameson's perspectives on political literature upon the shared ground of Lacanian theory and structuralist diagrammatics. It is, she concludes, 'a rhyme set into place by a graph's idiotic simplicity and its extravagant cunning' (Krauss 1994: 27).

Krauss wrote through a historical period when the story of modernism's journey towards abstraction had reached the terminals of minimalism (works reduced to pure formal abstraction) and conceptualism (works reduced to propositions). At the same time, the narrative of Western art's linear progress and historicism was being challenged on multiple fronts by new perspectives in critical theory (deconstruction, feminism, identity politics, post-colonialism) and new art practices (community art, institutional critique, performance, pop protest and video art) that were dematerializing traditional art objects (Lippard), challenging their value-forms (Marx) and undermining their philosophical foundations (Derrida). It was in the midst of these multiple fractures in the telos of modernism that Krauss found her thought drawn into the orbit of the diagrammatic.

Her diagram takes the form of a Klein Group, familiar to her through the work of A. J. Greimas and other writers associated with structuralism, a field of inquiry that sought to identify and analyse the underlying logical structures that governed signification and meaning in (primarily) human communication, and whose incursion into the disciplines of literary criticism and art history was seen by many as having a profoundly corrosive and unwelcome impact at the time (Krauss 1986: 291–7). Adapted from Aristotle's logic of categorical oppositions in the fourth century, a cornerstone of formal logical analysis and a precursor to Boolean algebra and programming language, it had been graphically represented as a square since the fifteenth century.

Greimas devised his version of the graph to simplify and rewrite the complexity of meaning in myths by reducing them to a logic of elementary contrariness, contradiction and implication that was assumed to operate at a deep structural

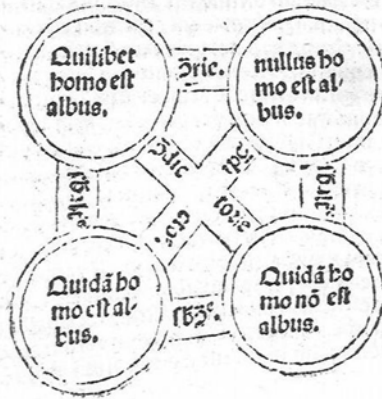


Figure 1.2 15th Century Square of Opposition.

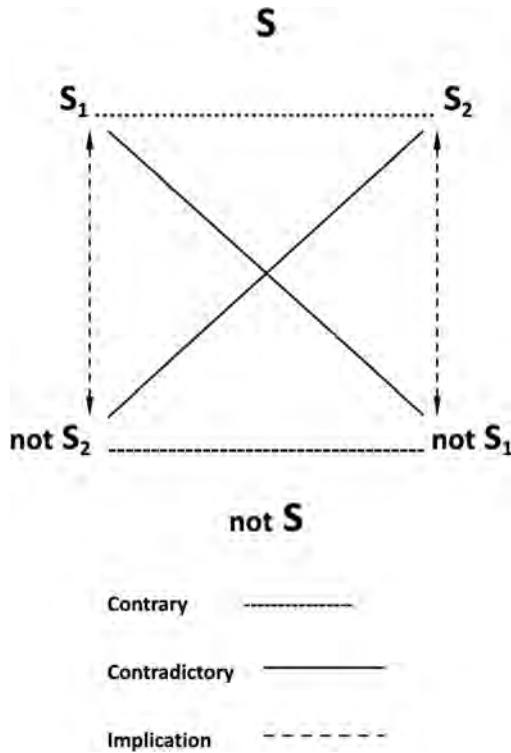


Figure 1.3 Semiotic Square after Greimas circa 1966.

level in both individuals and society (Greimas and Rastier 1968: 87). The semiotic square is a means of refining the oppositional analyses of signifying elements by increasing the number of analytical classes stemming from a given opposition (Hébert n.d.). In the basic diagram illustrated below, 'S' stands for *seme*, the basic unit of meaning. 'S1' represents the positive term, 'S2' its contrary, a binary pair whose negations are indicated at the lower level of the graph. If, for example, we take 'Life' as the positive term and 'Death' as its contrary, the square generates a number of alternatives – not living, not dead, living dead, neither living nor dead – intermediate referents generated from the initial contraries.

From the perspective of structuralist diagrams, all forms of meaningful human communication are organized by logical rules that exceed the subjective control. For Krauss, the semiotic square was an expressly trans-disciplinary artefact that revealed an underlying structure of logic and signification operating in all forms of discourse, including those of the art historian, the critic and the artworks they wrote about.

The semiotic square is an essential component of Jameson's approach to literature in *The Political Unconscious* too, where it is reappropriated for a 'historicizing and dialectical criticism by designating it as the very locus of ideological closure' (Jameson 2002: 32). According to Jameson, the semiotic square maps out what Greimas takes to be the 'logical structure of reality itself . . . whatever its historical form' (Jameson 2002: 31). As such it is 'endowed with at least the being and permanence of the categories of logic or mathematical thought' and can be used to map the limits of a 'specific ideological consciousness and marks the conceptual points beyond which that consciousness cannot go, and between which it is condemned to oscillate' (Jameson 2002: 32). As with Krauss, Greimas's frequent use of the 'graphics of formalisation' helped Jameson escape the traditional, humanist constraints of his discipline into the 'forbidden promised lands of mathematics or symbolic logic'. There, an interested outsider could 'beach and camp with profit and stimulation': 'Greimas's pastures', Jameson wrote 'belong to us' (Jameson 1987: vi).

Operating between the Lacanian registers of the Imaginary and Symbolic, the semiotic square was for both Jameson and Krauss a kind of meta-diagram enabling them to draw analogies between different art practices, criticism and history, and to forge theoretical alliances between their disciplines. It also enabled an a-historical bridge to be built between the revolutionary aesthetic theories of early twentieth-century avant-garde art and contemporary developments in structural linguistics, semiotics and psychology.

Through the window of the semiotic square 'whole cultural universes' could be seen as trapped in the grip of opposing choices and incompatible possibilities. 'Cultural production', Krauss wrote, 'is the creation of an imaginative space in which those two things can be related' (Krauss 1994: 21). The conflict however does not go away. Echoing Jameson, she writes:

The structuralist graph becomes the self-contained space of ideology. And cultural production the impossible attempt to construct an imaginary space within which to work out unbearable contradictions produced within the field of history.

KRAUSS 1994: 21

Into the Fields

Empirical vision must be cancelled, in favour of something understood as the precondition for the very emergence of the perceptual object to vision. To a higher, more formal order of vision, something we could call the structure of the visual field as such. For the structure of the visual field is not, cannot be, the same as the order of the perceptual one. The perceptual field is, after all, forever *behind* its objects; it is their background, their support, their ambiance.

KRAUSS 1994: 15

The opening chapter of *The Optical Unconscious* begins with a biographical sketch of the nineteenth-century art historian John Ruskin staring fixedly at the patterns in the fabrics that surrounded him as a child, a gaze that would later be turned to the sea and the passing landscapes of the foreign countries he travelled through with his family. Lost in the rapture of his gaze, the young Ruskin felt a sense of blissful quietude in this 'contemplative abstraction from the world'. Krauss compares Ruskin's reflections with the quintessentially modernist works of Piet Mondrian, whose paintings exemplified the heroic march from representation to abstraction. Guided by developments in nineteenth-century optical theory, Mondrian considered the flat planes of retinal and pictorial images to be *isomorphic* (i.e. what was happening in front of the eyes reflected what was happening behind them). His was a purely optical mode of painting, windows onto a third dimension that, in Greenberg's words, could be travelled through 'only with the eye'. Like Ruskin, Mondrian's gaze had often turned towards the sea, that vast continuum of space in which all figures would eventually become an indivisible pattern of plus and minus signs.

Krauss's thought was shaped by the gestalt psychology of Anton Ehrenzweig, who, combining it with psychoanalysis, understood the unconscious as a space where 'all distinctions fuse into a single oceanic image' (Krauss 1994: 303–4; Ehrenzweig 1969). Significantly such *gestalts* were referred to sometimes as 'systems' and at others 'structures' (Arnheim 1943). The concept of *isomorphism*, central to gestalt psychology, proposes a formal similarity between objects of perception and the brain activities of the perceiver, registered on an ideal vertical plane of visuality perpendicular to the viewer. Gestalt psychology was popular amongst artists in the early twentieth century because it emphasized a primary perception of forms, their capacity to carry emotional expression and the creative

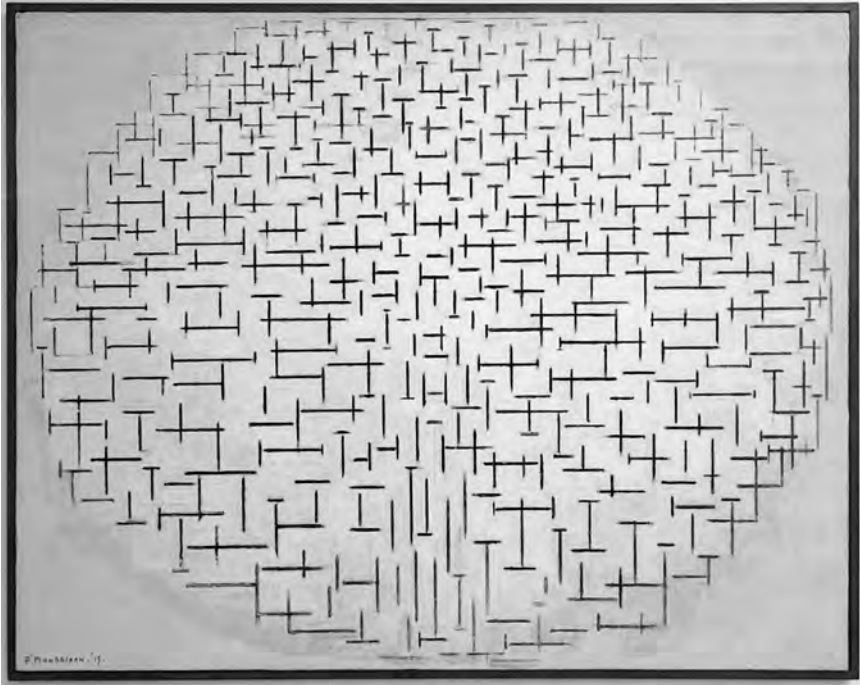


Figure 1.4 Piet Mondrian *Pier and Ocean (Composition No. 10)* 1915.

power of nature (Arnheim 1943: 257) and its principles were familiar to pioneers of modernist abstraction like Wassily Kandinsky, Paul Klee and Mondrian (Van Campen 1997: 134–5).

Derived from the German word for pattern or configuration, gestalt psychology proposed that organisms see wholes before details or parts and that such *gestalts*, expressed most powerfully in the spontaneous reactions of children, ‘primitive’ people and animals, are irreducible to atomistic analysis. As such it helped support theories about the intuitive communication of complex emotions through formal means that bolstered abstract expressionism – the movement in painting championed by Greenberg – and supported understandings of visual art as an expression of non- or pre-linguistic perception and feeling (see Korzybski chapter). It was also the term, as we shall see, that Jacques Lacan used to describe an infant’s perception of bodily unity during the mirror stage: the imaginary optical precursor to the ego and Cartesian *cogito*. For Lacan, a child’s recognition of itself in the mirror is the primary instance of all subsequent cognitive insights, the *aha* moment when things ‘suddenly fall into place’, as happened for Krauss with the figure-ground Klein square.

The correlation between the minimal properties of abstract painting, reduced to an optical tension between figure and ground, and the geometric simplicity of

a diagram that expresses a limited number of logical possibilities between opposing terms, brings modern painting into the orbit of the diagrammatic where subjective expression gives way to formal explanation. In a description that intimates a computational understanding of perception as a function of choices between positive and negative switching between figure and ground, Krauss suggested that Mondrian imagined optical law as

something that is itself submitted to a code, digitalized by the higher orders of the intellect, translated into the plus and minus of a moment not of sensation but of cognition, the moment, that is, of pure relationship. His field would thus be structured by these signals – black on white – these signs for plus and minus, these fragments of an abstract grid that would intend to throw its net over the whole of the external world in order to enter it into consciousness.

KRAUSS 1994: 12

Krauss's earlier work *The Originality of the Avant-Garde and other Modernist Myths* (1986) contains an important and influential chapter 'Grids' which discusses them as a defining motif of late modernist abstraction that had become emblematic of modern painting's 'will to silence, its opposition to literature, to narrative, to discourse' and its lowering of a barrier between 'the arts of vision and those of literature' (Krauss 1986: 8–22). The extended metaphor of the grid was imagined by Krauss as a 'staircase to the eternal' in the minds of artists like Malevich and Mondrian, a structure within which the spiritual and the material coexist and, more belatedly, as a fortress whose base-plan would become a ghetto (Krauss 1986: 8–10).

In her essay 'Sculpture in the Expanded Field' Krauss explained how the artist Mary Miss, by creating a minimalist sculptural earthwork *Perimeters/Pavilions/Decoys* (1977–78) in an open field, inspired her to draw analogies between the actual fields in which sculptures and earthworks are situated and the conceptual fields opened on to by the semiotic square (Krauss 1986: 282–6). The analogy between Miss's minimalist geometric anti-sculpture and the semiotic square is formal on the level of structure and conceptual in terms of its challenge to the conventional distinctions between sculpture and non-sculpture. When the flat optical field of abstract painting is brought into imaginary alignment with the flat physical field of minimalist sculpture and earthworks, they merge metaphorically into a generalized abstraction, windows onto the schematic fields of thought, logic and signification.

Krauss listed the multiple functions the figure-ground semiotic square served for her: 1) it shifted her view of the history of modernism from a linear-historical narrative to a structuralist-topographical containment that allowed her to see 'in one glance' the optical logic of modernism 'as a whole', 2) it empowered a sense of breakthrough from the 'nearly airless, self-abnegating reductions of modernist



Figure 1.5 Mary Miss *Perimeters/Pavilions/Decoys* 1978.

logic', 3) it made clear that the logic of the system was finite relative to the possible combination of contraries, contradictions and oppositions, 4) by showing her the system as-a-whole she could see her relation to it from both inside and outside, 5) this shift in orientation made thinkable an alternative history running against the grain of modernist opticality, an un-mappable territory beneath the clearly demarcated and idealistic spaces of modernism (Krauss 1994: 19–21).

Krauss imagined the social historians of her own era criticizing such claims as an extension of Greenberg's formalist fantasy of autonomous art, freed from the troublesome consequences of cataclysmic world history, perspectival diversity and the uneven terrain of power and privilege, into the fields of psychology and symbolic logic. Modernism, they say, is a *discursive field* constituted by power-knowledge systems and multiple agents with vested interest in their myths. And she agrees. But it is also a *structured field*, she responds, whose surface is gridded by concepts that organize and determine both the facts and the self-understanding of the artists and writers working within it.

A peremptory analogy might be drawn here with Jacques Lacan's quilting point diagram which represents the necessary binding of the *signifier* to *signified* for the purpose of meaningful communication within the symbolic order,

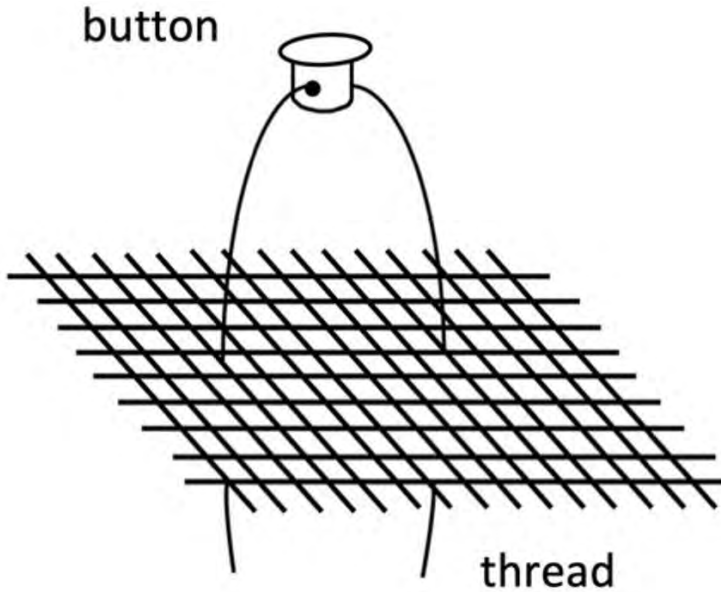


Figure 1.6 Quilting Point graphic after Lacan 1955–66.

developed in his seminar on the psychoses (1955–56). The purpose of the quilting point is to arrest the endless slippage of words from their referents that is symptomatic of psychotic thought and speech. The grid representing the fabric can be imagined as analogous to Krauss's *structured field*, the 'button' and 'thread' the necessity to ensure that language is used precisely according to the conventions of a particular discourse. As such, it succinctly represents a Lacanian understanding of diagrams as operating on the threshold between the registers of Imaginary (visual) and Symbolic (semiotic) experience.

In *The Originality of the Avant-Garde* (1986), Krauss had already begun the process of deconstructing the myths of formalist high modernism by excavating a disruptive counter history in photography and the excesses and irrationalism of Surrealism that retrospectively heralded the much-contested transition to postmodernism (Krauss 1986: 277–90). Lacan, whose theories of the mirror stage and paranoid knowledge were developed alongside Surrealism in the 1930s and '40s, and whose writings in the 1950s and '60s reconfigured structuralist diagrams in light of his three registers of subjective experience, was central to this diagrammatic and counter-historicist turn in Krauss's work. It was her encounter with his Schema L diagram that seemed to offer her a way to escape the straight-jacket of logical formalism.

Schema L was created in the second of Lacan's seminars, 'The Ego in Freud's Theory and in the Technique of Psychoanalysis' (1954–55). It represents the

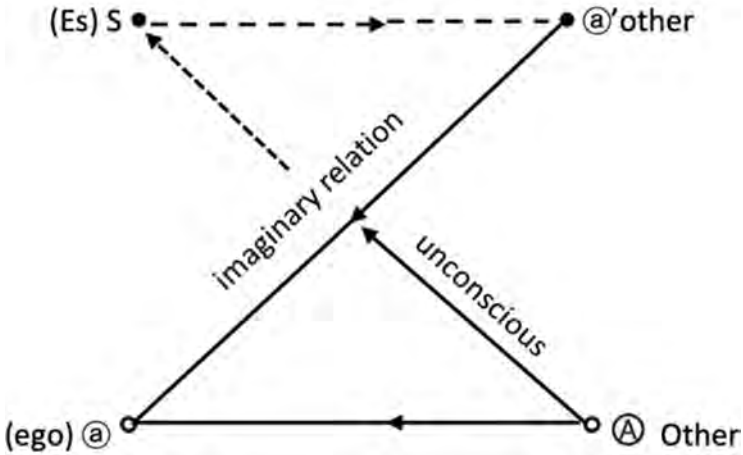


Figure 1.7 Jacques Lacan Schema L 1958–60.

elementary relationship between the imaginary and symbolic orders and the paradoxical status of subjective knowledge (*connaissance*) relative to the ego and Big Other (A). Importantly, in keeping with Lacan’s gradual move from topographical to topological diagrams, it makes no analogical inference about the anatomical structures or mechanisms in the brain, and the agencies of Ego, Subject, other and Other are reduced to simple algebraic symbols.

Schema L is a simplified version of the Inverted Bouquet diagram (or Optical Schema) that Lacan had used to illustrate how, through the mirror stage, the

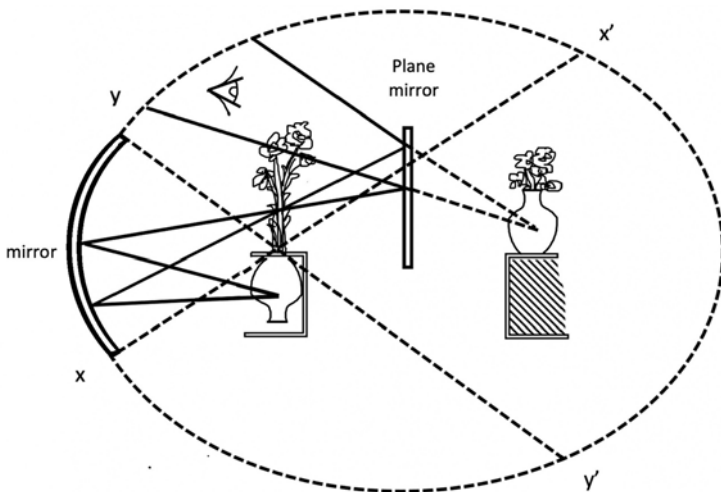


Figure 1.8 Optical Schema/Inverted Bouquet Diagram after Lacan 1954–55.

stability of the ego as perceived in the mirror is an optical illusion through which the false unity of the subject becomes internalized. For this to happen the subject must be positioned in a specific place relative to its reflections, and as such it depends on the fixed laws of geometry (Darby and Gallagher 1994: 91). Although the primitive ego is based on an illusion, without the ability to recognize one's self and its proper name, a subject cannot stabilize a 'self' relative to others in society. Subjectivity therefore depends on a specific positioning within optical space (Krauss's 'field of vision'). 'Optics', Lacan wrote, 'is founded on a mathematical theory without which it is absolutely impossible to structure it':

For there to be an optics, for each given point in real space, there must be one point and one corresponding point only in another space, which is the imaginary space. This is the fundamental structural hypothesis. It gives the impression of being overly simple, but without it one cannot write even one equation, nor symbolise anything – optics would be impossible. Even those who are not aware of this couldn't do a thing in optics if it didn't exist.

LACAN 1991: 76

As visual objects diagrams partake of the Imaginary. But within a Lacanian framework, the imaginary aspect of diagrams is *logically* co-ordinated by the operations of the symbolic order which governs the identification and location of objects within the field of vision. In Schema L the subject ((Es) S') is positioned in the place of the eye in the Inverted Bouquet diagram, from where the embodied subject sees its reflection in the mirror and takes the *gestalt* '@' other' as the basis for its sense of self ((ego) @'). Upon taking a name, the self enters into relation with others according to a pre-given structure of relations and identifications wholly outside the subject and over which it has no control (A Other). It is through the bottom right corner of Schema L, the 'place' where the Freudian unconscious coincides with the symbolic authority of the Law, that Krauss perceived 'the blind, irrational space of the labyrinth' where the postmodern, decentred subject ceaselessly tries to find it-self in a trans-temporal gallery of imaginary mirrors.

Social Apparatuses/Invisible Machines/ Symbolic Operations

The machine embodies the most radical symbolic activity of man.

LACAN 1991ii: 74

The term 'optical unconscious' was first used by the German critic Walter Benjamin in his essay 'A Short History of Photography' (1931) and later in 'The

Work of Art in the Age of Mechanical Reproduction' (1935) to describe affinities between the techniques of photography and film (close-up, enlargement, motion capture, microscopy, time-lapse) and the 'image worlds of the unconscious' (Hansen 1987).¹ For Benjamin, the alienating effects of technology on individuals and groups could be therapeutically harnessed by avant-garde artists to bring about new forms of consciousness more fitted to life in industrial societies (Hansen 1987: 207).

The fifty-year lag between Benjamin's formulation of the optical unconscious and Krauss's is characteristic of the strange temporal and historical loops associated with both postmodernism and the decentred, schizophrenic subject that was seen to exemplify it. Benjamin, like Freud before him and Lacan afterwards, drew analogies between the mechanical properties of mind and those of optical instruments and visual recording devices. The tendency to imagine social systems functioning like machines, combinatorial apparatuses designed to control subjectivity and maintain social order in the interests of particular classes or groups, is a characteristic of the paranoid modality in postmodern literature exemplified by writers like J. G. Ballard, William S. Burroughs and Philip K. Dick. It is also a specific form of delusion known as the influencing machine, first identified and discussed in depth by the German

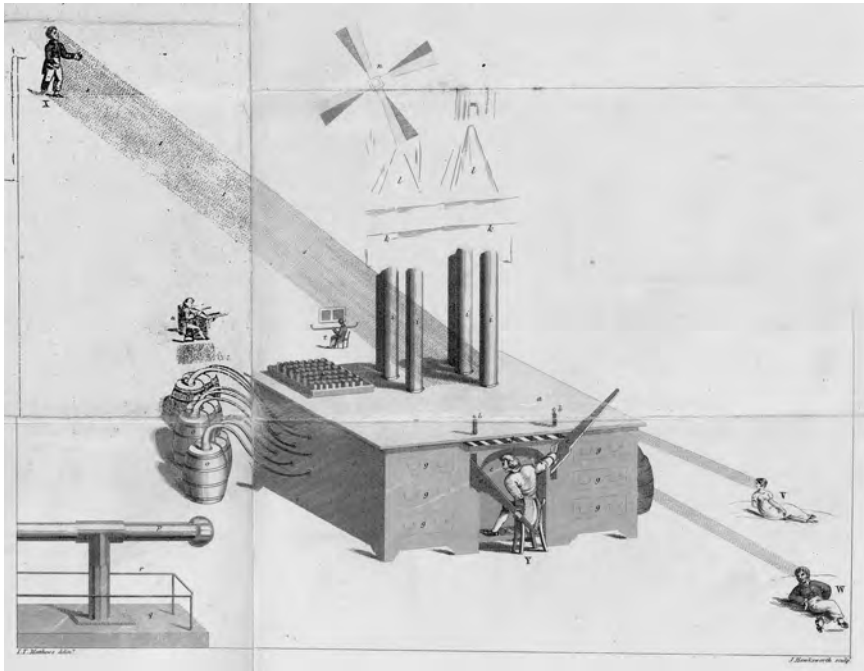


Figure 1.9 Detail of James Tilly Matthews's Illustration of the Air Loom, 1810.

psychoanalyst Victor Tausk in 1919, characterized by a consistent and recurrent delusion in which patients feel themselves controlled against their wills by an invisible and extensive apparatus into which their bodies and minds are integrated but whose function and purpose exceed their understanding.

The most definitive expression of the correlation between schizophrenia, machinic imaginaries and postmodern critical theory is Gilles Deleuze and Felix Guattari's two-volume work on capitalism and schizophrenia, *Anti-Oedipus*: (1972) and *A Thousand Plateaus: Capitalism and Schizophrenia* (1980). It is also present in Jameson who, like Krauss, associates it with a mode of disjunctive writing (*écriture*) characteristic of postmodern culture and post-structuralist philosophy (Jameson 1997: 25–31). Jameson's understanding of the schizophrenic subject, following Lacan to the letter, describes the schizophrenic experience as 'a breakdown in the signifying chain . . . the interlocking syntagmatic series of signifiers which constitutes an utterance or meaning' (Jameson 1997: 25). The 'crisis of historicity', which for Jameson is a symptom of postmodernism, is associated on the individual level with 'new forms of private temporality' and 'a whole new type of emotional ground tone' (Jameson 1991: 5).

For Krauss, this crisis of historicity is framed in terms of Lacan's notion of the Imaginary as an *a-temporal* place experienced purely for itself. According to Lacan, it is only with the acquisition of language that the child enters a dimension of structural constraints that preceded it-self and over which it has no control (Krauss 86: 198). Though this holds true for all subjects, it is experienced acutely by modern and contemporary artists whose activity must negotiate the pre-given rules and codes of aesthetic convention and the paradoxical imperative for self-expression, novelty and originality. It also has a very particular implication for psychoanalysis, a practice whose theoretical bases were evidenced by disruptions in language, the conversion of repressed memories into behavioural symptoms and the complex interactions of word and image in dreams.

In a short text from 1924, 'A Note Upon the "Mystic Writing Pad"', Freud likens the blank paper on which he writes notes to aid his memory as an externalized portion of his 'mnemonic apparatus'.² He uses the metaphor to represent an intermediate mode of memory between temporary and permanent traces in the human mind. The actual device is made up of a tablet of brown wax over which is laid a sheet of translucent waxed paper and a sheet of transparent celluloid. When one writes on the upper plastic sheet the marks are made on the lower paper sheet. To remove the writing one simply lifts both sheets away from the wax tablet. Although no marks are left on the cover paper, traces of the inscription are left unseen on the wax tablet below. If one was to draw directly on the paper it would be destroyed quickly. The plastic sheet thus acts as a protective barrier. As such it is analogous to the hypothetical protective barrier he had proposed in *Beyond the Pleasure Principle* (1920) as the outer-directed component of the mind's perceptual apparatus' (*Pcpt.-Cs.*).

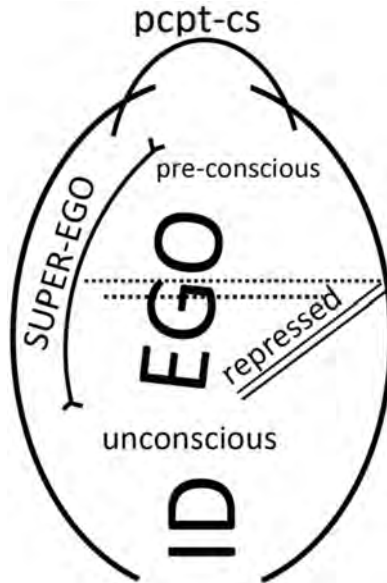


Figure 1.10 Freud's Mental Apparatus circa 1933.

Freud's use of the mystic writing pad is an exemplary case of an abductive analogy: explanatory insight gained by seeing a similarity of structure between two distinct objects. One can imagine the mystic writing pad operating, like Mondrian's paintings in Krauss, on the isomorphic threshold between perceived object and innate mental pattern. Extending the analogy from the realm of gestalt psychology into structuralism, we might imagine a deep structure of logical oppositions, within both the wax of the mind and the wider society, that determines the meaning/signification of the marks made upon the surface of inscription.

Freud famously produced two diagrams to represent the relationship between the agencies of the mental apparatus, the first in *The Ego and the Id* (1923) and the second from the chapter 'The Anatomy of the Mental Personality' in *New Introductory Lectures on Psychoanalysis* (1933). Both represent the structural relationship between ego, id and superego and the role of repression in the creation of the unconscious. For Freud, the instinctual drives of the id, which the ego must continually negotiate, create the unconscious when repressed. The superego represents the constraints placed on the ego when it enters into relation with others. In the 1933 diagram the ego, which is continually modified by the subject's experience of the outside world, takes centre stage in the struggle between the contrary demands of the id (governed by the pleasure principle) and superego (agent of the reality principle). The ego is divided by an axis of repression which connects the superego with the unconscious.

Although Freud used the terms ‘apparatus’, ‘mechanism’ and ‘anatomy’ to designate the referent of the diagrams, he also made clear that they do not correspond to any physical or locatable parts of the brain (Freud 1959: 1). They are, as such, imaginary in a conventional sense, borrowing their form from the schematization of biological (organ) functions. It is also, importantly, a metaphor which for Freud gave psychoanalysis the aura of science:

Every science is based upon observations and experiences arrived at through the medium of our psychic apparatus, but since *our* science has as its subject that apparatus itself, the analogy ends there. We make our observations through the medium of the same perceptual apparatus, precisely by the help of the breaks in the series of conscious mental events, since we fill in the omissions by plausible inferences and translate them into conscious material.

FREUD 1959i: 18

Hence Freud’s diagram has the unique and paradoxical property of being an observational device whose function is to give a clearer picture of itself.

Freud’s chosen word for the analogical correlation between mind and machine was ‘apparatus’ (German *Apparat*), the same one Benjamin used for the social system as a whole, an idea the latter drew from the writings of Marx and Lenin and their theory of an economic base of productive forces and social relations determining the superstructure of a society and its culture. The idea of an all-pervasive social and cognitive apparatus was articulated most emphatically by the Marxist theorist Louis Althusser, whose conception of ideological and repressive state apparatuses significantly influenced Jameson and other critical theorists associated with postmodernism (Althusser 2020). Perhaps the most important of these was Michel Foucault, whose concepts of *dispositif*, ‘discursive formation’ and ‘disciplinary apparatuses’ had a major impact on the postmodern cultural theory of Jameson and Krauss. The theories of both Althusser and Foucault were directly informed by Lacan’s structuralist theory of the unconscious and the role of language in the constitution of the subject.

The notion of ‘the machine’ is central to Lacan’s thinking in Seminar II where he proposed that contemporary understandings of it, shaped by long-standing debates between vitalist and mechanistic understandings of life, was undergoing a profound transformation in response to cybernetics (Lacan 1991ii: 31). Most importantly it was a notion at the core of Freud’s metapsychology from his *Project for a Scientific Psychology* (1895/1950) to *Beyond the Pleasure Principle* (1920), where he had attempted to elucidate his understanding of the relationship between the energetic, economic and automatic functions of mental phenomena and the role of symbol formation in human culture, communication and cognition. Freud, Lacan proposed, in his pursuit of the energy myth, stumbled upon the ‘dream machine’, whose functions (displacement, day residue, condensation,

secondary revision) differed significantly from causal mechanics. It was there he discovered 'the operations of the symbol as such' (Lacan 1991ii: 76).

If we know how to reveal the meaning of this energy myth, we see the emergence of what was, from the start and without it being understood, implicit in the metaphor of the human body as a machine. Here we see the manifestation of a certain beyond of the inter-human reference, which is in all strictness the symbolic beyond.

LACAN 1991ii: 75–6

Lacan's notion of 'machine' is central to his reading of Freud, the transition from neurology to psychoanalysis in his predecessor's career, and in his understanding of the mental apparatus as revealed precisely where the normal functions of language break down. For Lacan, the idea of man-as-a-machine was an inevitable consequence of developments in Western culture since Descartes and the paradoxical realization that it is only through symbolic thought that we can access the logical operations of biological bodies (Lacan 1991ii). The 'abstract machines' of mathematics and logic, imagined to be furnished by nature in the *cogito*, lead ineluctably to the conception of humans as behavioural automata guided by a transcendental operator. Ego is the contemporary name given to this ideal but imaginary operator of the body-machine.

Paranoid Critical Theory

Maybe *all* systems – that is any theoretical, verbal, symbolic, semantic etc. formulation that attempts to act as an all-encompassing, all explaining hypothesis of what the world is about – are manifestations of paranoia.

PHILIP K. DICK 'The Android and the Human' 1972, in DICK 1988, 159

The most complicated machines are made only with words.

LACAN 1991ii: 47

The importance of Lacan for a theory of diagrams and the diagrammatic is the distinction he made between the Imaginary, Symbolic and Real registers of subjective experience. Lacan extrapolated and developed his theory of the three registers in a series of annual public lectures given at St Anne's Hospital and the École Normale Supérieure in Paris between 1953 and 1980 for which he created a series of illustrative diagrams.

The Imaginary refers to the realm of images that infants inhabit before speech and naming. It is an effect of the mirror stage, a period in an infant's mental

development when it learns to control its reflected image. The theory of the mirror stage was influenced by the gestalt psychology of Wolfgang Köhler, whose work with chimpanzees showed that, although the human child is outdone by the chimpanzee in terms of instrumental intelligence, it is nonetheless able to recognize itself in the mirror from six months. Lacan refers to the image in the mirror as a *gestalt* 'whose pregnancy should be regarded as bound up with the species' (Lacan 1977: 2). It symbolizes the 'mental permanence of the I' while, at the same time, it 'pre-figures its alienating destination' (ibid.).

The Imaginary differs from conventional understandings of 'imagination' as a faculty of mind. It is the realm of subjective experience constituted by images, including everyday optical events in the field of vision and fantastical images occurring in dreams, memory and hallucinations. Importantly for Lacan, it designates a realm of mental functioning associated with deception, misrecognition and illusion. A subject (i.e. a person-in-the-making) learns to function as an active agent in the world through *imaginary* relationships with others. Imaginary knowledge (*connaissance*) is the self-knowledge of a subject as experienced in the realms of fantasy, through projection and idealization and in dreams of mastery and wholeness.

Lacan's concept of the Symbolic is indebted to the anthropologist Claude Lévi-Strauss who drew structural correlations between the laws governing meaningful statements in language and those governing social institutions like marriage, kinship and economics. Lévi-Strauss's conception of linguistics as a determining, totalizing system beyond individual agency correlates closely with Lacan's understanding of the Symbolic: 'Linguistics thus presents us with a dialectical and totalizing entity but one outside (or beneath) consciousness and will. Language, an unreflecting totalization, is human reason which has its reasons of which man knows nothing' (Lévi-Strauss 1962: 252). The Symbolic designates mental operations structured and organized according to the requirements of signification and meaning. The child enters into the Symbolic by developing the capacity to recognize and identify words and their referents (the signifier and signified). Although the relationship between the signifier and signified is arbitrary (i.e. there is no necessary relationship between objects in the world and the words we use to designate them), without a tacit consensus concerning their connectedness, no meaningful discourse is possible. The system of rules that govern the production of meaning in any particular language is, however, generally unconscious to those who use it, and we only come to know the Symbolic through interactions with others. Symbolic knowledge (*savoir*) does not reside in a particular subject but is necessarily intersubjective and social. The Symbolic then is the realm of Law, structure and logical systems that Lacan identified with the Name of the Father and referred to as the Big Other. It is also the realm of the unconscious to the extent that its operations are incommunicable to others without signs.

The Real refers to those experiences that exceed or elude representation by either the Imaginary or Symbolic means. It differs fundamentally from conventional understandings of *the real or reality* as a concrete absolute that can be objectively known and simply represented (something that Lacan associated with fantasy and the Symbolic). It is more closely related to the inexpressible subjective experiences of bodily drive, trauma, loss and excessive pleasure (*jouissance*). Importantly, contrary to common conceptions of reality as that which is known to be true with most certainty, the Real is that which exceeds and eludes epistemic capture: it can't be objectively known.

Lacan's theory of the three registers of subjective experience, and the diagrams he created to illustrate their interdependence, offered Krauss a way to elude entrapment in the formal logic of oppositions through the Imaginary realm of phantasms, ghosts and monsters of excess, where temporality is illogical and distinctions between past, present and future make no sense. It was, as both Jameson and Krauss recognized, a realm familiar to paranoiacs and schizophrenics, those exemplary subjects of the postmodern condition from whom Lacan had learned that the unitary ego, so prized by Western philosophy and enlightened humanism, was a necessary illusion. Just as there is no artwork whose meanings are entirely inherent, there is no ego, artist, or author outside the Symbolic. Eluding the constraints of discourse requires risking the loss of both the self and the object of desire. It also profoundly unsettles Jameson's Marxist imperative to 'always historicize' (Jameson 2002: ix).

Lacan's principal target in the seminars at St Anne's Hospital was ego psychology, a movement developed by significant followers of Freud, who proposed that psychoanalysis was primarily a practice of ego expansion. Lacan's decentring of the ego within psychoanalytic theory was, by extension, an attack on any branch of science predicated on the idea of a unified ego and the 'subject who knows'. As we have seen, his theory of the mirror stage had already undermined the idea of the ego as unity.

The important point is that this form situates the agency of the ego, before its social determination, in a fictional direction, which will always remain irreducible for the individual alone, or rather, which will only rejoin the coming-into-being (*le devenir*) of the subject, whatever the success of the dialectical synthesis by which he must resolve as / his discordance with his own reality.

LACAN 1977: 2

Although his major contributions are to the theory and practice of clinical psychoanalysis, like Freud's, Lacan's ideas and theories have had a lasting impact on contemporary art and visual culture. His ideas are also central to the paranoid modality of postmodern critical theory and philosophy exemplified by Deleuze and Guattari, Jameson and Krauss. In *The Originality of the Avant-*

Garde Krauss describes the experience of artists working at the threshold of optical/physical artefacts and abstract structures they unconsciously inhabit as 'schizophrenic' (Krauss 1986: 22). Today, she writes, we live in an age of 'cultural schizophrenia' (Krauss 1986: 261). Her use of the term, she insists, is not meant in a literal or medical sense but 'only analogically: to compare the structure of one thing to the structure of another' (Krauss 1986: 22). Inferring concrete correlations between the structure of one thing and another is also a characteristic of certain forms of paranoid delusion, a practice positively affirmed within Surrealism and articulated most emphatically by Salvador Dalí whose 'paranoiac-critical method' claimed to reveal concrete magical correlations between objects with similar forms.

Lacan's writing appeared at the same time as Dalí's in the avant-garde art journal *Minotaur* between 1933 and 1936 and Dalí's development of his paranoiac-critical method was developed under its influence. Dalí's autobiography *The Secret Life of Salvador Dalí* includes an example of the method in operation: while eating snails in a restaurant in Sens, France, and discussing a recent psychoanalytic study of Edgard Allen Poe by Marie Boneparte, Dalí notices a photograph of Freud on the front page of a newspaper being read by someone



Figure 1.11 Salvador Dalí *Morphology of the Skull of Sigmund Freud* 1938.

at the table beside him. In that instant, he discovered the ‘morphological secret’ of Freud’s cranium: ‘his brain is in the form of a spiral – to be extracted with a needle!’ (Dalí 1993: 23–5).

Paranoia was a central theme in Lacan’s thought from the beginning of his career. His doctoral thesis in 1932 was a case study of Aimée, a 38-year-old railway clerk and aspiring author, who, while suffering from self-punitive paranoia, attacked a famous French actress, Huguette Duflos, with a knife. He translated Freud’s essay ‘Some Neurotic Mechanisms in Jealousy, Paranoia and Homosexuality’ (1923) into French while writing the thesis, and his arguments there rely heavily on Freud’s theory that paranoia is in part a defence against homosexual thoughts whose disavowal leads to delusions of persecution by the loved one.

The source of Lacan’s understanding of paranoia was Emile Kraepelin, one of the first psychologists to systematically classify mental disorders and who identified paranoia as a unique category of psychosis characterized by a ‘gradual development of a stable progressive system of delusions, without marked mental deterioration, clouding of consciousness, or disorder of thought, will, or conduct’ (Kraepelin 1899/1915: 423). Although postmodern cultural critics often suggested paranoia was a symptom of schizophrenia, Lacan, following Kraepelin, identified it as a ‘functional psychosis’, qualitatively different from it (Lepoutre et al. 2017: 1).

The idea of paranoia as a unique form of psychosis, characterized by a lucid, systematic and sustained delusion but unmarred by mental deterioration, attracted Salvador Dalí to Lacan in the early 1930s. Dalí praised Lacan’s doctoral thesis for being the first to provide ‘a global and homogeneous idea of the [paranoid] phenomenon, beyond any abject notions in which psychiatry at present is mired’ (Sharon-Zisser 2018: 2). Dalí’s method involved inducing a state of paranoia by giving oneself over to external forces or agents. In the induced paranoid state, the artist perceives formal correlations between disparate objects which, for Dalí, make visible a subterranean dimension of concrete facts running counter to dominant ideas about what constitutes reality. In the process the artist gains insight into the workings of the unconscious mind which are akin to magic or sorcery.

The most complete statement of the method is given in his book *Conquest of the Irrational* (1935) where Dalí describes it as ‘an experimental method based in the sudden power of the systematic associations proper to paranoia’, the latter defined as a ‘delirium of interpretative association involving a systematic structure’ (Dalí 1935, 15). In his essay ‘Aggressivity in Psychoanalysis’ (1948) Lacan, echoing Dalí, proposed that the psychoanalytic method ‘amounts in fact to inducing in the subject a controlled paranoia’ (Lacan 1977: 15).

Greeley notes the importance of the paranoid-critical method for Surrealism which, until Dalí, had championed ‘pure psychic automatism’ (Breton) as the

essential method in painting and poetry. But automatism was unable to deliver a critique of capitalism required by the increasingly Marxist orientation of the movement in the early 1930s. 'The paranoiac-critic method', Greeley writes, 'advocated a dynamic role for the artist and an active production of imagery in the service of a social critique' (Greeley 2001: 486–7). A deliberate simulation of paranoia would demonstrate to anyone who applied the method that reality was not a fixed entity to which an individual responded, but rather a construct born out of that individual's comprehension of the world. 'In this manner, the paranoiac-critic method pointed the way to a critique of the symbolic realm as an integral part of any interrogation of social relations' (Greeley 2001: 469).

As Flieger has shown, the paranoid tone in postmodern literature is shared by several key proponents of postmodern critical theory (Flieger 1997). This tone (or 'modality') is characterized by 'uncertainties of discourse' (Derrida) and the loss of belief in historical and authoritative 'metanarratives' (Lyotard). Such uncertainties can be celebrated as a mode of liberation from constraint, or decried as a loss of ontological security, depending on where one places oneself in relation to the symbolic structures of discourse and history. They are consistent, Flieger writes, 'with a certain paranoid vision which refutes the accepted authoritative or consensual version of reality (the reality that normal people agree upon), even while sustaining an uncertain discourse (the paranoid's alternative version of events)' (Flieger 1997: 89).

Lacan's conception of paranoia was characterised by an essential disbelief in the authority of the Name of the Father, which can be understood as synonymous with 'consensus reality' (Flieger 1997: 90). The paranoid, Flieger writes,

fails to believe in the Other as the last word, constructing an alternative belief in what Lacan calls 'The Other of the Other', the fantasmatic persecutor who has arranged a system undermining the apparent Symbolic Order, belying reality as it appears to the rest of the world, but accounting for everything in it.

FLIEGER 1997: 90

This is what makes the paranoid an exemplary diagnosis for subjectivity in late modernity/postmodernity: the subject *knows* it can't *know for sure* but intimates a great evil (or angelic good) that has revealed itself directly to them. The sane person (neurotic) accepts the pre-determinism of systematic law and structure as reasonable and good, if emotionally distressing and challenging, while the insane person (psychotic) recognizes something secretly evil, inhuman and terrifying within it. When the *sensus communis* reacts against the psychotic individual and the *idios kosmos* they have constructed to make sense of their experiences, they either fall deeper into despair and terror or affirm their sovereign indifference to the beliefs of others. The issue at hand then concerns what kinds of machinic analogies are deemed correct, sane and normal and which are

erroneous, insane and pathological? Whose 'systematic structure' is more or less delusional, those which conform to the consensual order of disciplinary constraint and scientific orthodoxy, or those that see connections between different orders of object that others cannot?

In the preface to *The Four Fundamentals of Psycho-Analysis* (1977), Lacan spells history with a 'y', a reference to the origin of psychoanalysis in Freud and Breuer's work on hysteria; the hysteria of his colleagues for him having imposed Freud upon himself; and the role of the unconscious in any desire to *historicize* (Lacan 1986: vii–viii). A subject can only be conscious of history after entering into a pre-given structure of signs, symbols and codes, suffused with external authority, often assumed to be absolute but which is itself historically contingent. From then on there is no position from which to discriminate true knowledge from systemic deception, existential certainty from organized delusion, and one is condemned to a permanent state of critical suspicion and radical indeterminacy. From a paranoid-critical perspective, one cannot *know* if one's consciousness of things is *false*, or if one's *knowledge* is true. In light of such radical uncertainty, it is understandable that a subject might reach for the reassuring functionality of machines or mathematical formulas as the analogical foundation for a world-view aspiring to certainty. Simply siding with the Law however is the surest means of avoiding the existential anxiety that comes from questioning the authoritative structures of reality. Alternatively, the paranoid subject gives precedence to its *connaissance* of the Big Other and its hidden motives, setting *another* Other in its place (i.e. transforming their imaginary *connaissance* into schizophrenic *savoir*).

Paranoid-critical theory then refers to a broadly postmodern theoretical orientation where psyches cannot be subjectively disentangled from the structures that surround and determine them. From such a 'matrixial' perspective (Ettinger), the historical consciousness demanded by Marxist theories of class-driven revolutionary social change is an authoritarian phantasm, tied to the Symbolic and aligned with the Big Other (i.e. the symbolic order itself, beyond any representative of it). For Lacan, the 'original splitting' of the subject as it passes from the mirror stage into speech means that the ego has a 'bipolar structure' at its core (Lacan 1977: 10). The Imaginary is consequently the realm proper to paranoia and the particular form of knowledge associated with it (Lacan 1977: 306).

Surrealism, poststructuralism and schizoanalysis, by eroding the epistemic foundations of Western rationalism, channelled the insubordinate, pre-modern and heterological currents within avant-gardism towards a permanent critique of reason and law. Postmodern critical theory revealed a paradox at the psychological core of the modern individual relative to the systemic properties of extrinsic social and physical realities within which it lives and thinks. If reality is assumed to be governed by physical, social and communicative laws that pre-

determine the subject prior to self-consciousness, one can only be free from systemic constraints through innocence, unknowing (Bataille) or unreason (Surrealism). Dalí's paranoid-critical method, which was repurposed by science fiction writers like J. G. Ballard, Philip K. Dick, and William S. Burroughs, offered a way into diagramming and drawing analogies free from the expectations of rationality and disciplinary fidelity, while at the same time respecting the intentions of the authors who devised them and put them to use.

Symptom Instruments

Diagrams, as operational icons of intelligible relations, traverse Lacan's registers of the Imaginary and Symbolic. All diagrams partake of the Imaginary, regardless of their intended function. Despite the logical and symbolic meaning of the semiotic square for instance, it was its *form as image*, echoing those of minimalist painting and sculpture/non-sculpture, that inspired Krauss's intellectual breakthrough (i.e. it offered a *visual analogy* between different kinds of cultural objects). From this perspective, diagramming could be defined as the act of drawing the imaginary into discourse.

The revelatory and productive power of diagrammatic analogies for Krauss's understanding of the vicissitudes of modernity, and her critical commentary upon it, is exemplary of the power of diagrams to open the mind to new modes of thinking. Such effects, following Lacan, can be understood as moments when something unrecognized or not understood suddenly makes sense, or when a previously obscure relation between different things becomes intelligible. This is what Douglas Hofstadter and Emmanuel Sander mean when they refer to analogy-making as the creative core of cognition. Like the therapeutic illuminations experienced in psychoanalysis, these moments of revelatory analogy-making can have the quality of *anamnesis* (the discovery of innate knowledge) and as such create trans-temporal loops in the narrative of a subject's *coming-to-knowledge*. Lacan succinctly represented these paradoxes in a series of diagrams he called the Graph of Desire.

Lacan's Completed Graph illustrates how diagrams operate between the registers of Imaginary and Symbolic, and how language creates an unclosable gap in the latter designated by *petit objet a* (*i(a)*): the object-cause of desire that eludes satisfactory symbolization). It is a 'psycho-logical' diagram which functions as an icon of intelligible relations within the context created by Lacanian psychoanalysis. Seen independently of that context however, it could be read as a schematic representation of an insect's face, a predatory alien machine, an aerial view of a rowing machine or some unknown technical device. These would not be unreasonable correlations to draw given the importance of Roger Caillois's theories of insect mimicry, the fascination of masks for Lacan's theory of the

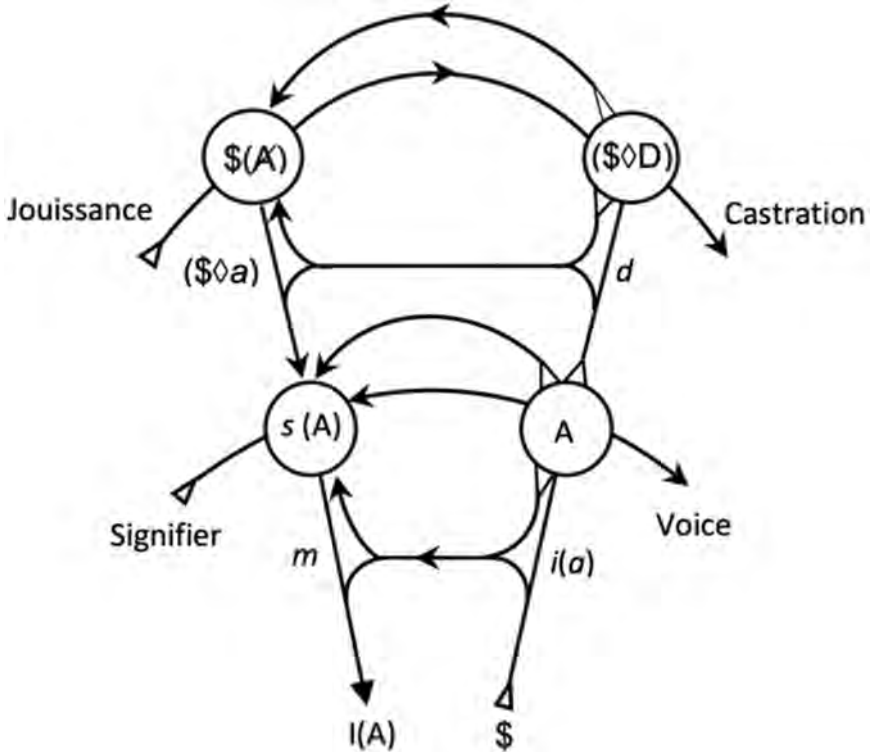


Figure 1.12 Completed Graph of Desire.

Imaginary, Dalí's formulation of paranoid-critical activity and the metaphorical 'apparatus' within Marxist and Freudian critical theory. The graph can also function as a ready-made sign of the diagrammatic tendency within postmodern cultural theory regardless of the functions it was designed to illustrate or the viewer's understanding of them. It is also a beautiful graphic object that can be admired for on purely aesthetic terms for its symmetry, balance and *gestalt*.

To do so however, would be to lean away from the logical operations of the symbolic order and practical, scientific discourse in the direction of fantasy, illusion and pleasure. As such the Graph of Desire can be seen to hover between the Imaginary register, where its likeness to other things (analogy) could potentially generate a range of joyful, playful and useless interpretations, and the Symbolic, where it definitively demonstrates how the subject of psychoanalysis must acknowledge to function of the signifier and the Name of the Father in the process of being cured.

Diagrams depicting the rule-bound conventions of formal logic, structuralist theories of semiotically mediated social systems and topological schematizations

of psychological mechanisms suggest a general systemic alterity that leaves little room for subjective agency, creativity or resistance. Diagrams which claim to represent the underlying laws of a pre-given and deterministic reality are projections of the Symbolic order onto an unknowable, undifferentiated Real mediated through the lived experience of a subject. In the theories of Krauss and Jameson, structuralist diagrams operated in tandem with new understandings of contemporary subjectivity as schizophrenic, correlating breakdowns in conventional symbolic functions with a paranoid modality in postmodern culture and theory. The psychoanalytic idea of paranoia as a logically sustained systemic delusion, endorsed by Lacan and celebrated by Dalí, bears an uncanny resemblance to the totalizing and deterministic character of Marxist critical theory exemplified by Althusser and Jameson, whose ideas, explicitly informed by Lacan, seemed to leave little room for creative agency in ‘the prison house of language’.

In an article discussing the value of a Lacanian approach to art therapy, Shirley Sharon-Zisser discusses the importance of Lacan’s conceptualization of the *sinthome*. Sinthome or ‘symptom instrument’ – an older spelling of ‘symptom’ – evokes the name of the doubting Saint Thomas and cyborg Synth-Man. Lacan used it to refer to a complex subjective invention that binds the Imaginary, Symbolic and Real components of psychic life into a Borromean knot, a ‘creation that makes life tolerable’ (Sharon-Zisser 2018: 3), exemplified for Lacan in the late fiction of James Joyce. The concept, developed in the 1970s and the focus of Seminar XXIII (1975–76), grew out of Lacan’s interest in a purely topological representation of psychic life and the possibility of representing the interdependence of its three registers without recourse to metaphor or analogy.

The *sinthome* represents a fourth register of psychic life constituted by the most intolerable elements of the imaginary, symbolic and real for the psychic life

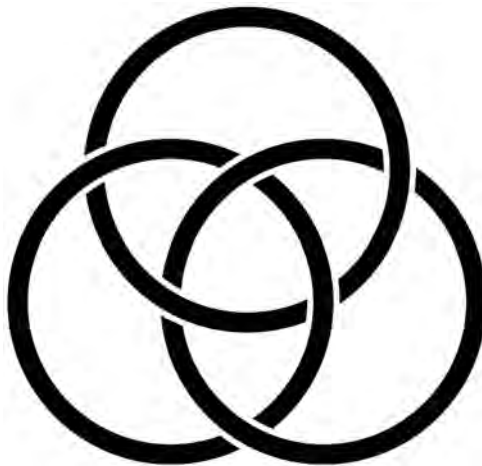


Figure 1.13 The Borromean Knot.

of the subject. It is precisely from these elements that a solution to the conflicts is found at the end of the analysis (Sharon-Zisser 2018: 4). Sharon-Zisser defines the *sinthome* as ‘an idiosyncratic object signifier, fabricated by the subject at the end of analysis rather than pre-existing in the common treasury of signifiers’ (Sharon-Zisser 2018: 9). Importantly, *the sinthome*, and the seminar Lacan dedicated to it, was expressly concerned with the question of art within the Lacanian system (Lacan 1976–77: 6). From this perspective diagramming one’s subjective experience and understandings of the inter-play of the Symbolic, Imaginary and Real could have value as both a therapeutic and pedagogical tool in what Sharon-Zisser refers to as ‘the adventure of the subject’.

Notes

- 1 Krauss addresses Benjamin’s invention of the term ‘optical unconscious’ in section four of her book, where she questions the analogy Benjamin proposed between the psychoanalytic revealing of the instinctual unconscious and the photographic revealing of the optical (Krauss 1994: 178). Can the ‘optical field’, she asks, have an unconscious in the same way a person can? Freud, she argues, would not have recognized the claim that a field of technical operations can have an unconscious in the psychoanalytic sense. Where the camera reveals the workings of something akin to the unconscious, however, is in the recording of crowd behaviour (i.e. the collective unconscious) (Krauss 1994: 179). ‘My own use of *optical unconscious*, as it has been invoked in the pages of this book, is thus at an angle to Benjamin’s’:

If it can be spoken of at all as externalized within the visual field, this is because a group of disparate artists have so constructed it there, constructing it as a projection of the way that human vision can be thought to be less than a master of all it surveys, in conflict as it is with what is internal to the organism that houses it.

KRAUSS 1994: 179–80

- 2 The English word ‘apparatus’ derives from the Latin *apparare*, ‘to make ready for’. In this sense, it shares a root meaning with ‘preparation’ and ‘arrangement’, i.e. ‘an intentional organization of elements’.

2

THE DIAGRAMMATIC WORKS OF HILMA AF KLINT

Mary Yacoob

Introduction: ‘A Pioneer of Abstraction’

The Swedish artist Hilma af Klint (1862–1944) has been described as a ‘pioneer of abstraction’. At the same time, it has been widely acknowledged that her works resemble diagrams.¹ This chapter discusses the connections between the abstraction in the works of af Klint and diagrams as abstract representations of ideas by drawing on the ideas of the American philosopher and scientist Charles Sanders Peirce (1839–1914), one of the founders of semiotics, the general theory of signs. Peirce’s ideas about how diagrams enable us to visualize relationships, and his ideas about the role of annotations in diagrams, a distinctive feature of some of af Klint’s more diagrammatic works, will be used to analyse af Klint’s drawings and paintings. Also important will be Peirce’s division of signs into three main categories: icons (which include diagrams), symbols and indexes. Peirce maintained that most signs contain the characteristics of all three of these categories, and this chapter will examine the ways in which interpretations of af Klint’s works can be enriched by distinguishing between these different types of signs in her works.

The paintings and drawings of af Klint address relationships between matter and spirit, visible and invisible, and duality and unity. Af Klint’s works illustrate how diagrams can facilitate the schematization and manifestation of that which is intangible or invisible, such as imaginary, sacred, or metaphysical ideas, and how they can be the space in which observations of known entities can be analogically explored to speculate about unknown entities. The artist’s works



Figure 2.1 Hilma af Klint, *The Evolution, No. 16, The WUS/Seven-Pointed Star Series, Group VI*, 1908. Courtesy of The Hilma af Klint Foundation. All rights reserved.

demonstrate how diagrams can function as a kind of conceptual laboratory in which visual imagery and ideas from varied disciplines can interact. Though af Klint's works were rooted in her spirituality, they were influenced by geometry, natural science and ideas about evolution and taxonomy. Af Klint's practice points to the relevance of diagramming as an exploratory, meditative and creative practice, and her esoteric approach to diagramming raises questions about our interpretative responses.

'A Great Commission'

That af Klint chose to use drawing and painting to develop her spiritual research reflects her education at Stockholm's Royal Academy of Fine Arts from 1882 to 1887. The artist was one of the first generation of female students to be permitted to study art. Her training was in the conventional portraiture and landscape styles of her era. As the art historian Julia Voss writes, her early works included watercolours of wildflowers (2022: 110), and in 1900 she worked at the Veterinary Institute in Stockholm as an illustrator for a book project on horse surgery (Voss

2019: 37). This early technical work had its influence: botanical and biological imagery became key aspects of her art practice. Another influence on her work might have been af Klint's family association with the navy, mathematics, hydrographic surveying, and the making of charts and tables for astronomical navigation, all of which meant that the artist would have been familiar with diagrams and maps (af Klint 2005: 6).

In 1896, af Klint and four other female colleagues set up a group called De Fem (The Five). They studied the New Testament and Rosicrucianism, conducted seances, and meditated. De Fem believed that higher spirits wanted to communicate to them through pictures and they recorded these messages in automatic drawings, an inventive practice that allowed them to move beyond academic paradigms (Lomas 2013: 227).²

From 1889, af Klint attended meetings at the Theosophical Society, an esoteric movement founded by Helena Blavatsky and Henry Steel Olcott in New York in 1875. The popularity of Theosophy reflected that era's growing interest in spiritualist ideas and occultism. Central tenets of Theosophy included spiritual emancipation, universal brotherhood and reincarnation, and Theosophy was influential in the introduction of aspects of Buddhist and Hindu ideas to Western societies. Af Klint also joined the Anthroposophical Society, founded by Rudolf Steiner in 1912, and visited The Goetheanum, an Anthroposophical study centre in Dornach designed by Steiner, eight or nine times between 1920 to 1925.

As the art historian Åka Fant explains, in attending to spiritual beliefs and higher spirits through paintings and drawings, af Klint had doubts about how to understand some of her own works as she felt she was merely channelling messages from spirit guides (2021: 44). Af Klint made few statements about the sources of her art, and 'she was constantly surprised by the results of her unconscious activities and was unable to explain them' (Fant 1986: 157).

In 1906, af Klint believed that she received a 'great commission' from a spirit guide to complete a body of work which manifested in *Paintings for the Temple*, a series of one hundred and ninety-three individual works organized into groups of paintings, created between 1906 and 1915. These works entailed a shift away from the portraits and landscapes of her academic training towards a more diagrammatic style that often included annotations and symbols. Her works incorporated botanical and biological imagery, progressing, as time went on, to more geometric and abstracted forms. Expressive and symbolic use of colour, gestural drawings and paintings, and poetic language all played roles in the gestation of af Klint's art, as did her notebooks, which contained preparatory sketches and reflections about her works.

Af Klint recounted that some of her works were created whilst she acted as a medium. She claimed that she was directed by spirits and that images were then transferred onto canvas. Some images were communicated to the artist whilst she was asleep (Svensson 2005: 27). Sometimes af Klint believed that spirit

guides instructed her to work independently of them (Svensson 2005: 27). From 1912 to 1915, af Klint worked as a 'partial medium', exercising more direct control over the composition of her pictures (af Klint 2005: 8). From 1916 onwards, she was more active in creative decision making, although she retained contact with her spirit guides (af Klint 2005: 8).

In summary, the use of drawing and painting by De Fem as a means to translate spiritual experiences into visual form, and more specifically, af Klint's background in technical drawing and her family history in diagrams and maps, may all have contributed to the importance of diagrammatic form in her works.

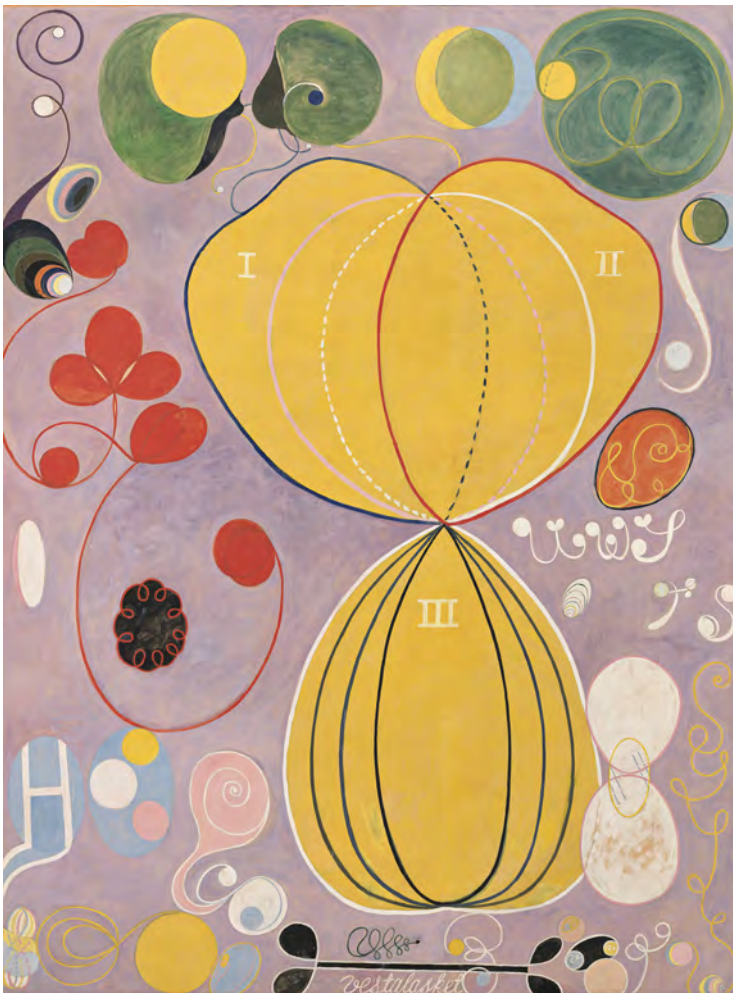


Figure 2.2 Hilma af Klint, *The Ten Largest, Group IV, Adulthood*, 1907. Courtesy of The Hilma af Klint Foundation. All rights reserved.

Evolution, Optics and Esoteric Diagrams

There are numerous ways in which af Klint's spiritual ideas and their expression in diagrammatic works may have been influenced by scientific ideas and visualizations. Both Theosophists and Anthroposophists aimed to unite spirituality and science. Whilst acknowledging the achievements of science, Steiner believed that its disciplinary boundaries cannot penetrate into spiritual supersensible worlds. At the same time, he believed that the clarity of thought and investigatory approach of science should be applied to spirituality to guard against 'illusionary elements' or hallucinations when entering higher spiritual worlds.³

An example of the way in which scientific ideas influenced esoteric thinking can perhaps be seen in af Klint's series *The Evolution*. It has been argued that Charles Darwin's ideas about biological evolution, published in his book *On the Origin of Species* in 1859, influenced ideas about spiritual evolution. For example, the art historian Linda Dalrymple Henderson suggests that Darwin's ideas about evolution influenced the mystic philosopher Carl du Prel's thinking about the evolution of human consciousness to higher levels. Af Klint is known to have had du Prel's book in her collection (Henderson 2019: 80).

The Evolution series explores the spiritual evolution of the self. Af Klint writes that in the sixteenth work of the series (Figure 2.1), the lower half of the work depicts 'body, soul and spirit in hibernation' and the top mandala-like shape represents innocence, though, as Fant argues, even with these explanations the full meaning of the work is still remote from viewers (2021: 60). Another series of works exploring the theme of evolution was af Klint's *The Ten Largest*, which the artist said provide insight into the 'systemisation of four stages of human life': childhood, youth, adulthood and old age (Fant 2021: 48). The seventh in this series is an annotated diagrammatic form surrounded by motifs reminiscent of flowers, petals, seeds, coils, and reproductive cells, etc. (Figure 2.2).

There is another way in which scientific ideas may have influenced Theosophical and Anthroposophical ideas. It has been argued that scientific discoveries that were revealing the hidden properties of matter influenced ideas in esoteric circles that there were hidden spiritual facets of the universe that may be uncovered by prayer or meditation (Müller-Westermann 2013: 38). In this way, it might be said that religion was being re-imagined through the perspectives being developed in science. In 1831 Michael Faraday discovered electromagnetic induction, and in 1838 Matthias Schleiden proposed that all plants are made of cells. The late nineteenth century saw the discovery of the X-ray by Wilhelm Röntgen and the discovery of electromagnetic waves by Heinrich Hertz (Müller-Westermann 2013: 38). These discoveries, indicating that the universe is permeated with unseen particles or force fields, undermined confidence in the adequacy of the naked human eye as a perceiving instrument (Henderson 2019:

73). These ideas may have had a bearing on af Klint's attempts to diagram the spiritual forces of plants, as can be seen in *Violet Blossoms with Guidelines* and the *Flowers, Mosses and Lichen* series, discussed later in this chapter.

Af Klint's adoption of diagrams reflects their use in religious and esoteric practice. For example, kabbalistic 'tree of life' diagrams have been used in Jewish, Christian and Theosophical mystical traditions, and mandalas are used as meditative devices and tools for spiritual guidance in Buddhist practices. Af Klint's works can be considered alongside the diagrams in *Occult Chemistry* (1908) by her contemporaries Annie Besant and Charles W. Leadbeater, some of whose books af Klint had in her collection.⁴ *Occult Chemistry* presents the authors' claims that clairvoyance can offer an alternative instrument of observation that can supplement what cannot be observed through the five senses. The book includes diagrams of circular and oval shapes that contain spirals and molecular-like structures composed of circles and dotted lines. Images are annotated with letters, numbers, and plus and minus signs.⁵

The next section considers Peirce's definition of diagrams and the roles that symbolic and indexical signs play on diagrams. Following sections will then include an analysis of which of these signs can be detected in af Klint's works and how this analysis can assist in our interpretations of her works.

Peirce: Types of Signs

Charles Sanders Peirce wrote about a wide range of topics including semiotics, logic, metaphysics, mathematics and astronomy, amongst others. Peirce's understanding of semiotics involves a sign, its object (what the sign refers to) and its interpretant, the latter meaning, for example, an idea that the sign/object relation excites in the mind. In Peirce's semiotic theory, an emphasis is placed on how a sign is interpreted and the process of interpretation.⁶

A significant aspect of Peirce's broader classification of signs, for the purposes of this chapter, is his division of signs into three main categories: icons, symbols and indexes. Symbols rely on the application of a general rule or convention for comprehension, for example, the way in which the word 'book' is interpreted by an English speaker to indicate the general concept of a book. The relationship between symbols and what they represent may be arbitrary as they do not need to have any similarity with their objects to function. For example, the word 'book' does not look like what it represents.

Indexes rely on a direct and factual connection with their objects to convey meaning, for example the way in which a weathervane indicates the direction of wind. Indexes also direct attention, an example being the way in which a pointing finger draws attention to something. Annotations on diagrams are also indexes.

Peirce gives the example of the way in which 'geometricians mark letters against the different parts of their diagrams and then use those letters to indicate those parts' (1998a: 8). For example, the letters A, B and C on a geometrical figure are indexes.

All icons resemble their objects in some way, and so for Peirce, both images and diagrams are types of icon because they both have some sort of resemblance to their objects.⁷ An image resembles its object by representing the 'simple qualities' of that object – an example is a portrait. This differs from a diagram, which resembles its object because the relations between the parts of the diagram are analogous to the relations between the parts of what it is representing, such as a thing or an idea (Peirce 1998b: 274). For example, in a pie chart, the proportions of the diagram are analogous to the proportions of the data it represents. As the writer on semiotics and philosopher of science Frederik Stjernfelt explains, a diagram resembles its object through 'a skeleton-like sketch of relations' (2000: 358). The historian and philosopher of science Chiara Ambrosio explains, 'for Peirce, diagrams make *relations* visible' (2014: 259). Af Klint's works can be said to bear comparison with these examples and descriptions of diagrams in that her works filter the complexities of thought and perception into structures that make visible the relations between matter and spirit.

Ambrosio writes that Peirce suggests that the process of designing an icon, for example a diagram or image, is a process of discovery. Dynamic acts of interpretation are triggered by the process of selecting relevant qualities that can, in some respects, enable the icon to capture aspects of the object it stands for (Ambrosio 2014: 256). Furthermore, observing an icon and trying to decipher how it represents its object invites the viewer to re-enact the process of its construction. This is a fruitful and dynamic act of interpretation that reveals new facets of the object (Ambrosio 2014: 261).

Peirce noted that sharp distinctions cannot be made between different types of icons because the concept itself is inherently vague (Stjernfelt 2000: 358). This suggests that, for example, some images may have diagrammatic qualities. Furthermore, Peirce wrote that although some signs may predominately contain one or two of these characteristics, all signs include a blend of different measures of iconic, indexical, and symbolic characteristics. Accordingly, this chapter will consider how a mixture of diagrammatic, symbolic and indexical characteristics in af Klint's works can be detected and how this mode of analysis supports interpretations of her works.

As regards the ways in which af Klint's works can be considered diagrammatic, one factor to consider is how they are annotated. Peirce explains that indexical information on diagrams plays an important operational role. Discussing the example of a map, he writes that unless a map carries the mark of a known locality, a scale, and a compass, it can fail to convey where a place is to be found (1998a: 8). Peirce also writes:

It is, however, a very essential feature of the Diagram per se that while it is as a whole an Icon, it yet contains parts which are capable of being recognized and distinguished by the affixion to each of a distinct Semantic Index (or Indicatory Seme, if you prefer this phrase). Letters of the alphabet commonly fulfil this office. (1976: 317)

Later sections will discuss how af Klint's lettered annotations can enable us to distinguish different parts of the diagrams in the artist's *Primordial Chaos* series.

It should be noted that Peirce wrote about diagrams in relation to their functional roles in logic, mathematics and science.⁸ This raises the question of how we can relate his ideas about diagrams to those made in an artistic context. The semiotician Nicole Everaert-Desmedt explains that Peirce did not write extensively about art, but he did specify the purpose of a work of art is to capture what he called a 'quality of feeling' that seems 'appropriate' or 'reasonable' to the artist but which leaves the artist in an unsettled state. The artist tries to capture a quality of feeling and aims to give it intelligible form by embodying it in an artwork. Peirce believed that artworks are ideally received with a kind of 'intellectual sympathy' and a type of 'cognition' that differs from that used in scientific contexts. Furthermore, artworks remain incomplete in the sense that they continue to unfold themselves through new interpretations (Everaert-Desmedt 2006).⁹ Again, this emphasizes the important role of interpretation to the way in which signs operate.

Diagrams and Abstraction

However, what happens when we do not fully understand the meanings that af Klint may have been trying to convey in her diagrams? Perhaps we can consider this in the light of everyday experiences of, for example, encountering a map or an engineering diagram and not fully understanding it, but nevertheless engaging with its aesthetic and structural qualities, its geometric patterns and linear systems. When this happens, are we merely engaging with the diagram's formal and abstract qualities and eliding the diagram's meaning? Or does something of the diagram's intended meaning or purpose carry through, even if we cannot fully unlock it? These questions will be considered in a section about af Klint's *Primordial Chaos* series. But before that, it would be useful to consider the connections between diagrams and art via the concept of abstraction.

Stjernfelt offers a useful means of connecting the abstraction of diagrammatic form with developments in Modern Art when he writes that 'twentieth-century high modernism often approaches diagrammatic qualities' (Stjernfelt 2017: 135). Stjernfelt argues that the abstract nature of diagrams is one of a number of their

'potential aesthetic qualities' that may be exploited for artistic purposes. Diagrams are abstractive in that they abstract away properties of objects that are seen as irrelevant to the considerations in hand. They are also abstract in the sense that the properties and relations that they represent are subject to idealized depictions. Diagrams filter out what are considered to be irrelevant points of information in order to focus the eye on structures that reveal significant information (Stjernfelt 2017: 135). The way in which diagrams can help us distil ideas in visual form so that we can process complexities of thought and experience is exploited by artists to articulate ideas and visions. Accordingly, we might see af Klint's artworks as abstractive (rather than as abstract works of art), i.e. works that use diagrammatic properties to filter out unnecessary information in order to focus on specific qualities and subject them to idealized depictions in, as Stjernfelt puts it, skeleton-like sketches of relations.

As already noted, in 1906, af Klint believed that she received a 'great commission' from a spirit guide to convey a 'message to humanity' about 'the immortal aspect of man' (Adams 2020: 2). So, for af Klint, the communication of the meaning of the works was important. Indicating why the communicative power of signs is important in her work, she wrote of:

an artist or author who, in his dreams, can fully and totally perceive beauty, the greatness of things. But it is not enough for him to see, others must also be allowed to see. What does he do? He creates, you say. That is to say, he limits his own free, lofty flights of thought in order to give his vision a form that others can understand. This is an inadequate image but it suffices to indicate the essential limitations of form.

LINDEN 2005: 42

In what seems like a cautionary note, Peirce writes about how viewers may get lost in dreamlike and imaginary moments when looking at diagrams or paintings. During these moments, a painting or a diagram may become the 'very thing', and we may forget they are representations (Peirce uses the word 'abstractions') of something else. Peirce writes:

but in the middle part of our reasonings we forget that abstractness in great measure, and the diagram is for us the very thing. So in contemplating a painting, there is a moment when we lose the consciousness that it is not the thing, the distinction of the real and the copy disappears, and it is for the moment a pure dream. (1992: 226)

Some of af Klint's diagrams are cryptic, and the annotations on her works can be difficult to understand. The enigmatic nature of af Klint's works may lead us to get lost in the dream of the picture plane as if that is the 'very thing'. This may

lead us to lose sight of the spiritual themes that af Klint was trying to communicate through diagrammatic form. The potential for loss of meaning in the viewing of works of art was an issue addressed in the 1986 exhibition *The Spiritual in Art: Abstract Painting 1890–1985* at the Los Angeles County Museum of Art. Af Klint's inclusion in this exhibition was instrumental in attracting world-wide attention to her works. The exhibition built on the research that had been emerging in the 1960s which, according to the art historian Sixten Ringbom, countered a tendency to overlook the influence of occultism and Theosophy on the art of some early modern abstract artists such as Wassily Kandinsky and Piet Mondrian. Both Kandinsky and Mondrian believed that art was a route to spiritual knowledge and that what Theosophists aspired to achieve by their methods, for example doctrinal instruction or meditation, etc., 'the artist visualizes by the means at his disposal' (Ringbom 1966: 414). In Mondrian's works, for example, horizontal and vertical lines represent the sea and the forest as well as the relationships between matter and spirit.

In his influential 1939 essay *Avant-Garde and Kitsch*, the American art critic Clement Greenberg advocated formalist readings of art. He argued that an artwork should call attention to the unique attributes of the medium with which it is made. For example, paintings should explore the properties of line and colour on the two-dimensional picture plane. Greenberg argued that representation, subject matter, or narrative were properly the domains of other spheres such as literature or theatre. However, the growing interest in the esoteric subject matter of early modern abstract artwork made by artists such as Mondrian and Kandinsky, explored by Ringbom and *The Spiritual in Art* exhibition, provided an alternative to such purely formalist readings of their works.

Artists such as Mondrian were taking advantage of an abstraction that approached diagrammatic qualities as a means to visualize that which is invisible, such as metaphysical relationships. As we will see, a distinctive feature of af Klint's more overtly diagrammatic approach to schematizing metaphysical relations were her annotations.

'A Language of Symbols'

Af Klint's creative mixture of iconic and linguistic registers can be considered in relation to the ideas discussed by Sybille Krämer and Christina Ljungberg in *Thinking with Diagrams* who argue that almost the entirety of intellectual and cultural history treats image and language as 'disjoint orders that differ in their semiotic registers'. However, they contend that from both a cognitive and aesthetic point of view, our creativity is rooted in hybrids of the iconic and the discursive, the figurative and the symbolic, and that diagrams, maps, technical drawings, and graphs are examples of these 'mixed forms' (2016: 1).

Af Klint created a list of the words and abbreviations that appear in both her visual works and in more than twenty thousand pieces of writing. Entitled *Letters and Words Pertaining to Works by Hilma af Klint*, the list is thought to have been compiled in the 1930s. The artist described the work as a ‘language of symbols that has already existed forever and that has now been given to humanity by the creative spirits’ (Müller-Westermann 2018: 246). Some words refer to a concern with overcoming physical desire. Others allude to the Old Testament, Rosicrucianism and to Buddhism. Metaphorical relations are created between natural elements and emotional and spiritual qualities:

Het sand [Hot sand] = the fire of desire
 Hyskan [The eye, hook-and-eye] = love
 Skär ros [Pink rose] = spiritual knowledge and devotion
 b = broken rays of WU
 m = the caged bird’s struggle
 t = beneath the beds of dust the seed will grow
 Ö = the end of everything

BURGIN 2018: 259–85

Af Klint’s list exemplifies an individual’s attempt to construct a private symbolic system as a creative and exploratory exercise. However, this raises the question of how such individually created symbolic systems can be understood by others, and perhaps Peirce’s definition of symbols can help here. As previously stated, Peirce writes that symbols, which include words and abbreviations, rely on working general rules. Symbols depend upon ‘habit (acquired or inborn)’ (1998a: 9). Symbols, then, are generally held to be conventions that are communally understood. However, in *Letters and Words Pertaining to Works by Hilma af Klint*, the artist assigned her own meanings to words and letters of the alphabet.

Af Klint included some of these words and abbreviations as annotations on her diagrams. Whereas diagrams often have a key that explains the meanings of abbreviated annotations, af Klint’s did not. Even if viewers had access to af Klint’s list of words and abbreviations, the artist often included multiple definitions for the same abbreviation. Viewers may be able to acquire an understanding of (or speculate about) af Klint’s intended meanings through a study of her works and the wider context of the artist’s practice and interests. However, these symbols would need a greater degree of interpretative attention than more conventional symbols. Or, if the viewer cannot understand the annotations on af Klint’s diagrams, then they might perhaps construe them as images that signify the notion of language. For example, the philosopher Douglas N. Morgan refers to the pictorial function of verbal signs played by newspaper headlines in the paintings of Georges Braque (1955: 52).

The following section considers the role of lettered annotations in af Klint's works, how they can potentially unlock af Klint's intended meanings, and what other interpretative responses come into play when we do not fully understand these annotations.

Primordial Chaos

Primordial Chaos is a series of twenty-six works made by af Klint between 1906 to 1907.¹⁰ It is one of the groups of works that comprise the larger body of work *Paintings for the Temple*. *Primordial Chaos* includes a mixture of images and diagrams in which symbols and indexes play important roles. As such, the series demonstrates that although Peirce divided signs into the three categories of icon, index and symbol; in fact most signs contain all of these characteristics but in different degrees and combinations.

The *Primordial Chaos* series can be seen as a diagrammatic unit that unfolds a progressive series of developments. Each work narrates a different stage in the story of the formation and evolution of the cosmos. Images that refer to the natural world are used to visualize abstractions, such as the evolution of spiritual consciousness or the idea of creation. This reflects the practice in esoteric circles of searching for real or symbolic links between the visible and invisible, to clarify, interpret and distribute knowledge to others (Svensson 2005: 24). Af Klint's use of natural imagery as signifiers for thought processes suggests a kind of continuum between the spirit and natural world. As such, the imagery reflects the artist's pantheistic leanings and the resurgence of vitalism at the turn of the twentieth century (Lomas 2013: 228).

The *Primordial Chaos* works reflect the themes of the broader series of *The Paintings for the Temple*. The art historian Iris Müller-Westermann explains that *Primordial Chaos* depicts the dissolution of oneness that existed at the beginning of creation, the splintering of unity into dualities, and the emergence of matter out of spirit. The works explore polarities between male and female, matter and spirit, light and dark, and good and evil. Although polarity is presented as an organizing principle of life, embedded into this polarity is a yearning to return to unity, which leads to spiritual evolution. A core theme of the works is the unity of all existence, which lies hidden behind the polarized dual world in which we live (Müller-Westermann 2013: 34, 38). As Svensson puts it, the series conveys the aim to achieve 'the union of opposites, a total dissolution of matter and spirituality or of the male and female' (2005: 17). Af Klint's ideas may have been influenced by Carl du Prel, who argued against materialism and dualism, and in favour of a continuum between matter and spirit (Henderson 2019: 72).¹¹

In the seventh painting of the *Primordial Chaos* series, an orb seems to be hurtling through space against a stormy atmosphere (Figure 2.3, top right). The

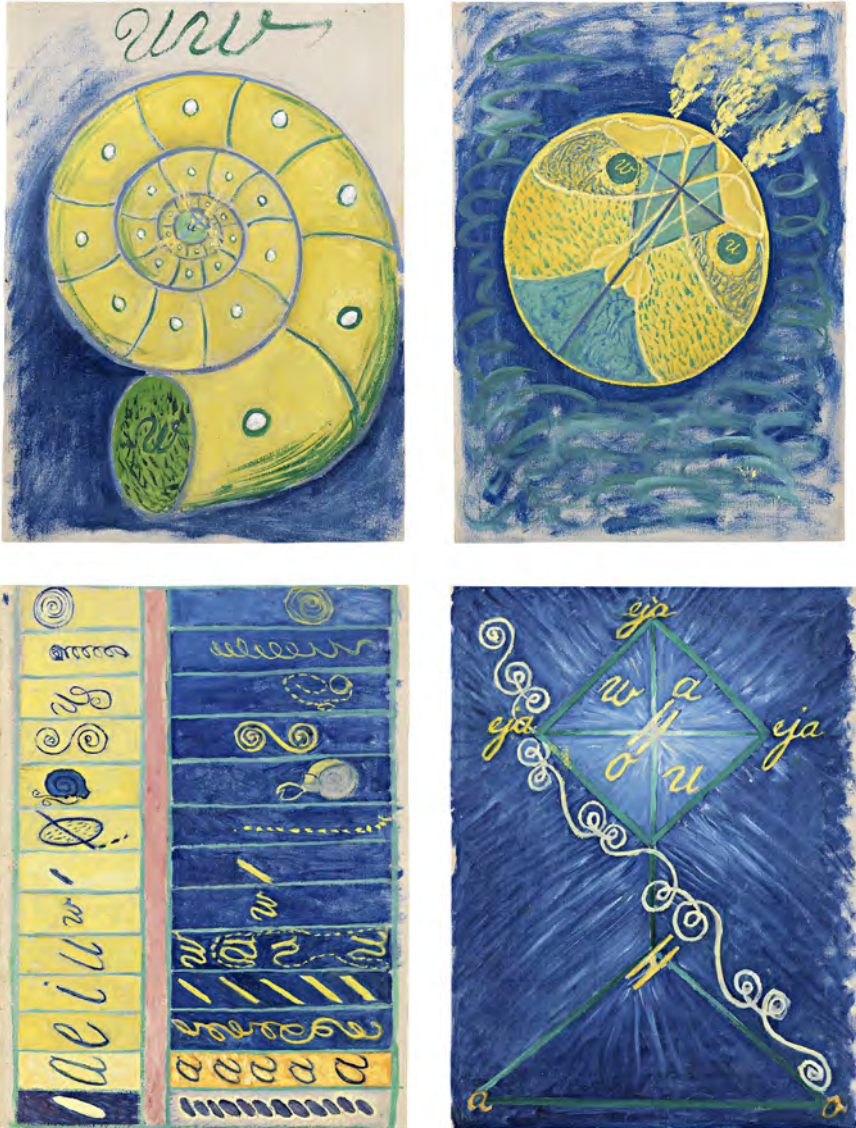


Figure 2.3 Clockwise, from top left: Hilma af Klint, *Primordial Chaos, Group I, The WU/Rose Series*, 1906–1907, No. 5, No. 7, No. 11, No. 10. Courtesy of The Hilma af Klint Foundation. All rights reserved.

orb is split into two by a cross which lies inside a shape that resembles a kite or a diamond. The letters 'W' and 'U' appear on either side of the horizontal bar of the cross. These letters serve an indexical function as their placement indicate and distinguish between different parts of the diagram. The letters also have a

symbolic function as they are invested with literal meaning. In af Klint's works, the letter 'U' symbolizes the spiritual and 'W' symbolizes matter (Müller-Westermann 2018: 34). Here, af Klint's work conforms to Peirce's idea of a diagram, as the relations between the parts of the diagram are analogous to the relations between the parts of the idea it references: the dual relationship between matter and spirit. The work recalls Peirce's dictum that signs may combine iconic, symbolic and indexical qualities because the work is a diagram (a type of icon), and the W and U have both indexical and symbolic qualities.

In the fifth work of the *Primordial Chaos* series, a yellow snail shell is outlined in blue and shaded in green (Figure 2.3, top left). Af Klint wrote that in her works, the snail shell represents spiritual evolution or development (Fant 2021: 56, 58). Af Klint depicts a logarithmic spiral, also known as a growth spiral, by which the distances between the curves increase at each turn. This differs from the Archimedean spiral in which the distances between the curves stay the same.¹² Af Klint's botanical knowledge would likely have made her familiar with logarithmic spirals in nature, such as in sunflowers or pinecones. Logarithmic spirals are also dynamic organizing principles on the macrocosmic scale, such as in the formation of hurricanes and galaxies.

The image of the snail can be seen as symbolic. Writing about Peirce, Morgan argues that in the visual arts, icons can become symbolic if they are used repeatedly to reference the same meaning. They acquire a 'constant, conventional connotation' (Morgan 1955: 53). As Helmut Zander explains, the spiral is commonly used in Theosophy to mean spiritual evolution (Müller-Westermann and Zander 2013: 127).

At the top of the fifth work in the *Primordial Chaos* series, the letters 'u' and 'w' appear united in cursive script. It is not clear what this annotation means in the context of this work, though in *Letters and Words Pertaining to Works by Hilma af Klint*, one definition of 'uw' is listed as 'symbol of the dual truth' (Burgin 2018: 281). The letter 'u' appears at the centre of the snail and 'w' at the opening (Müller-Westermann 2013: 42). My speculative interpretation of the work is that it is depicting the emergence of matter out of spirit, one of the stages of cosmic development previously mentioned.

The work does not comply with conventional notions of what a diagram looks like, for example a graph or a geometric diagram. However, the work can be said to approach diagrammatic qualities because it maps out a process of development. The way in which the eye is taken on a spiralling path of development from spirit at the centre to matter at the outer edge is analogous to the idea it is representing (if my interpretation of the work is correct). Regarding the spiralling path of the snail, Müller-Westermann explains that spirals can be thought of as representing a 'development from the centre outward, an expansion, but also as a path from outside towards an internal centre' (Müller-Westermann and Zander 2013: 127).

The spiral as a symbol of spiritual growth is to be found not only in af Klint's drawings and paintings but also in her unrealized plan for a temple in which to house her paintings. Visitors would be guided through a three-tiered spiral pathway around a central tower. The complex was also to house a library and an altar. A tower would contain a spiral staircase leading to an observatory (Voss 2019: 39).¹³

The tenth work in the *Primordial Chaos* series looks like a table arranged in two columns (Figure 2.3, bottom left). There are letters of the alphabet, spirals, snails, letters, coils, dashes, swirls, dotted lines and zigzags. Voss writes that the work 'resembles a scientific table, with formula-like symbols'. The artist compared the paintings in the series to 'charts and logarithms for a seaman' (2022: 134).

The colour scheme throughout the series is blue, yellow, and green. Af Klint related the colour blue with the feminine and yellow with the masculine. In Johann Wolfgang von Goethe's *Theory of Colours*, which Klint is known to have studied in 1921 (af Klint and Ersman 2018), blue and yellow are associated with paired forces of nature, for example, plus and minus, repulsion and attraction, force and weakness, warmth and cold, and action and negotiation (Kemp 2000: 57). Blue and yellow are therefore presented as opposites, which, when combined into green, create a unified whole.

The eleventh in the *Primordial Chaos* (Figure 2.3 bottom right) series looks like an annotated geometric diagram. A triangle and a diamond shape are indexed with letters of the alphabet and there are spiralling coils. We know that 'w' and 'u' mean matter and spirit. In af Klint's notes, 'A' signifies the past and Kurt Almquist writes that 'O' signifies the future (2023, 170). Svensson explains that for af Klint, the letters 'ao', when united together, symbolize spiritual evolution and quotes the artist as follows:

The idea is to present a core from which evolution starts in rain and storm, lightning and tempest. *ao* can also stand for Alpha and Omega: *ao* the beginning and the end of a day's journey, i.e. a period of development in both climbing down into matter and rising up to full clear consciousness of life's content.¹⁴

SVENSSON 2005: 17

So perhaps the positioning of the letters 'a' and 'o' as well as the letters 'w' and 'u' diagonally across one another on the diamond shape signify the beginning and end of the spiritual journey that brings matter and spirit together. However, again, this is my speculation based on the diagram and wider discourses about af Klint's works. Without fully understanding all the other annotations on the work, and without additional interpretative information, it is difficult to fully understand how the relations between the parts of this diagram represent the relations between the parts of its object, for example, a thing or an idea, which is central to Peirce's notion of the operational function of the diagram.

Af Klint's works draw on both our familiarity with diagrams as a visual genre and the way in which we are used to interpreting letters on diagrams as indices which draw our attention to specific parts of diagrams, facilitating our interpretations of them. However, the cryptic nature of af Klint works destabilizes our habitual interpretative responses to diagrams. Nevertheless, in complying with our conventional notions of what a diagram looks like, the work strongly connotes an exercise in diagramming. The work suggests a process of schematizing relations, even if, as viewers, we may not be able to unlock exactly what the artist had in mind.

Af Klint's works can be said to be indexical in that the artist claimed that she was channelling messages from spirits and so there was a perceived direct and causal relationship between messages from spirits and her works, and between af Klint's perceived reality and her visualizations of this reality. We can read indexicality in another way. The works take the form of sketches made at speed with the medium of paint. Backgrounds are filled with scruffily painted marks and diagonal hatches which leave the surface exposed. These brushstrokes can be said to be indexical signs (Morgan 1955: 53). There is a causal relationship between the appearance of the brushstrokes and the gestural speed, dynamism and energy with which the artist created the works. These indexical signs manifest the work's wider themes of vitality and change. The brushstrokes also direct our attention to the presence of the artist who is exploring and visualizing a thought process, and this creates a kind of relationship between artist and viewer.

Discussing a logician viewing a diagram, Peirce wrote that the material qualities of a diagram, for example whether it is drawn on a blackboard or piece of paper, are 'accidental characters that have no significance' (1976: 317). Similarly, discussing the role of diagrams in logic, Stjernfelt argues that the gestural qualities of lines are irrelevant (2000: 366). This suggests that the purpose of a diagram is to carry out a logical proof and what matters is the diagram's structural relations, and the conventions by which we understand them, which would remain the same whatever its material qualities.

However, it could be argued that interpretative responses to the material and expressive qualities of diagrams can be important in some contexts. As previously stated, af Klint's rapidly painted and gestural brushstrokes convey meaning, and they are integral to the way in which she uses artistic strategies to draw our attention to the themes of the works. The artist and writer Dean Kenning addresses a potential aesthetics of Peircean diagrams. In an essay published in 1906, Peirce briefly mentions the idea of 'tone', meaning the 'character' of a particular instance of a sign, such as in a tone of voice.¹⁵ Kenning questions whether tone, or the way in which a diagram is drawn in a particular instance, might not just be of aesthetic interest but also contributes to the meaning and interpretation of a diagram. For example, a wobbly line might index the nervousness the maker of the diagram felt at the time of its making (Kenning

2021: 188). Therefore, the relevance of the ‘tone’, or the expressive qualities, of a diagram, may depend on the purpose of the diagram and whether the diagram-maker chooses to use the material qualities of a diagram to convey meaning. In certain contexts, focusing on the ‘tone’ of a diagram may allow us to discern meanings that we would miss if we ‘abstracted’ (or ignored) it.¹⁶

Furthermore, the aesthetic, formal and abstract qualities of af Klint’s works, for example their shapes and colours, connective lines and structures, can be said to attract our attention and engage our imagination. So, in the case of artistic diagrams, or diagrams that use artistic strategies such as gestural brushstrokes to convey their meaning, the moments in which we get ‘lost in the dream’ of abstract qualities may be fruitful moments which encourage contemplation and engagement with diagrams as representations of ideas. Artistic diagrams may incite fruitful transmissions between dream-like moments and ‘intellectual sympathy’ (as Peirce puts it) with the meanings that the artist is trying to convey, meanings whose full import may ultimately elude us.

The Tree of Knowledge

Another example of the use of annotations on af Klint’s diagrammatic works include those in the third work in *The Tree of Knowledge* series, a group of eight works made between 1913 and 1915. In the third drawing (Figure 2.4) a tree trunk is enclosed by a circle which is divided into three main sections, which are annotated ‘ether plane’, ‘astral plane’ and ‘mental plane’. These annotations have an indexical function, as they mark different sections of the circle and indicate what these parts mean, enabling us to distinguish between three conceptual realms within the plane of the drawing. The conceptual model of this part of the drawing aligns with Theosophical ideas about interconnecting but successively higher planes of existence (Henderson 2019: 79).

As in the *Primordial Chaos* series, images deriving from nature are used as symbols. Within the circle, there are two rows of lotus flowers, which are symbols of purity and are indicative of the influence of Hinduism and Buddhism on Theosophy (Lomas 2013: 232). The tree structure is present throughout most of the drawings in the series and reflects how trees have been used as a diagrammatic idiom in various religions, including Christianity, Buddhism and Hinduism.

Like the *Primordial Chaos* series, *The Tree of Knowledge* can be considered as a diagrammatic unit that charts stages of an unfolding process, namely, a state of innocence and balance which is followed by a bifurcation into male and female, the Fall from Grace, and finally the conception of a child (Fant 2021: 64). As such, the series connects Theosophical ideas with themes in the Christian biblical narrative.

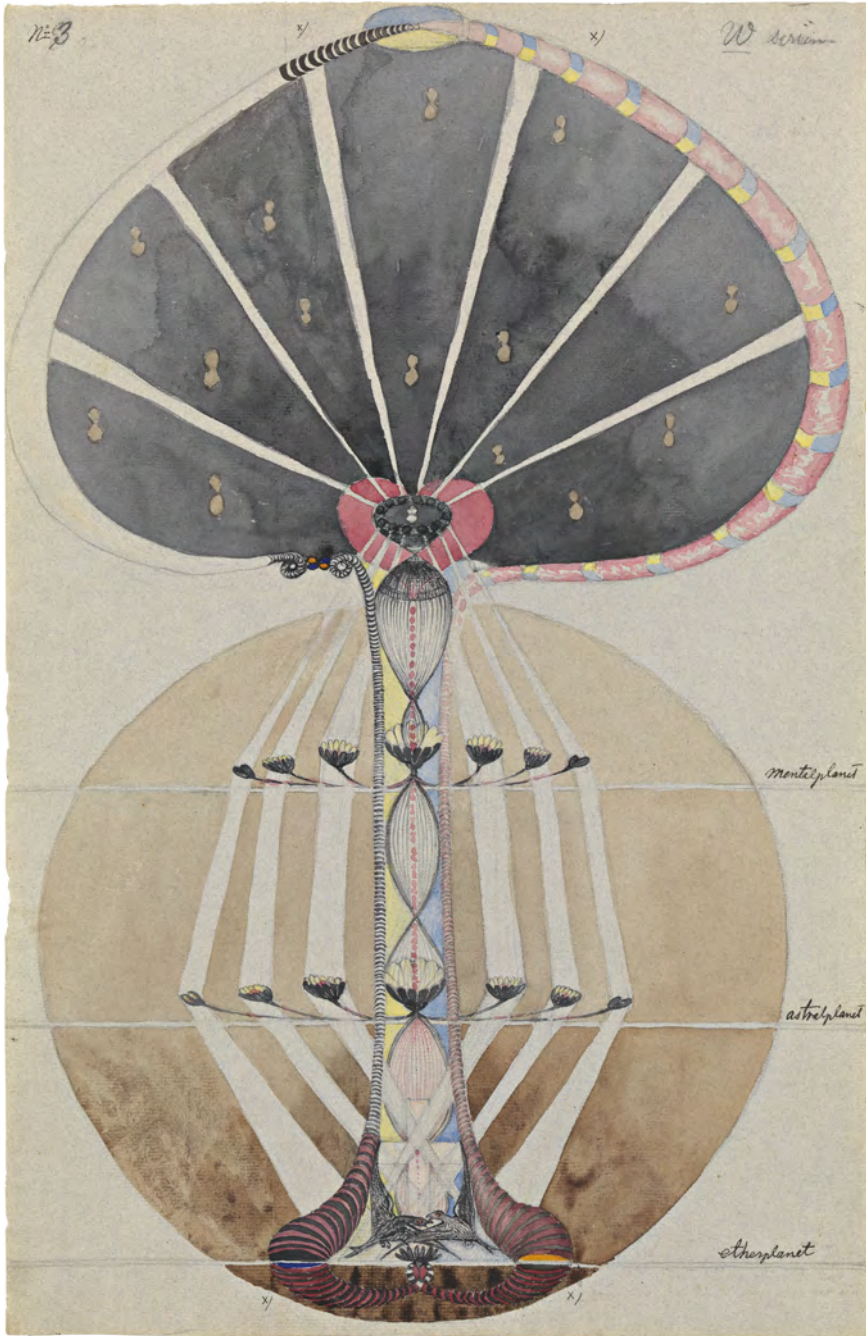


Figure 2.4 Hilma af Klint, *Tree of Knowledge, No. 3, The W Series*, 1913 – 1915. Courtesy of The Hilma af Klint Foundation. All rights reserved.

Diagrammatic and Meditative Practice

An example of a mixture of figuration, annotation and diagrammatic form can be seen in af Klint's *Violet Blossoms with Guidelines* (1919), in which observations of the external appearance of the natural world lead to speculations about the invisible spiritual world (Figure 2.5). The drawing depicts the appearances of plants as perceived by the eye and as they appear in the 'astral plane, a supra sensible realm described by Theosophy' (Lomas 2013: 223). This work may reflect the earlier-mentioned influences on esoteric practices of recent scientific discoveries of previously invisible realms of matter. This work also recalls the botanical drawings af Klint made early on in life. Naturalistic drawings of plants are juxtaposed with geometric forms: squares that are divided into four, some of which are filled with colour or particles that resemble seeds. The squares are annotated with the date of the drawing and the word 'guidelines', and they signify understandings of the plant's inner spiritual essences.

This work was made at a time when af Klint's working processes had become meditative rather than mediumistic. Steiner was critical of mediumistic practices as he perceived these as passive and entailing a loss of control (Müller-Westermann and Zander 2013: 125). He advocated what he saw as more active meditative practices as a means to reach higher knowledge. Indeed, David Adams suggests that works such as *Violet Blossoms with Guidelines* may have been influenced by Steiner's meditative exercises which involved observing the outer form of plants and imagining the unfolding of the inner forces which drive their growth and death (2020: 14–15). The plant's emotional or spiritual qualities are noted, for example joy, dissatisfaction, or willingness to sacrifice.

Violet Blossoms with Guidelines can be contrasted to the one hundred and forty-six botanical studies in the *Flowers, Mosses and Lichen* series, in which realistic drawings of the plant's outward appearance do not appear (Figure 2.6). The latter series contains diagrammatic features, such as the use of arrows to indicate direction of travel and, again, lettered geometric shapes that are divided into sections.

The *Flowers, Mosses and Lichen* series presents diagramming as a framework for a daily meditative and creative practice. Af Klint made about one drawing a day. The artist's methods may not be rational or scientific, but they do follow a self-determined system. Adams describes the three stages of af Klint's process. Firstly, the specimen's scientific name is recorded. Secondly, the plant's spiritual properties are schematized in squares or circles. Thirdly, there is a written description of the specimen's emotional, spiritual, or therapeutic qualities (Adams 2020: 14–15). As such, the drawings indicate a kind of subjective taxonomy, a naming, describing and classifying of plants according to the qualities af Klint ascribed to them.

In works such as *Flowers, Mosses and Lichen*, the practice of diagramming is intrinsic to a form of research, and the exploration and manifestation of ideas



Figure 2.5 Hilma af Klint, *Violet Blossoms with Guidelines, Series I, 1919*. Courtesy of The Hilma af Klint Foundation. All rights reserved.

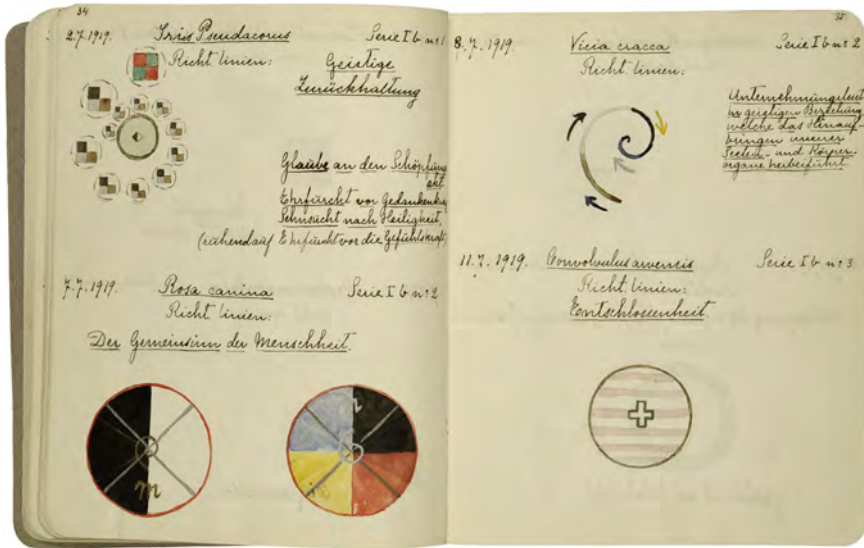


Figure 2.6 Hilma af Klint, *Flowers, Mosses and Lichen*, 1919. Courtesy of The Hilma af Klint Foundation. All rights reserved.

seem to take precedence over formal concerns. The art historian Gertrud Sandqvist draws a parallel between af Klint's working methods for this series to those adopted by conceptual artists, whose works are guided by ideas and processes. In *Sentences on Conceptual Art* (1968), the artist Sol LeWitt states that 'conceptual artists are mystics rather than rationalists. They leap to conclusions that logic cannot reach' and that 'irrational thoughts should be followed absolutely and logically' (Sandqvist 2020: 233). In this series, af Klint's working method similarly involves setting in motion an intuitive process for creating works that is followed through systematically. In af Klint's works, the diagramming of the perceived spiritual qualities of plants is a means to commune with the natural world. Diagrams become a kind of laboratory for exercises in observation, meditation, and the structuring of perceptions.

Conclusion: Fruitful Transmissions

Af Klint is an example of an artist creating diagrammatic works to visualize metaphysical realms, which had been an overlooked aspect of the abstraction in Modern Art. Indeed, it has been suggested that af Klint may not have considered the paintings discussed in this chapter as art in quite the same way in which they

have been considered since their rediscovery in the 1980s. Rather they were a means for af Klint to convey messages about the divine to those who were prepared for the spiritual calling (Almqvist 2023: 172). Peirce's theories unlock these readings of af Klint's works and help us approach the possible functions of her diagrams which may be known, in detail, only to her. Furthermore, Peirce's descriptions of the iconic, symbolic and indexical characteristics of signs can help us analyse how combinations of these characteristics can visualize ideas.

Although af Klint stated that her intention was to communicate a message about her spiritual beliefs, some of Klint's works are difficult to fully comprehend. Furthermore, Peirce writes that when looking at paintings or diagrams our 'reasonings' may be disrupted as we get lost in the 'pure dream' of what we observe. We may lose consciousness that a painting or a diagram is not 'the thing', and we may forget that it is actually a representation of a thing, a process, or an idea, etc. The viewer may leave their observer's position and enter the world of the diagram or painting, engaging in an immersive experience of its formal relations. Af Klint's works point to the potential for abstraction at the core of the diagrammatic to invite a wide range of cognitive and imaginative responses when specific and concrete details are removed or not fully understood.¹⁷ The cryptic nature of af Klint's works, combined with their heightened visual and gestural qualities, may encourage these kinds of engagements, disrupting the notion of diagrams as functional or didactic tools for thought.

The compositional and painterly qualities of af Klint's works reflect her training as an artist and demonstrate the expressive potential of diagrams. Af Klint's works amplify the visual language of diagrams with a rich and suggestive vocabulary that exceeds the functional display of information. These kinds of artistic diagrams highlight the potential for the expressive and material properties of a diagram to facilitate the communication of ideas. The gestural brushstrokes of *Primordial Chaos* convey impressions of energy and movement which contribute towards our understanding of the theme of cosmic creation at the centre of the works.

Artistic diagrams may sit in a distinctive in-between space. On the one hand, their diagrammatic form conveys the impression of an artist trying to transmit specific information, and we can try our best to unlock these meanings through interpretation and speculation. Yet their aesthetic qualities or ambiguous nature may invite appreciations of the formal qualities of their structural, geometric and linear relationships, or in af Klint's case, their rich imagery grounded in botanical and biological references. These responses may excite our curiosity and feed into interpretative responses of the meanings of the works. Artistic diagrams can invite fruitful transmissions between multiple of modes reception and perhaps this is why they are so intriguing.

Notes

- 1 For example, the title of af Klint's solo retrospective at the Moderna Museet in Sweden in 2013 was *Hilma af Klint – A Pioneer of Abstraction*.
- 2 The Five's use of automatic writing and drawing precedes its use by Surrealist artists, who similarly opted to cede elements of creative control, though they did so by playing with chance operations, nonsense verse, and dreams.
- 3 For a history of spiritualism, Theosophy and anthroposophy see 'There is no religion higher than truth' by Iris Müller-Westermann and Helmut Zander (2013). Zander explains that in relating biological concepts of evolution to culture and races Steiner made racist statements. Steiner also idealized a future state, in which differences of gender, culture and religion will disappear, and humanity will merge into one great spirit (Müller-Westermann and Zander 2013: 120).
- 4 Voss's list of the books in af Klint's collection includes a book by Besant on esoteric Christianity as well as two other religious texts by Besant and Leadbeater, though *Occult Chemistry* is not listed (2022: 316).
- 5 A footnote in *Occult Chemistry* explains that the drawings were made by Herr Hecker and Mrs. Kirby and with the research assistance of Mr Jinarjadâsa.
- 6 According to Peirce, the interpretant is itself a sign that can trigger yet more interpretants, creating a chain of semiosis.
- 7 Metaphors, which involve a kind of 'parallelism' found in something else, are the third type of icon in Peirce's triadic system.
- 8 For an essay on the central role of diagrams in Peirce's semiotics and ideas about reasoning processes see Stjernfelt (2000).
- 9 Everaert-Desmedt cites *Creativity and the Philosophy of C.S. Peirce* (1987) by Douglas R. Anderson who argues that an implicit theory of artistic creativity can be found in Peirce's body of thought.
- 10 The historian Hedvig Martin writes that although knowledge of the production of af Klint's work is limited, new research suggests that *The Paintings for the Temple* were made by af Klint with the assistance of several female friends. Martin argues that the *Primordial Chaos* series was created by af Klint in collaboration with the artist Anna Cassel (1860–1937), member of The Five and fellow student at the Swedish Royal Academy of Fine Arts (Martin 2023: 157, 161).
- 11 Af Klint's dualistic thinking can be contrasted to Peirce's metaphysical theory of synechism, which Peirce believed was a scientific philosophy that could play a part in the unification of science and religion. Synechism challenges dualistic thinking and assumes a tendency to regard everything as continuous. For example, Peirce argued that physical and mental phenomena are not entirely distinct and that some entities are 'more mental and spontaneous, others more material and regular'. Likewise, Peirce disputed the notion that being and not-being are entirely dualistic and instead held that 'being is a matter of more or less'. Peirce posited the existence of a 'spiritual consciousness' that might continue to exist after death (Peirce 1998c). However, Peirce was wary of the impact that religious dogma can have on scientific inquiry, and he doubted that any convincing evidence had so far been produced for the existence of ghosts or spirits.
- 12 An Archimedean spiral can be seen in *Spiral Jetty*, the earthwork sculpture made by the American artist Robert Smithson in 1970.

- 13 Examples of spiral walkways in sacred architecture include the Great Mosque of Samarra and the Abu Dulaf Mosque. Spiral motifs can be seen at the megalithic temples of Malta, amongst others.
- 14 Alpha and Omega are the first and last letters of the Greek alphabet and a biblical allusion to the idea of god as eternal.
- 15 Kenning is referencing a version of Peirce's text *Prolegomena to an Apology for Pragmaticism*, published in Volume 16 of *The Monist* in 1906.
- 16 I thank Chiara Ambrosio for comments which clarified this point. According to Ambrosio, the idea that the purpose behind a diagram may dictate whether the material qualities of a diagram are important for its interpretation is in keeping with an aspect of Peirce's philosophy of pragmatism, by which the meaning of a conception is inseparable from its practical consequences (personal correspondence, 2023).
- 17 I thank Sharon Morris for useful comments on this point.

3

COSMO-DIAGRAMS: BEYOND THE BUBBLE

David Burrows

Outside of time, the journey has & hasn't happened yet

In the liminal lies all the space-time needed to create

BLACK QUANTUM FUTURISM

Introduction: A Dying Star/a Bright Red Giant, London 2020/Betelgeuse 1320

There were no upsides to the lockdown but in response to the spread of the coronavirus, new perspectives emerged as many adopted a bubble-like existence eschewing physical contact. The virus was everywhere and invisible – everyone and everything a potential assassin to be kept at a distance. Exercise keeps you sane, or so they say. During the pandemic, a walk at night or early morning seemed safest, when the skies are dark, and all is silent and still. On every lockdown walk I looked at the stars when visible, and my thoughts jumped from the macroscopic and the microscopic to the interplanetary and the interstellar, and from there – through the little I know about astrophysics – to the cosmological, relativity, gravity, singularities and the quantum. How does the macroscopic scales of everyday life relate to the cosmological? This is the question I thought about on my lockdown walks in South London, and that this chapter addresses by attending to diagrammatic presentations by scientists and artists concerned with the cosmos or the cosmic, and that have made, to my mind at least, a significant contribution to the development of modern and contemporary diagrammatic practices. To this end, diagrammatic works are explored in this text as technical and aesthetic devices and as presentations that embody specific cosmologies. To help undertake this study, this chapter draws

upon and repurposes the concept of cosmotechnics, which has been defined by Yuk Hui as a term addressing technicity (Hui 2016 and 2021) and summarized by the writer in a foreword for a special edition of the journal *Angelaki*, in which Hui states:

I gave a preliminary definition of cosmotechnics as unification between the cosmic order and the moral order through technical activities, in order to suggest that technology should be re-situated in a broader reality, which enables it and also constrains it. The detachment of technology from such a reality has resulted from the desire to be universalizing and to become the ground of everything. Such a desire is made possible by the history of colonization, modernization and globalization, which [. . .] has given rise to a mono-technological culture in which modern technology becomes the principle productive force and largely determines the relation between human and non-human beings, human and cosmos, and nature and culture.

HUI 2020: 2

Hui's definition casts technological modernism as a dominating force that favours a European, Promethean narrative or myth. This narrative, in which humans develop knowledge that enables a domination of nature, is also presented as a story of mastery that divides humans from nature and the cosmos, with humans becoming masters over reality through scientific, technical activities. For Hui, technological modernism elides approaches to technology found in other societies, such as can be found in China, in which divisions between culture and nature, and human and cosmos do not emerge, at least in the same way. While the cosmopolitics of this are not addressed below, with Hui's criticism in mind, this chapter examines the work of modern and contemporary artists informed by physics but addressing a relation of cosmic and moral orders through their technical and aesthetic activities. Specifically, the chapter examines these activities, named here as *cosmo-diagramming*, by addressing the ways in which they present the cosmos as the ground of everything, as opposed to presenting humans and their technical devices as primary agents producing reality. Here, it needs stating that the cosmo-diagramming of artists examined in this chapter adds cosmotechnic perspective to scientific technical activities and concepts; artists may present alternatives to narratives which separate moral and cosmic orders, but they do not deny scientific knowledge or theories. This study then, necessarily requires attending to the ideas and diagrams of physicists, which leads to a second question: are there any physicists that share not only aesthetic approaches but similar cosmotechnic orientations with artists, pointing to a cosmo-diagramming that spans art and science? Examples of this are not so easy to find, and the chapter addresses why this might be a difficult orientation for modern physicists to take

up, without questioning the importance or, indeed, the innovation and creativity of the diagrammatic practices of physicists.

If differences emerge between the diagramming practices examined below, it undoubtedly relates to the question of how to order (or diagram) or understand the relations of macrocosms and microcosms, and quantum and bulk levels of reality. At the height of the pandemic, the microscopic greatly influenced the macroscopic and moral orders, arresting the daily life, customs and politics of many societies. In general, the microscopic has great importance for a common understanding of hygiene, causes of illness and ecologies supporting human societies; whereas the sciences concerned with cosmology, spacetime and the quantum do not seem to touch everyday existence much at all. Or rather, contemplation of the stars or the quantum realm can create a distance from Earthly affairs, or even lead to a romantic colonization of outer space or spacetime as a new *terra nullis* – an escape and refuge from the problems of everyday life. But there is nothing wrong in gazing at stars. The night sky offers off-world perspectives for the imagination to play with, as alternative viewpoints to perspectives calibrated by Earthly concerns. This would be a function of cosmo-diagramming, to attend to cosmic orders, to question or make precarious, human habits and common-sense notions of reality. And this relates to the third question of this chapter: how to integrate the cosmic and cosmological with everyday life and give the cosmic realm significance within a society's moral orders?

As I gazed at the heavens on my lockdown walks, I thought about whether this would mean the creation of new myths or calling on ancient divinities. Thanks to my lockdown walks, I can now recognize the pink glow of the god of war Mars, and the pinpricks of light that signal Jupiter and Saturn are in the night sky, which are the gods of the sky and time respectively. I have seen Venus, goddess of love, low on the horizon, and once and very early in the morning, I saw what I thought to be the messenger Mercury. I am familiar too with Polaris and Sirius the Dog Star, and the constellation of Orion the Hunter. He is a constant companion, and the red star Betelgeuse – the hunter's shoulder – is the gas ball I always look for first. And I was not the only one looking at Betelgeuse during the pandemic. Not long ago, this once bright star dimmed considerably, and astronomers wondered if the star was about to explode. If it was, it had probably already exploded, as the red-tinged light from the star takes about 700 light years to reach our planet. There was no need to worry though. The star made a comeback. Betelgeuse increased in brightness and astronomers suggest a gas cloud is passing (or passed about 700 light years ago) across the star, explaining why Betelgeuse faded and then grew brighter. This is what I try to imagine as I take a lockdown walk in November 2020: a diagram of a storm of particles passing across the sightline between the Earth orbiting the Sun and Betelgeuse.

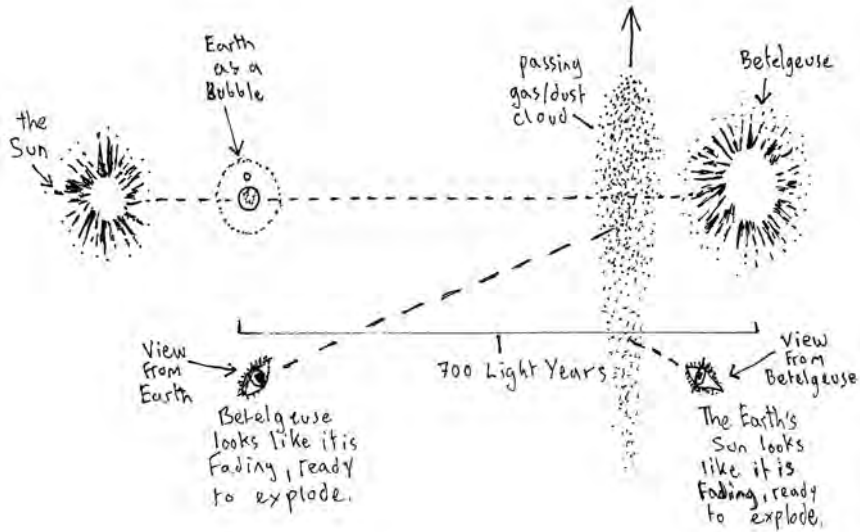


Figure 3.1 Diagram of sightline between Earth and Betelgeuse [David Burrows].

To relieve the monotony of an online meeting, I drew this diagram and tried to understand my relation to the dust cloud, relying on what little I know of relativity and other theories concerning spacetime (see Figure 3.1). When would a human living in the orbit of Betelgeuse have seen our Sun fade behind a dust haze? 700 hundred light years ago? I draw a gaseous dust cloud as a series of dots, as small as I can make them. The cloud is intersected by a line connecting our Sun and Betelgeuse, joining one star, one perspective, with another (I forgot that spacetime is curved, but would struggle to depict this anyway). Is one star ahead or behind the other? By the end of the meeting, any concept of time seems not meaningless so much as complex, questionable. And here it is possible to further qualify the function of cosmo-diagramming: it is a technology presenting cosmic orders, which troubles a sense or concept of universal or linear time and the idea of humans as principle productive agents operating in a dimension of absolute time.

(How Long is) a Piece of String? Cape Town 2019

Drawing the Earth and Betelgeuse as two perspective points affects my sense of spacetime. The present – what is referred to as ‘now’ – seems doubled. For

there are now two 'nows' (a 'now' here on Earth and a 'now' that is far away), which doesn't make sense, as the present (my 'now') seems real enough. But I look at the sky at night and 'now' seems a precarious concept. My diagram reminds me of an analogy that astrophysicist Carlo Rovelli, author of *The Order of Time* (2019a), uses to question the concept of linear time or the idea that there is a past, present and future. In a lecture, captured on film, and posted on YouTube, Rovelli ties a red cord across a stage. This is a diagram – he calls the cord a metaphor – presented as an analogy for time, with one end being the future, the other the past, and the present indicated by a piece of string loosely knotted around the cord, so that it can move along the timeline. This is a model of absolute time, as a universal timeline travelling in one direction – a common notion that Rovelli states is false (2019b).

After explaining his metaphor (his diagram), Rovelli declares gravity slows down time. To test this, go interstellar-travelling and spend ten minutes near a black hole where gravity increases as mass collapses and a zone is created from which light cannot escape. After your brief sojourn to a singularity, return home and you will find a century has passed on Earth while you were hanging out near the collapsed star. Even on Earth, moving between the ground and the exosphere means time slows or speeds up. A universal timeline looks a poor, one-speed-only model of time.

Rovelli acknowledges that we appear to grow older (not younger) and that time seems to travel in one direction, like an arrow, from the present to the future, leaving the past behind. In the world according to 'the grammar of physics', time makes no sense though (2019b). A clue that helps us understand this conundrum is that in every past and future distinction there is entropy at work – there is the mechanical movement of atoms at different speeds until they average out in concentration and heat. As humans in daily life do not look closely at what atoms are up to when they average out, an illusion forms, which is punctured (for physicists) when atomic or quantum detail is attended to. That is, human perception of entropy is registered as an illusion of time flowing from past to future, which, in his book *The Order of Time*, Rovelli suggests is 'a possible perspective effect for particular subsystems' (2019a: 136); that is, an effect of human motor-sensory processes.

It is not just the idea of a flow of time that Rovelli challenges. The physicist is not shy about declaring there is no shared present moment (2019b). Light travels, even from people or things seen close by, and therefore people and things are always viewed as they were a few nano-seconds ago (human senses just cannot register this). Travel far away, as far as Betelgeuse (Rovelli chooses Andromeda), and the concept of 'now' means nothing except, perhaps, as a term indicating what is seen from a specific perspective. Send a message from Earth to Betelgeuse and, according to Rovelli's thinking, a kind of 'super-extended present' is produced as an interval between transmission and reception

of the message (2019b). It is for this reason that the ‘present moments’ of two, distant perspectives (two stars) never coincide. As Rovelli claims, neither perspective is past or future. Time is relative, not absolute. Rovelli’s conclusion: ‘Now is a bubble that surrounds us’ (2019b).

I imagine a diagram of the ‘bubble of the now’ as an environment-adapting sensory production, as a wrap-around screen with surround sound speakers. Through my senses and various technologies, my own bubble extends as far as I can see and hear and therefore it intersects with other people’s bubbles, producing differences of perspective that are so slight that latency issues never arise. Rovelli asks, from the perspective of physics, how to explain human attachment to the illusion of time. Human limitations, as implied above, explain much. As Rovelli states though, this does not explain why time is felt as flowing. His answer is, it is the brain – it is experience – that gives humans a sense of time flowing. Quoting Dean Buonomano’s book on neuroscience, physics and time (Buonomano 2017), Rovelli states, ‘your brain is a time machine’ (Rovelli 2019b).

This knowledge does not stop Rovelli checking his watch throughout his talk, and he does not dismiss time: ‘we are in time’ he says, and ‘we know we are all going to die’ and ‘time as emotional aspect of human life is key’ (2019b). Still his conviction that, in reality, time does not flow is unshaken. At the end of his lecture Rovelli is asked, what are the practical applications of understanding the relation between emotional time (or experience of time) and the reality that there is no time? Rovelli can think of none beyond vague possibilities, which he does not identify. And in his book *The Order of Time*, Rovelli alludes to the emergence of life and evolution that is particular and relative ‘to a few billion years ago’, producing a sense of time ‘determined by the interactions that a physical system has with the rest of the world’, and that, ‘a study of time does nothing but return us to our selves’ (Rovelli 2019a: 147). Rovelli offers no relation between cosmic and moral orders, or cosmic orders and everyday, human existence.

Looking again at my lockdown diagram, I think a relation can be made between emotional (or experiential) and moral registers and the ‘grammar of physics’, produced by sensing that one way of comprehending reality is to explore the relation of multiple perspectives across different systems, scales and distances. Whether time exists is not the focus of this chapter, though towards the end of this text, various practices are examined that offer a different concept of temporality to absolute time critiqued by Rovelli. Rather, the focus is on how cosmo-diagramming spacetime has cosmotechnic potential. To this end, the rest of this chapter examines twentieth and twenty-first-century diagrammatic art influenced by physics, in which a relation of cosmic and moral orders and emotional life is articulated, exploring too the diagrams of scientists that share aesthetic and diagrammatic approaches with artists.

A Manifesto for Cosmic Art, Paris 1936

How did physics influence modern art? There is not one but many stars in this constellation of narratives but perhaps there is one big bang moment too. By the 1920s, Albert Einstein's theories of General and Special Relativity are central to physics and beginning to be known by lay-publics. After the Second World War and by the 1960s, the scientist's theories are increasingly important to cosmological research and have transformed concepts of reality – space and time are not separate or absolute dimensions but components of a four-dimensional, manifold universe. This post-Newtonian model of the universe is discussed beyond the circles of physicists and for some twentieth-century artists, Einstein's conceptions of reality herald new possibilities for art. It is the contention of this chapter that a number of practices developed abstract art as a diagrammatic rendering or presentation of spacetime rather than as a formalist exploration of mediums. This diagrammatic approach signals something like a cosmological consciousness which perhaps the *Dimensionist Manifesto*, published by Charles Sirató, is a key example. The manifesto states: 'We must accept—contrary to the classical conception—that Space and Time are no longer separate categories, but rather that they are related dimensions in the sense of the non-Euclidean conception, and thus all the old limits and boundaries of the arts disappear' (Sirató 1936: n.p.). A bubble is burst.

Signatories endorsing the manifesto include Hans Arp, Francis Picabia, Wassily Kandinsky, Marcel Duchamp, Camille Bryen, Sonia Delaunay and Sophie Taeuber-Arp, as well as artists from Tbilisi, New York and Santiago de Chile. The manifesto states, this pursuit of the four-dimensional leads to painting leaving the two-dimensional plane to enter space, and to sculpture embracing movement. In this, elements in a composition are presented as analogous to the relations of physical phenomena: 'And after this a completely new art form will develop: Cosmic Art' (Sirató 1936: n.p.).

A Mobile (Universe), New York 1937 and New York 1959–63

With grace and surprising speed, a red circle glides through the air around a three-legged cone, which sets two other shapes – a yellow teardrop and green boomerang – in motion. This untitled artwork (1937) was chosen as the poster image for the Tate Modern's 2015 survey of Alexander Calder's work; it is an image that could also serve as a poster image for Sirató's manifesto. The untitled artwork is a sculpture that encompasses movement, and it should be no surprise that Calder, who is known for making mobiles of brightly coloured abstract

shapes, endorsed the *Dimensionist Manifesto*. Playful in appearance, the untitled sculpture of 1937, like the artist's other mobiles, reflects Calder's interest in cosmology, which is fuelled by his insights into the theories of physics. In an essay on Calder, Vanja V. Malloy addresses how the artist gained mathematical knowledge when training as an engineer and developed an understanding of Einstein's theories (Malloy 2012: 6). Although a childhood encounter with an orrery is cited by the artist as a formative experience and important influence on his later work, it would seem Calder was not just engaged with classical physics. As an advocate of the *Dimensionist Manifesto*, the artist developed a non-Euclidean, abstract art that presented models of spacetime informed by twentieth-century physics. There is some correspondence here with an account Calder once gave of seeing the Sun and Moon set in the same sky when sailing, an experience that engendered an embodied understanding of the Solar System. This account is re-narrated by Malloy as a decentering, in which Calder, after processing what he sees, understands that he occupies a mobile perspective point registering the mobility of the Solar System and curvature of space, which Malloy further suggests is a phenomenological approach to understanding the cosmological (Malloy: 8). Calder presents spacetime or 'universes' as a series of bodies constantly moving in relation to each other, and Malloy implies that Calder's mobiles are analogous to celestial bodies held



Figure 3.2 Diagram of a mobile by Calder.

together by gravitational effects – ‘universes’ being the term the artist used to refer to his mobiles (which legend has it, was the name Marcel Duchamp suggested for Calder’s kinetic works). Indeed, Calder’s mobiles are diagrams of what escapes everyday observation: humans live in a universe of mobility in which different masses – including their own bodies – affect each other (see Figure 3.2).

To encounter a large mobile by Calder, such as *Triumphant Red* (1959–63), is to play a part in the mobile’s slow and gentle turning in space, for the movement of a spectator’s body, along with drafts and eddies of air in the room, influence the motion of one or many parts of the sculpture or, indeed, the assemblage as a whole. Of course, the assemblage as a system holds its integrity. The mobile consists of fifteen shapes cut from sheet metal, which are joined together with wire and suspended from a ceiling. One red element stands out amongst nineteen black silhouettes of varying sizes and is analogous to a sun amongst orbiting planets and moons, or to a nucleus of an atom and its circling electrons. The balance and counterbalance of the sculpture is a technical marvel of hand-crafted engineering, and it is the mobile’s ever-changing composition that makes the space described by Calder’s mobile seem incompatible with Euclidean geometry and space. It is this aspect of Calder’s work that Malloy relates to Einstein’s theories.

As *Triumphant Red* turns, the space occupied by a viewer can be encroached upon and occupied by the mobile’s advancing elements. That is, the space occupied by the mobile can be larger than first assumed and revealed as the sculpture sweeps through space, accelerated or arrested by eddies created by a viewer’s moving body. As Malloy writes, Calder’s mobiles present – and I suggest diagram – a mobile universe related to theories concerning a constantly expanding cosmos (Malloy 2012: 17). Here we might agree with Malloy’s conclusion that ‘Calder’s artwork need no longer be limited to Formalist readings but may be recontextualized within Einsteinian physics’ (Malloy 2012: 18), except that Calder cannot be said to be practicing physics. Calder’s work remains, at all times, non-utilitarian and playful. What then are the functions of Calder’s work? The artist’s mobiles, as compositions analogous to universes of suns and planets or atoms or particles, enable humans to imagine or register perspectives beyond human experience of spacetime. For a mobile can be affected through being viewed and a viewer can occupy the space in which a mobile may turn, entailing having to move to avoid a collision with the artwork. Through such experiences, a viewer of Calder’s mobiles (his ‘universes’) can imagine or register how they might be implicated in or affected by cosmic relations, as one cosmic body among others. As the chapter will show, Calder is not alone in tapping embodied knowledge to produce understanding of what is beyond human experience. Others too have developed abstract forms for similar but also different ends.

A Figure (that is Not a Number), Pennsylvania 1948

It is legend that Richard Feynman, at the end of a long day at a conference at Pocono Inn in Pennsylvania in 1948, upset and frustrated many physicists attending the event (including Niels Bohr) by presenting diagrams of particles rather than equations or numerical formula. This was not the first time the physicist had created confusion through demonstrating calculation through diagrams rather than numbers. Feynman's figures were first presented a year before the Pocono conference at a meeting on Shelter Island in June 1947, where fellow scientists also struggled to understand the physicist's drawings. Feynman's Pocono Inn presentation followed Julian Schwinger's long paper concerned with the complexities of mathematical calculations addressing Quantum Electrodynamics, which addresses how similar charges repel each other and how opposite charges attract each other at the quantum level (Feynman's own field of study). Specifically, as David Kaiser explains, Feynman and others were engaged in trying to understand how particles exchange photons – the carriers of electromagnetic forces; a process concerning photons that are considered virtual as they 'borrow' and quickly 'payback' energy from a vacuum and then disappear (Kaiser 2005: 157). As Kaiser explains, a problem is that there is no limit to how much energy can be borrowed if it is given back quickly enough, and this leads to infinite rather than finite quantities; that is, it leads to uncertainty showing up in equations which require finite rather than infinite quantities. This problem, coupled with the complexity of needing to track and account for every exchange, makes mathematical calculation of Quantum Electrodynamics a cumbersome task, as demonstrated by Schwinger who also found fellow physicists struggled to follow his presentation at the Pocono Inn.

Unlike Schwinger, Feynman presented figures representing particles and their movements of attraction and repulsion by drawing lines on a blackboard, which were later published as graphic diagrams. That his presentation did not go well may relate to the doubts Feynman's fellow physicists had about the possibility of picturing the behaviour of particles. According to Feynman though, the physicist himself deserves all the blame for the failure of his presentation, admitting he was tired and nervous and that he gave a chaotic account of his figures (Feynman and Weiner 1968: n.p.). What Feynman suggests is that his diagrams, which were later taken up by physicists and transformed his discipline, were challenged by conference attendees demanding to know the rules of his diagrams, which Feynman could not provide. As he explains, 'One of the troubles was that all my thinking was physical, and as I told you, I did everything by cut and try. So I didn't have a mathematical scheme' (Feynman and Weiner 1968: n.p.). In fact, Feynman did have a mathematical scheme of sorts, but he could only demonstrate this by

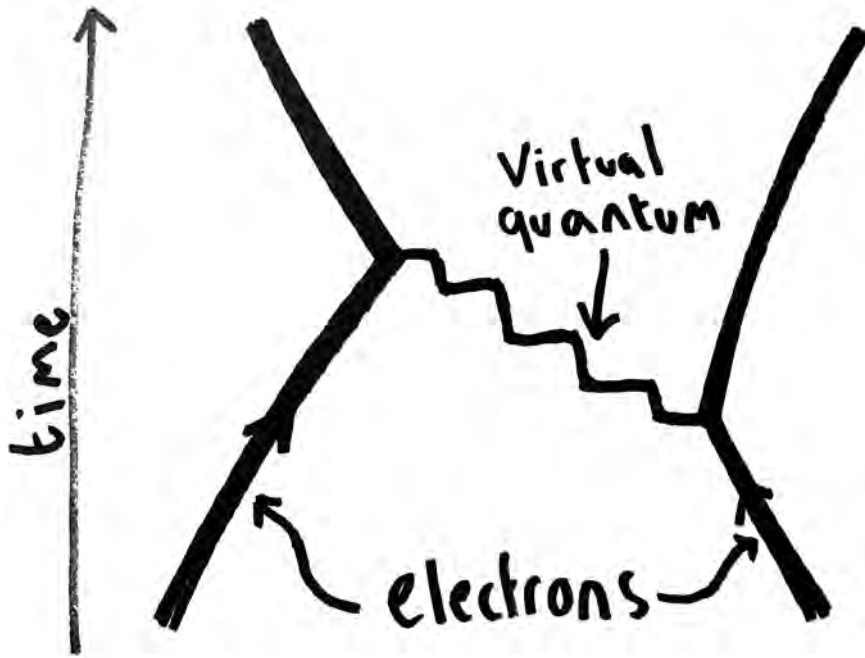


Figure 3.3 Basic Structure of a Feynman Diagram [David Burrows].

drawing the diagrams, which produced the right answers. As Kaiser explains, what made Feynman's method significant was that he was able, through novel calculation processes performed when diagramming, to remove infinities (a procedure termed 'renormalization'). Feynman's diagrams start as a 'mnemonic aid in order to write down the relevant integrals' of particles that, in quantum mechanics, have multiple rather than single trajectories, and then later the diagrams become a tool to alter integrals, 'one at a time, to remove the infinities', solving a 'long-standing puzzle that had stymied the world's best theoretical physicists for years' (Kaiser 2005: 160). As Kaiser argues, this function of Feynman's diagrams is grasped by fellow physicist Freeman Dyson who publishes a set of rules for his colleague's figures, popularizing the schemas even before Feynman himself publishes an explanation of his diagrammatic tools.

Feynman's diagrams are difficult for the non-physicist to understand and consist of interconnected straight and undulating lines or vectors that mark the movement of two different particles and their exchanges of virtual photons. The diagrams are drawn in two dimensions – space and time – with an arrow pointing upwards marking a direction for time (see Figure 3.3). This may seem like Feynman has introduced the 'arrow of time' (a concept ridiculed by Rovelli) at the

quantum level. This is not the case. The common practice of marking a direction for time in the diagrams of physicists allows, in this case, for an understanding of how particles may appear to travel forwards and backwards in the direction of time; that is, their movements can be reversible. Feynman's diagrams aid calculation and bookmarking of these processes, assisting a tracking of the amplitude of particle trajectories and exchanges. The diagrams assist counting and normalizing processes. If the scientist's figures are an abstraction of mobility, are there analogous and phenomenological aspects to Feynman's diagrams, similar to Calder's mobiles? If there are (unacknowledged) phenomenological, embodied or analogous aspects to the scientist's figures and processes, they are revealed through Feynman's reflection on how his figures were developed. Feynman states that when working on electrodynamics and visualizing time and space, his diagrams did not assist him in seeing physical relations and processes, but then he adds, 'I was seeing something in time and space' (Feynman and Weiner 1968: n.p). Does seeing something in time and space, through a diagrammatic imaginary or imaging, entail making an analogy between things visible to the senses and particles invisible to the eye?¹ While again there does seem to be an affinity here with Calder's work, the eye that 'sees something' in Feynman's account of his development of his figures is without a body – the body is bracketed out of his investigation of quantum phenomenon (for obvious reasons). This eye without a body scouting the behaviour of particles – conjured by Feynman's diagrammatic presentation – is a technology that affords mastery from a disembodied vantage point. The physicists at the Pocono conference didn't need to worry then; Feynman's diagrams were always intended as tools of mathematical, techno-scientific modernism – of counting rather than seeing.

Perhaps though, visualizing Quantum Electrodynamics processes – seeing something – makes it easier to calculate exchanges between particles, and this explains the success of Feynman's figures. As Kaiser remarks, physicists eventually found a wide use for the scientist's figures (Kaiser 2005: 164). What might be important about Feynman's diagrams is that, unlike equations, they engender something impossible (to see what cannot be seen in spacetime, viewed as if from outside of spacetime). Here, a difference between the scientist and Calder hinges on the part a body or embodiment plays in diagrammatic processes. As implied above, this part is elided in Feynman's diagrams when considering the function and use of the figures – of how the diagrams are put to work – which is not to be critical of the scientist, just to identify him again with a scientific-technological modernism in which the phenomenological is cast as limiting. Here the asymmetry of Calder and Feynman becomes clear, which can be further explored through attending to the work of other artists and scientists concerned with cosmic orders.

A Polka Dot and Infinity Nets, New York 1978 and New York 1959

In the much-quoted novel *Manhattan Suicide Addict* written by artist Yayoi Kusama, cosmological themes are cited and a human is equated with a polka dot which is further compared with the Sun and the Earth's Moon and atomic particles; a human is described as one among billions of particles, implying that the book's protagonist, and you and I, are dots made of dots that make up a universe of dots (Kusama 1978). Kusama's comparisons of particles, humans, and the Sun and Moon with polka dots are now well known; as is the artist's practice of covering surfaces – canvases, clothes, skin, horses, furniture and even whole rooms – with dots to make the boundaries between things obscure and uncertain. Equally well-known are Kusama's diagrammatic Infinity Nets, which is the name the artist gives to her paintings that were made soon after the artist arrived in New York from Japan in 1958. An example of such a painting is *No. F* (1959), which consists of a web of white paint on a grey-blue ground, creating a field of mid-tone dots. The white paint is applied through repetitive gestures that build an impasto surface, leaving small dots of grey-blue visible, giving the painting an appearance of foam – a field of bubbles. The painting offers a game of figure and ground reversal: (depending on what is seen) one colour (white) reads as a web in front of another colour (grey-blue) that reads as a void;



Figure 3.4 Diagram of a function of an *Infinity Room* by Yayoi Kusama (room of mirrored walls and hanging lights), overlaid with stars, planets, raindrops and molecules, [David Burrows].

or, alternatively, dots of one colour (grey-blue) sit in another colour (white). Similarly, in other artworks – sculptures, performances, installations, mirrored boxes and (infinity) rooms – Kusama’s polka dot productions serve the same diagrammatic function: to create a field of infinite dots that make figure and ground relations ambiguous or collapse entirely. Disorientation occurs through viewing this repeated symbol – the polka dot – that implies a shifting scale between the planetary and the atomic. In this, Kusama’s abstract works engage and affect the viewer’s body and sense of space, and her work bears comparison with Calder’s sculptures (rather than Feynman’s figures). Kusama famously concerned herself with making works engendering obliteration and self-obliteration, her polka dots flit between positive marks (they are something) and negative space (they are nothing). And if there is a difference between Kusama’s presentations and Calder’s suspended shapes (which remain positive if mobile figures), it is because Kusama’s affirmation of the cosmos as the ground of everything is through registering the universe as compositions of elements in flux.²

Much has been made of Kusama’s illness and hallucinations, which the artist herself has said are the source of the polka dot delirium explored in Kusama’s work. Much too has been made of Kusama’s obsessional production that includes the covering of surfaces with phalli, to confront her fear of penetration and sex, all of which the artist explains in her autobiography *Infinity Net* (Kusama 2013). Less has been written about how Kusama’s art draws on cosmological themes and produces images that engender uncertainty concerning what is present and, as Yuko Hasegawa writes, what is internal and external (2006: 47). To lend weight to this observation, Hasegawa quotes from another of Kusama’s semiautobiographical novels, *Sumire Kyohaku (Violet Obsession)* (Kusama 1998) pointing out that:

Kusama’s protagonist expresses gratitude for the physiological suffering she experiences: ‘There are ten billion bubbles inside my body. Which is precisely why I feel at one with the ten billion stars that twinkle in the heavens, and why I talk to the clouds made up of ten billion tiny drops of water, and why I hear the voice of the wind carrying ten billion atoms.’

KUSAMA quoted in HASEGAWA 2006: 48

Kusama’s practice collapses a ‘bubble of the now’ through registering a multiplicity of stars, raindrops and atoms as a cosmos that is analogous to the billion ‘bubbles’ that make up a human (see Figure 3.4). This may seem an intense, simplified and almost gauche poetic image when compared to the calculations of physics, but are these analogies connecting cosmic and human realities – humans as a bubbles or dots in a universe of bubbles and dots – representative of thinking exhibited only by artists, or do some scientists share similar thoughts?

An Eye on the Letter U (that sees Quantum Foam), Texas 1978

An image of a human eye perched on the top of the left prong of the letter U is perhaps John Wheeler's most famous diagram, published in 'Beyond the Black Hole' (Wheeler 1978: 362). The letter U in the diagram represents the universe, and the astrophysicist described this figure, topped by an eye, as a self-excited circuit. The eye emerges out of the universe it is gazing at, but it is a special 'dot' (to borrow a term from Kusama). In Wheeler's diagram, the human eye perched on the arm of the letter U marks the point where the universe becomes conscious of itself, which also marks or separates the human (eye) out from the rest of the cosmos: it is a special dot among all the other dots (stars, planets, animals and plants, atoms and particles), marking a difference with Kusama, for there are no privileged polka dots in her universe. Wheeler's human eye can see across spacetime and into atoms, grasping cosmic relations as it attempts to see (or rather diagram) all the dots of the universe, whatever their size. The power of this human eye is that it can see the universe from a point outside the cosmos: it sees from a third person and God's eye perspective (even though Wheeler notes how, in quantum theory, observation of reality effects or produces that reality). It is the case then, Wheeler's diagrams mostly offer disembodied, objective perspectives for obvious reasons – to assist and explain the work of the scientist.

Wheeler does acknowledge that there are domains where this special eye cannot see though, specifically black holes, where time and space and the laws of nature are uncertain or collapse. Wheeler's engagement with black holes through quantum theory and physics involves not only mathematical calculation but imaginary investigations of phenomenon, often presented through images analogous to human experience of the sensible world. An example is found in his book *Geons, Black Holes and Quantum Foam*:

On our imaginary downward voyage to ever smaller domains, after reaching the size of a single proton, we would have to go twenty powers of 10 further to reach the Planck length. Only then would the glassy smooth spacetime of the atomic and particle worlds give way to the roiling chaos of weird spacetime geometries. The wormhole would be but one simple manifestation of the distortions that could occur. So great would be the fluctuations that there would literally be no left and right, no before and no after. Ordinary ideas of length would disappear. Ordinary ideas of time would evaporate. I can think of no better name than quantum foam for this state of affairs.

WHEELER 2000: 352–3

For Wheeler, the universe, at the quantum level, is made up of bubbles. To help the reader understand this, Wheeler reproduces part of a diagram of Quantum

Foam – literally, a series of drawings of foam – that appears on a page in the book *Black Holes and Time Warps* by fellow physicist Kip Thorne (1994: 478). This borrowed picture of frothiness illustrates the idea of Quantum Foam as formless and aids imaginary investigation of the quantum, particularly for the non-physicist, which seems important to Wheeler. In conversation with Kenneth Ford, Wheeler states: ‘I have the feeling that an idea is not a good idea unless it lends itself to be stated in a nice compelling picture [. . .]. I would be happy if the whole of physics could be expressed in the form of simple attractive diagrams’ (Wheeler and Ford 1994: n.p.).

An affinity between the astrophysicist and artists mentioned above might be found here – not just in Wheeler’s pursuit of images but through Wheeler’s complex reflections on the relation of humans to the cosmos; however, as suggested above, in Wheeler’s diagram of the universe as an excited circuit, humans mark a point inside the cosmos from which the whole universe may be seen. The power of Wheeler’s special eye comes from being a disembodied orb that can move faster than light and where the body cannot (even if embodiment is called upon in Wheeler’s narratives). This special eye is, as Hui might say, ‘universalizing’, and ‘the ground of everything’ (Hui 2020: 2). However, it would be ridiculous and wrong to argue that Wheeler’s figures are somehow representative of all that is troublesome about modernism, and that they are representative of the sciences in general. The answer to the question about whether Wheeler shares, through diagramming, a cosmotechnic orientation with Calder and Kusama is, not surprisingly, no, or at least not quite. There is a difference. To paraphrase Yuk Hui’s statement cited in this chapter’s introduction: Wheeler, for all his imagination, is a physicist who works in a field that aims to unify cosmic and mathematical orders through technical activities (even when mathematics reveals a domain – black holes – where mathematics fails).

Having addressed the question of whether and how scientists may share an orientation with artists, what about the other way round? Is there an artist that aims at unifying the practices and concepts of art and physics for scientific and artistic (and cosmotechnic) ends?

A Time Base Spectrum/a Residency in Flat Time House, 01–10/London 2021

The diagrammatic artworks and texts of John Latham promote the idea that time (rather than space) is fundamental to the reality of a universe of structured events. Latham’s commitment to exploring time, and the artist’s view that society needs to engage with the theories of physics, became clear to me during a residency at Flat Time House which I took part in as a member of the Diagram Research

Group in 2020. During the height of the pandemic, I searched for cosmological terms in the John Latham Archives hosted by Flat Time House, based in Latham's former studio and home in South London. My search helped me grasp Latham's figure '0I-I0' and its related term 'Least Event', which appears in many of the artist's texts. Although at first glance, the figure 0I-I0 looks like an equation, it can be read as a diagram of Latham's notion of the Least Event becoming extended – that is, of something emerging and continuing to exist in spacetime with no discernible cause – which is explained in Latham's text influenced by his reading of the theories of Quantum Mechanics titled, 'Consideration of One Least Event Universe' (Latham 1993). An example of the Least Event is the counting of a single proton, which Latham calls 'one extended state' and 'a proto-universe'. The emergence of the Least Event is written as '0I' (zero and one); '0' representing a non-extended state (Wheeler's quantum foam) and 'I' representing the extension of an event, '0I' pointing to a state 'between the quantum and the least event' (n.p.). At the other end of Latham's figure, 'I0' represents an event returning to a non-extended state. It follows that if 0I-I0 refers to our universe, '0I' is the 'birth' of the cosmos, the hyphen (in the middle part, 'I-I') denotes the duration of the universe, with 'I0' marking its 'end'. Somewhere along the hyphen, humans emerge and develop physics but as will be discussed below, Latham does not view this event exactly as Wheeler does.

To understand this, it is helpful to attend to another of Latham's diagrams, the *Time Base Spectrum* (n.d.), which is held in Latham's archive and described by the artist as a score. The Spectrum marks out Latham's various cosmological terms through letters 'A to Z', which run in a line, left to right, and correspond to 0I-I0. Halfway along the Spectrum, 'M' marks a point in which the impulse of extension produces a universe with 'U' marking the end of the universe as it returns to a state of non-extension. These complex diagrams and theories convey Latham's ambition to produce work that is scientifically significant. More than this, in letters and texts, Latham suggests that art rather than the sciences has developed the means – 'the envelope' – to present the event structure of the universe. Importantly, for Latham, art provides a visual rather than mathematical presentation of the universe and reality, and here we might think of Wheeler's statement, 'I would be happy if the whole of physics could be expressed in the form of simple attractive diagrams' (Wheeler and Ford 1994: n.p.). Again, there are differences between the approaches of a scientist and an artist though. It seems, Latham's diagrams aid reflection on existence and duration, for 0I-I0 and the *Time-Based Spectrum* might be read as referring to the universe but also to the duration of elements of the cosmos, including humans, stars and galaxies, all of which will return to a state of non-extension.

Latham has more to say about the emergence of humanity within the universe, suggesting that three types of humans appear in the cosmos – 1. the non-reflective individual propelled by hunger and desire, 2. the rationalist, and 3. the

reflexive, intuitive individual – all of which are marked in Latham's Spectrum. It may seem that Latham engages in something like a cosmic teleology, similar to that proposed by Wheeler (see Figure 3.5), in that point M of the Spectrum marks the 'time-base of a specious present', Q marks the 'boundary of reason

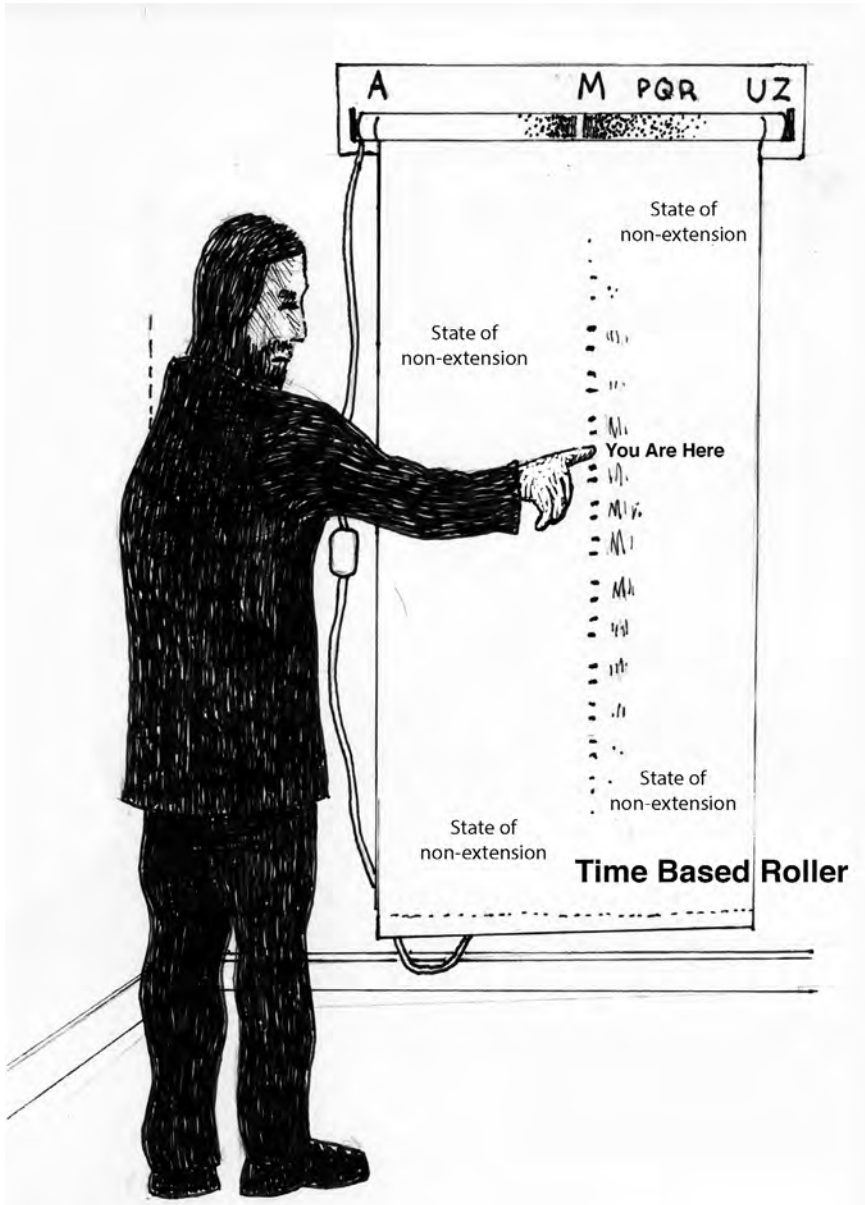


Figure 3.5 Diagram of a function of John Latham's *Time-Based Roller with Graphic Score*, presenting the relation of non-extension and existence, and locating the event of the viewing of Latham's work within the cosmos [David Burrows].

in extended events' and R,S,T indicates the emergence of intuition and morality.³ But in this schema, Latham places emphasis on the emergence and existence of humans as finite events within a universe of structured events, rather than as the universe becoming conscious of itself.

The notion of event and process underpins many of Latham's visual artworks including, perhaps, Latham's most significant diagrammatic, cosmological work: *Time Base Roller with Graphic Score* (1987). This wall work was once displayed at Flat Time House and the title refers to the function of the artwork, which consists of a canvas strip that winds and unwinds around a barrel operated by an electric motor controlled by a switch. The board on which the roller is mounted, and from which the canvas drops, is marked with the letters of the *Time Base Spectrum* (A-Z), giving the *Time Base Roller* a horizontal axis, below which the roller unfurls a canvas – a diagram and score of the (flat) time of the universe, within which any viewer of the work can try and locate themselves (see Figure 3.5).

Latham's spectrum and other diagrams promote ideas that physicists may contest, including Latham's belief that gravity waves cannot exist, for that would indicate space could be the fundamental and primary dimension of the universe, rather than time. So strong was Latham's conviction that the universe should be understood as structured events that he offered the following promise in the text, 'From the point of convergence between art and the sciences': 'Relativity theory requires the existence of a wave/particle called a graviton. In theory of structure of events there can be no such wave or particle. If the alleged graviton is shown to exist, then I withdraw the whole premise' (Latham n.d.: n.p.). While gravitons have not been detected his project stands.⁴ It might seem here though, that Latham's reasoning stands in contrast to Rovelli's argument presented above. Latham's explication of reality as time-based does not argue exactly for time as flow though. As already noted, the artist presents the universe as structured events – and Latham may find some sympathy for his ideas from physicist Lee Smolin, Rovelli's collaborator on developing Quantum Loop Gravity theory. Smolin proposes that time is fundamental to reality, and he asks that if time (as irreversible events) does not exist, is there such a thing as change (Smolin 2013)?⁵ As interesting as this debate is for diagramming, as stated above, the scientific debate over whether time or space is fundamental to reality is not the focus of this chapter, rather it is the cosmotechnics of artists. It is important to note that Latham implies knowledge of a universe of structured events might transform human societies that live very much in (a bubble of) the now. Latham's ambition for his cosmological artworks was not just scientific; the artist intended to create a shift within how his audience conceived of time, and to transform habits of thought abroad in society. Paraphrasing Hui once more, Latham's practice aims at a unification between cosmic, scientific and moral orders through technical and artistic activities, re-situating these orders in a reality which both enables and constrains them.

Conclusion: Community Futures Lab/ Temporal Deprogramming, Philadelphia 2016/London 2019

This chapter proposes that a number of scientists and artists, significant to the development of diagrammatic practices in the twentieth century, explore cosmological problems and themes in similar ways, but with important differences relating not so much to subjective and objective perspectives, but in their focus on the relation of humans and the cosmos. Furthermore, some artists informed by the ideas of physics, explore abstraction and space as a medium to create visible or immersive physical displays or environments analogous to realities that are invisible or elide the sensible. Paradoxically then, the artists cited above attend to what is not present to us through means that directly call upon embodied and phenomenological registers. If there is a difference here between artists and scientists due to their respective fields of practice, this is not a relation of opposites, as the scientists provide insights that inform the practices of the artists. What seems significant is that the artworks discussed in this chapter, mark or make palpable the emergence, perspectives and degeneration of human bodies and minds within spacetime. What connects the diagrams and diagrammatic artworks of artists and scientists so far presented is that all explore a universe in which a 'bubble of now' is questioned. To use a term coined by Latham, there is 'Noit' (no it). It is the artists though, as stated above and as might be expected, who explore how the reality of the cosmos has emotional or existential or social relevance, and who pursue a relation between moral and cosmic orders.

If a case for a mid-twentieth-century emergence of a diagrammatic, scientific-inflected and cosmotechnic turn in art stands, at least in the work of some key figures, can the same or similar orientations be found in twenty-first-century art, in a period when many artists have questioned or left behind formal and universal modernist approaches? Are there contemporary artists producing artworks that are analogous to cosmological research, addressing the 'bubble of the now', and exploring a relation between moral and cosmic orders through less universalizing perspectives. One such practice has been developed by Camae Ayewa and Rasheedah Phillips, through a collaboration named Black Quantum Futurism which presents exhibitions and online works in which diagrams often feature. The pair are activists too, and initiate workshops and community-based events, drawing upon their diagrammatic figure named *Quantum Event Map* to engage communities in thinking about time. Before describing their practice in more detail, it is helpful to attend to Michelle M. Wright's book *Physics of Blackness* which, like the work of Black Quantum Futurism, addresses blackness as both historically constructed and as contingent, drawing upon, and making

analogies with concepts of physics to explain this idea (Wright 2015: 4). Wright contends that ‘the dominant assumption that collective identity is constructed through historically based linear progress narratives creates cognitive dissonance between these collective epistemologies and most Black individuals at various moments of interpellation’ (Wright 2015: 113). This is because, for Wright, (the spacetime of) blackness consists of multiple affective events rather than just historical or linear causality. Wright does not deny that history is significant but suggests that ‘*Epiphenomenal time* or the “now” of blackness’ are ‘phenomenological manifestations’ which may have no direct cause or single identifiable past or future (Wright 2015: 4). Here, the implications of Wright’s scientific analogies for blackness are radical in that they combine the theories of Newton (related to ideas of historical cause and effect) and the theories of Einstein and other twentieth-century physicists (related to her notion of contingency). In particular, Wright is interested in Superposition – a term proposing that a particle can occupy more than one position in space – and Hugh Everett’s Multiverse – a theory asserting the existence of many virtual or alternative universes (Wright 2015: 16–19). For Wright rejects linear time and posits there is no single cause or history-producing experiences identified with blackness; indeed, such experiences may have multiple pasts and futures.

A similar notion of time is found in a circular diagram by Black Quantum Futurism, which has the term ‘Now’ inscribed at its centre, which is a design that echoes the Cosmogram and found in many cultures. As Nettice R. Gaskin notes, it is ‘used across the African Diaspora’ and shows ‘complex intricate patterns simplified into abbreviated X’s, V’s or arrows implying an arc of travel and counterclockwise motion’ (2021: 260). A Cosmogram is a portal that connects to many times and places, and in Black Quantum Futurism’s diagram, ‘Now’ is surrounded by incoming arrows that connect eight, non-linear influences: A. Mood or Emotions, B. Sounds of Music, C. Time of Day, D. Location or Space, E. Other People or Objects, F. Scents or Smells, G. Colors, H. Miscellaneous and Variables. Exhibited in installations alongside other schemas and artworks, Black Quantum Futurism’s diagram of ‘Now’ engenders DIY Time Travel, as does their *Quantum Event Map* presenting a complex matrix of curving, double-headed arrows, which is used in workshops to allow participants to make connections between events without recourse to a linear timeline. The figure was used in Ayewa’s and Phillip’s Community Futures Lab, set up in 2016 in the Sharswood neighbourhood of Philadelphia, as well as being featured in the exhibition *Temporal Deprogramming* in 2019 at the ICA London (as was the diagram of ‘Now’, which seemingly had the potential to be a dance floor that invites the audience to place themselves – their bodies – in the centre of a Cosmogram).

In *Temporal Deprogramming*, the *Quantum Event Map* engendered collective as well as individual questions about time that were also expressed by the wall text, *The Black Grandmother Paradox*:

Outside of time, the journey has & hasn't happened yet
 In the liminal lies all the space-time needed to create
 Memories of the future, (re)-visions of the past
 To activate the motionless present
 We hold the times & memories of
 Our mothers & grandmothers
 They are everywhen we will be
 Been everywhen we are
 Secrets in our skin, gifts of reverse aging
 There is never a wrong time
 On the mother curve/mother line

BLACK QUANTUM FUTURISM 2019

The Black Grandmother Paradox counters the grandfather paradox which states inconsistencies emerge when the past is changed by a time traveller – kill your grandfather before you are born and you will not be around to travel back in time to kill your grandfather. This paradox contests the possibility of time travel but also endorses a notion of time as linear (similar to the notion critiqued by Rovelli through his chord and knot diagram). In comparison, *The Black Grandmother Paradox* points to narratives that seem impossible to those advocating for models of linear time; Black Quantum Futurism assert that women of the African diaspora travel through time as multiple, non-linear influences, and they give this idea plausibility by citing theories of Quantum Mechanics. The collective relate this narrative to how time is manifested or experienced in Afrofuturisms or Afrodiasporic traditions, in which pasts, presents and futures are intertwined and ancestors reside in the present as well as on other planes of existence. On the other side of the wall text, *Black Woman Temporal Portal* is presented in the form of a touchscreen featuring a *Quantum Event Map*. The Portal can be explored by visitors when they use the screen to diagram different and multiple times, across deep and immediate pasts, and futures and no-time planes. In this way, Black Quantum Futurism engender reclamation and renewal of collective memories, histories, futures and fictions of diasporic people. In their twenty-first-century, scientifically inflected, diagrammatic art practice, Black Quantum Futurism offer a cosmotechnics (to paraphrase Hui one last time) that unifies cosmic and moral orders through technical and aesthetic activities, in order to suggest that technology and art should be re-situated in Afrodiasporic and Afrofuturist realities, which both enable and constrain.

Notes

- 1 For a discussion of the imaginary and the diagrams of physicists see Burrows (2020).
- 2 For a discussion of the diagrammatic and obliterating aspects of Kusama's practice see Burrows and O'Sullivan (2019: 63–82).
- 3 The artwork *Basic (T) Diagram* (1991) includes descriptions of the *Time Base Spectrum*:
 - The Line AZ is a succession of points:
 - The point A on AU represents the time-base off a Proto-Least Event (c. 10 x 21 sec.)
 - The point M on AU represents the time-base of a specious present (c. 10 x 4 sec.)
 - The point P on AU represents the time base of a body event P (c. 10 x 9 sec. or 30 years)
 - The point Q on AU represents the time-base off a boundary of reason in extended events
 - The points R, S, T on AU represents the time-base of 'intuition', 'conscience'
 - The point U on AU represents the time-base off the Universe as extended event
- 4 Gravity waves produced by two colliding black holes were detected by physicists in 2016, and these and other detections of gravity waves may hold information about gravitons. The question of gravitons remains open and Latham's project hangs in the balance.
- 5 Smolin goes further and asks a philosophical question: if there is no time and no change, how can there be politics?

4

DELEUZE'S LIVING DIAGRAM PT. 1: FROM STRUCTURAL TO INTENSIVE RELATIONS (THE BIOLOGICAL IDEA)

Dean Kenning

Prologue: The Abstract Line

In Chapter 1 of *Difference & Repetition*, Deleuze draws on the artist Odilon Redon's 'abstract line' to give us a sense of how something is determined as *such*. Determination is a question of difference, usually encountered in terms of distinction and division. Imagine a taxonomic diagram in which individual things (living, non-living, etc.) are distributed into distinct but related sets and subsets. The problem with this classificatory mode of determination is that it is passive, a question of arranging already-given elements in relation to other pre-given elements. There is no sense of determination as an immanent process, and so we are left guessing as to how an individual thing came to be *prior* to its schematic, spatial representation alongside things which it shares properties with and things which it is essentially opposed to (or entirely other to). 'The difference "between" two things is only empirical, and the corresponding determinations are only extrinsic' (Deleuze 1994: 28). By contrast, genuine difference is active; it 'makes itself', when 'determination takes the form of unilateral distinction'. But this active distinction is not a case of something distinguishing itself *from* some other thing in a clear delineation, but of Redon's abstract line: 'that agent from a profound source, acting directly on the spirit' (Redon quoted in Deleuze 1994: 308). Redon's strange figures are not

representations of forms given and clearly defined against a backdrop; they rather emerge immanently out of a chaotic chiaroscuro background in the process of graphic and imaginative expression. His graphic line 'distinguishes itself from [the ground] without the ground distinguishing itself from the line' (29), just as lightning 'distinguishes itself from the black sky but must also trail it behind, as though it were distinguishing itself from that which does not distinguish itself from it' (28). The ground is raised up, churned up; differentiation occurs, but what is distinguished as figure remains connected to the ground, carries the ground with it – that 'profound source' of indetermination. Such indetermination, which signifies virtual openness rather than identity under a concept, nevertheless enables difference to be determined in a singular actualization. The abstract line is the diagram, or at least a nascent version of what will become the diagram concept for Deleuze in subsequent books. The basic elements are there: abstraction, connection, and the genetic emergence of a concrete figure from, or in the midst of, an intense and chaotic determining ground. Using examples drawn from the confusion, plasticity, horror and emotion found in certain artworks (Redon and also Goya's ambiguous figure-ground nightmares), the abstraction suggested by Deleuze at the start of his chapter is anathema to the rational abstract arrangement of things into distinct categories familiar from organizational charts and genealogical trees. It is as if the epistemological determination of things into distinct classes is a way not to reveal difference as key to understanding, but to avoid or tame difference (see Williams 2003: 58).

Diagrams Peircean and Deleuzian

Deleuze first utilizes the diagram concept in an essay on Michel Foucault from 1975, seven years after the publication of *Difference & Repetition* – something he'll return to a decade later in his book-length study on Foucault (Zdebik 2012: 2). He takes the term 'diagram' from *Discipline & Punish*, where Foucault describes Jeremy Bentham's panopticon prison plan not as an architectural blueprint, but as a 'diagram of . . . power' due to its 'generalizable model of functioning' (Foucault 1991: 205) – i.e. the fact that as a mechanism of surveillance, the panopticon can be *abstracted* from the particular case of criminal incarceration and imposed as a form of behavioural modification wherever a mass of people are contained (in schools, barracks, factories, etc.). Subsequently, in *A Thousand Plateaus* (with Felix Guattari [1980]), the diagram concept is utilized throughout, being likened to (or being an aspect of) an 'abstract machine', performing a differentiating function (511) via connections made on a virtual plane operating beneath concrete formations. Following this, in 1981 Deleuze picks up on the painter Francis Bacon's use of the term 'graph' (translated in French as 'diagramme') as an operative threshold whereby chaotic-

messy 'abstract' paint marks are surveyed so as to offer possibilities for a more intense or profound resemblance to emerge.¹ What we notice from these small samples is that *abstraction* is key to Deleuze's diagram concept – and in this respect he appears to agree with standard definitions. But, as intimated already with respect to Redon's abstract line, and as I will go on to show, the abstractions Deleuze is concerned with are far removed from the schematic, geometric or classificatory abstractions that normally constitute the form and function of diagrams. A consequence of Deleuze's notion of abstraction is that it makes a new mode of *relation or connection* between elements possible, relations which, again, differ profoundly from those encountered in a conventional diagram.²

As with many of Deleuze's concepts, the operations which will be performed by the diagram in the later texts can, I argue, already be detected in *Difference & Repetition*, in his efforts there to present a positive and 'genetic' notion of difference. Deleuze seems to use the term in an idiosyncratic way, because Deleuze's diagram is not an 'icon', and therefore not a representation or an object of inferential reasoning. It is not primarily something which is presented to reason or consciousness and does not correspond structurally in a part-to-part relation with another object. Deleuze's diagram is not where we end up – a representational figure we can inscribe and see on a surface, or construct in the mind; it is the invisible and unknowable zone of activity which determines the visible and knowable in the first place; a generative agent that connects an actualized form to an unformed or indeterminate chaos. C. S. Peirce famously defined the diagram as 'an Icon of intelligible relations' (1906: 497); or, more precisely, an icon 'which represents the relations . . . of the parts of one thing by analogous relations in their own parts' (1998b: 274). As one of the three major categories of sign in Peirce's system, all icons – of which there are also three: images, diagrams and metaphors – represent an object in terms of *resemblance*. As for the other two major sign types, an 'index' represents its object through an existential connection (e.g. a human footprint represents the prior presence of a foot and, by implication, a person),³ and a 'symbol' by means of convention (e.g. the English word 'foot'). And so, whilst an icon, unlike an index, 'has no dynamical [physical] connection with the object it represents', its qualitative resemblance to its object – in the case of the diagram, the way the elements which make up the object can be seen to connect – 'excite analogous sensations in the mind for which it is a likeness' (Peirce 1998a: 9). The diagram is, then, a sign defined by resemblance or analogy (the two terms having the same sense for Peirce). The nature of a diagram's resemblance concerns the relations between the parts that make up the object under consideration, the structure of the object for which the diagram is a sign.

Deleuze is not resistant to utilizing icons and analogies – far from it. Diagrams (in the conventional, Peircean sense) and metaphors proliferate as arguments

unfold, differentiations are made, and concepts are delineated. Deleuze tells us that 'Difference is "mediated" [represented rather than explained] to the extent that it is subject to the fourfold root of identity, opposition, analogy and resemblance' (Deleuze 1994: 29). Reason does not show how things actively distinguish themselves, but presents difference in terms of categorical oppositions, analogies and resemblances between things, all deriving from a primary conceptual identity. And so, the four 'roots' or elements become 'the four heads or the four shackles of mediation' (29). Later, the analogy is extended, the roots becoming branches, as difference is stabilized in a rational subject who is content to think of difference within the limits of representation's four elements. Each element appeals to a specific faculty (identity to conception, opposition to imagination, analogy to judgment, resemblance to perception/memory) 'as though these were the four branches of the Cogito', and are organically unified across them all by means of the rational subject's 'common sense'. Upon these four branches, Deleuze writes, 'difference is crucified' (Deleuze 1994: 138).

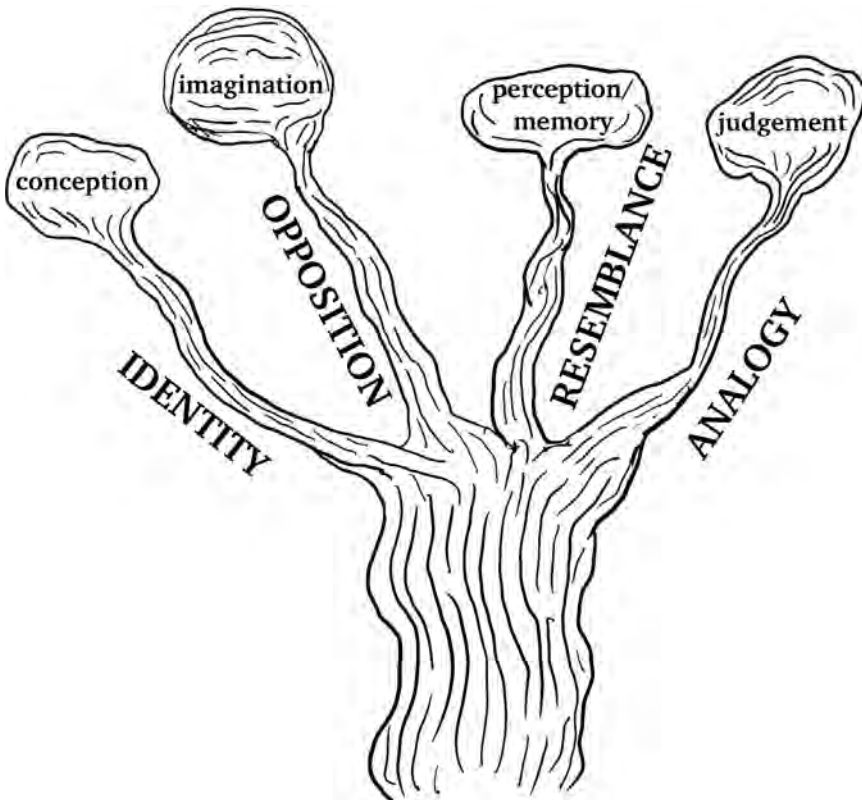


Figure 4.1 Difference represented (Deleuze's tree analogy) [Dean Kenning].

As I read Deleuze's book, I make, as Peirce says, 'some sort of mental diagram' (1998a: 10) and, taking my cue from the image of the tree (or else by making a list using numerical symbols) even inscribe it in the margin, so as to clarify to myself how the system of reason, through which difference is represented, has four distinct aspects, each of which relates in specific ways both to forms of determination and to particular faculties (Figure 4.1). As the text continues, I check for inconsistencies (in the argument or my understanding of it) and spot other relations amongst this arrangement of philosophical concepts which may yet be described and elaborated upon.⁴ Poetic and corporeal imagery carries me off to associative speculation (a crucifixion perhaps intimating that difference as a contingent event is murderously transfixed in an essence) – but I'm always brought back to earth through the modesty of the diagrammatic form (even if these metaphorical figures subsist, disturbing logical clarity and closure). The drawn diagram operates as some sort of index which I can return to (and alter) as the textual argument traces an increasingly complex route. But Deleuze's fourfold root or branch diagram, whilst operating diagrammatically in the manner described above, is also (I would suggest) a parodic diagram, a likeness or iconic image of a particular diagram; a parody, that is, of 'Porphyry's Tree'. Porphyry's third-century-CE *Introduction* to Aristotle's *Categories* explains how genera are divided into distinct species according to a two-way 'branching' by means of differentiae. Later, in medieval Europe, Porphyry's written description took the graphic diagrammatic form of a branching tree.

Aristotle and Analogy

According to Deleuze, because Aristotle's way of determining difference is founded on the principle of conceptual identity, it has resulted in 'a confusion disastrous for the entire philosophy of difference' (32). We'll never arrive at a positive concept of difference in itself, Deleuze argues, if we start by placing terms within general categories, because the other elements of mediation are bound to follow: 'the subordination of difference to opposition, to analogy, and to resemblance'. Let's take a closer look at how Aristotle's classificatory system works. Differentiation is understood in terms of a repeated branching of general concepts into contrary species (see Figure 4.2). By means of this repeating structure of opposition and identity, we can determine what something is according to its essential properties, all the way from what is most general to individuals residing within the most specific.

'A "genus"', writes Aristotle, 'is what is predicated in the category of essence of a number of things exhibiting differences in kind' (Aristotle 1941: 192). If *substance* is the genus, then corporeality is the differentiating factor that

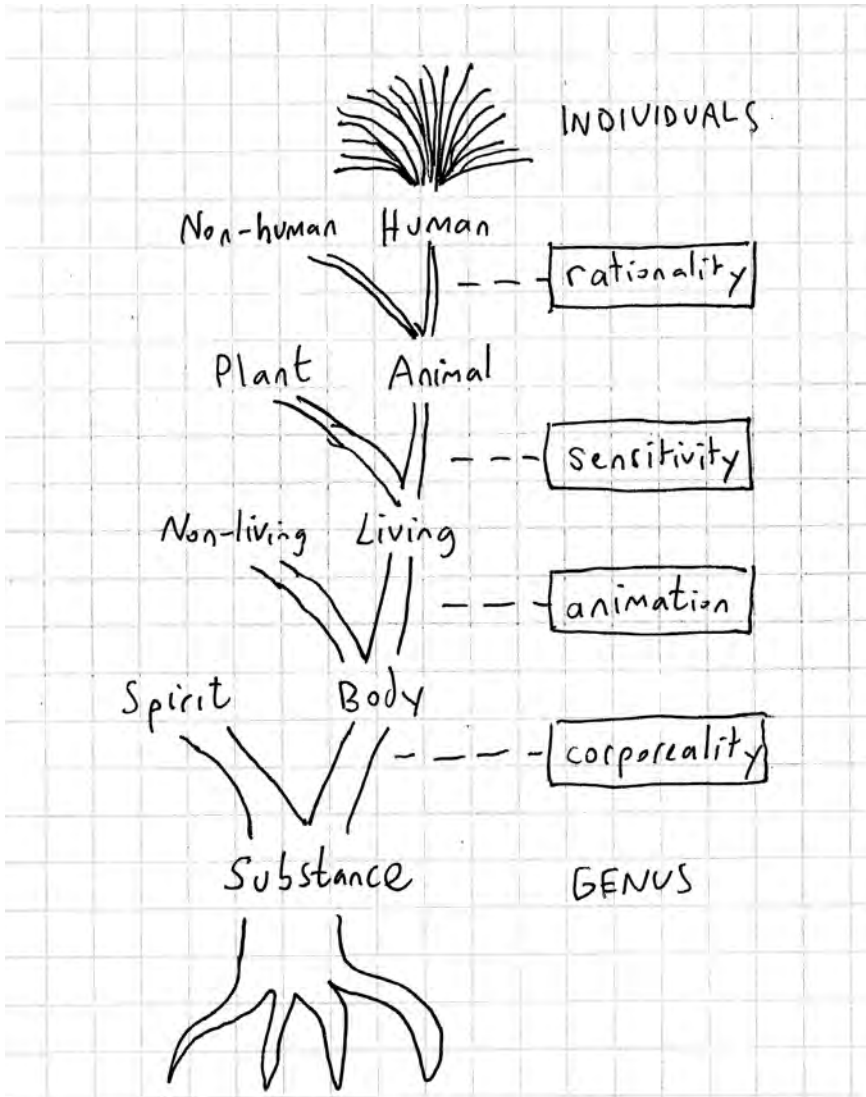


Figure 4.2 Difference as oppositional branching in Aristotle [Dean Kenning].

determines *body* ('corporeal') and *spirit* ('incorporeal') as opposite species of *substance* (the concept that identifies them both). In the following stage, the species *body* becomes genus (genus and species being relative rather than fixed terms for Aristotle), a general category which can take the different specific forms of *living* ('animate') or *non-living* ('inanimate') *bodies*; and so on. When we reach a certain point, the point of dividing up the concept *human* into individual

humans, it is clear we are no longer dealing with specific (essential) but merely individual differences (differences between members of the same species), and so *human* remains a specific rather than a general category – the concept which unites all actual individuals in a single identity.

We can see the way that opposition (contrariety), which determines different specific things, presents us with a negative conception of difference, one therefore anathema to Deleuze's ambition to account for a positive notion of difference in itself, and an active notion of difference making itself. But Aristotle's classificatory method also determines difference in terms of similarity: similarities both within species (individual or small differences between things sharing a common identity) and similarities across general categories (large differences which can nevertheless be seen to resemble one another in some way). The key term for Aristotle – one which is to play a crucial role for Deleuze in drawing out his alternative concept of difference – is *equivocity*. We have seen how Aristotle's categorical ordering of reality places each thing under the unifying identity of a general concept. But if concepts are used equivocally, that is, in more than one sense (so that a term seems to mean different things at different times) then the clarity and order of a single, *univocal* meaning is threatened. Aristotle solves this problem by means of 'equivocity by analogy' (Owens 1978: 118). 'Analogy', meaning 'proportionate' or 'according to a ratio', is utilized by Aristotle as a way to establish a proportional likeness between things that differ beyond what is determined by contrary species. Disregarding cases where the same word differs in meaning without any conceptual correspondence (homonymy), Aristotle finds two types of analogy, which are resolved (their senses related) by means of two distinct forms of likeness. In an example of the first type, the word 'healthy' 'describes what produces health, what preserves health and what betokens health' (Aristotle 1941: 202), and as such it can refer to medicine, food or good complexion. But while the term 'healthy' is 'used with more than one meaning', all these meanings correspond insofar as they all genuinely partake in 'health' – the single, shared 'focal meaning' which relates the secondary definitions to each other (Somers-Hall 2013: 29). We recognize a common source for the various manifestations of 'health'. But take the case of the 'good' itself, which may refer to 'definitions of honour [or] prudence [or] pleasure', etc. (Aristotle from the *Nicomachean Ethics* quoted in Owens 1978: 116). 'Are they . . . called good because they are from something one,' asks Aristotle. 'Or are they good rather by analogy? – for just as sight is good in the body, so is mind in the soul' (116–7). The term 'good' is, for Aristotle, equivocal – goodness has a different nature and hence a different sense in each case. But the shared term is not arbitrary: an analogical likeness can be made, a resemblance found between fundamentally different things.⁵ The structure, or diagram, of analogical likeness is made explicit by Aristotle with respect to things differing outside of a common genus: "in the case of things belonging to different genera, the formulae [is] "A :

B = C : D" . . . and "As A is in B, so is C in D" (e.g. as sight is in the eye, so is reason in the soul, and as is a calm in the sea, so is windlessness in the air)' (1941: 204). This second type of analogy, without a shared focal point, is more abstract, allowing us to make big leaps across categorical 'branches', whilst the first type is more concerned with concrete resemblance, and the way we may connect up contiguous phenomenon ('she took the medicine, ate well, and started to look her old self'). Analogy therefore saves judgement – our ability to decide the nature of a thing – in cases which exceed Aristotle's taxonomic diagram. In cases, that is, where we cannot locate the correct position of something i.) as subsumed under a general conceptual identity (genus); ii.) in opposition to other species of that same genus; or, iii.) according to the resemblance that holds amongst differing individuals of the same species. Beyond the branching (differentiation) of a genus into its species according to the essential property which defines each (e.g. rational and non-rational), structural analogies make big leaps across the branches in order to determine the nature of one thing (e.g. a soul) in terms of something else – usually better known (e.g. a body). And so we *recognize* the world in terms of the common proportions that are found to pertain to different forms of being. Whilst this analogical isomorphism breaks with determination according to a spatialized taxonomic identity (this belongs in this category here, not here, etc.), the 'disaster' of analogy for philosophy lies precisely in disconnecting things, in rendering their nature equivocal.⁶

Univocity – the Common Ground of Connection

Against the 'sedentary' (spatially fixed) reconciliation of difference by means of either conceptual identity (genus-species-individual relations) or structural similarity (analogy), Deleuze wants to show 'difference changing its nature', a dynamic action 'which would relate, in their respective immediacy, the most universal and the most singular' (32). What is required is a common or transcendental ground from which difference might emerge in such a way that complete connection amongst elements is achievable. The ontological principle of *univocal being* delivers just such a ground, enabling connection without subsumption under a shared identity. Univocity is the term employed by Duns Scotus to describe how 'being' is said in the same way of different things (being is spoken 'with one voice'). Scotus was arguing against Aquinas' theological resuscitation of Aristotle's analogy as a means to fundamentally distinguish the nature of God from that of humans (the 'goodness' of God is of a different nature to the 'goodness' of humans, etc.). Univocity determines that there is no

substantial ontological difference but merely differences in degree or *mode*. Univocity is set against Aristotle's principle of equivocity, which claims that things *are* in *different* ways (a soul is, a body is, a stone is, a plant is, a person is, God is; but what we mean by 'is' or being in each case, differs). And if specific things *are* in different ways, then 'being' itself cannot be a genus, because we would be confronted with the paradox of the class 'being' containing within it other equivocal forms of 'being'. For Deleuze, this is a potentially radical moment in Aristotle's thinking because if specific or individual differences *are*, if difference constitutes the being of each thing independently of a generic category of being, we can think difference *in itself*. However, the radical potential is not pursued because Aristotle subjects difference to categorical and hierarchical determination according to two forms of similarity: i.) a continuity of *perceptual resemblance* ('this individual thing differs from other members of its species in this particular way'), and ii.) the abstraction of *structural analogy* ('the relation between this and that is similar to the relation between an entirely different this and that'). In the first case we have small differences, which can be observed and subject to order and hierarchy within species – like various individual leaves on a branch; in the second case we have large differences across general categories, which can be bridged

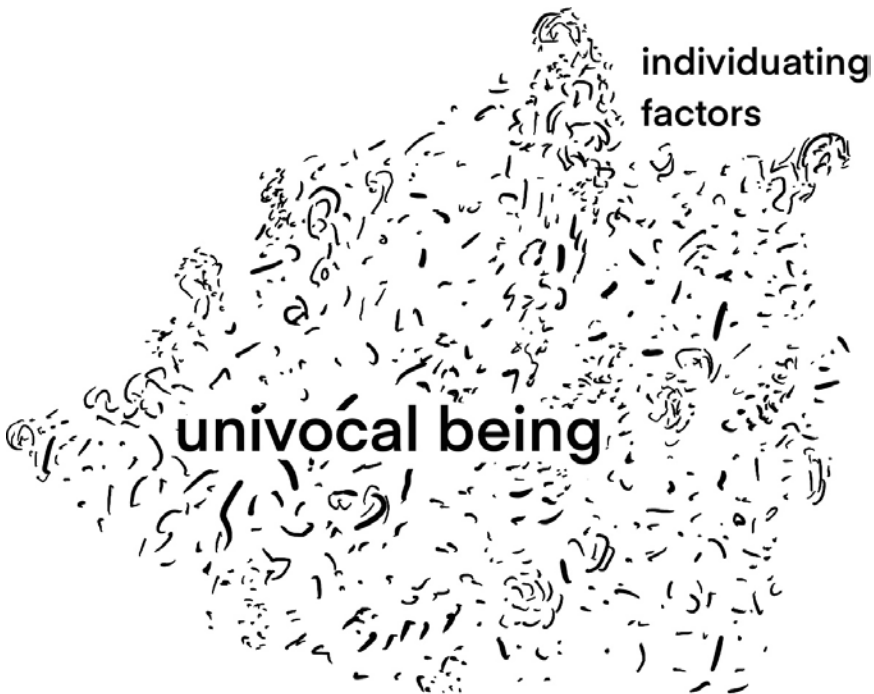


Figure 4.3 Difference making itself [Dean Kenning].

by means of abstract reasoning or 'judgement' – the analogous structures of distinct sub-branches or trees. But where does this leave singular-universal relations? Can the distances between the smallest difference and the largest difference be collapsed and connected on a single plane of existence?

The possibility for immediate connection between all the different instances and modalities of being, from the 'largest' to the 'smallest' difference, relies on a univocal being or being-in-common. But how do we have existential commonality without subsumption of singular differences in a higher concept? How can being be common without being a genus? Or else, how can univocity not regress to a holism which would make each individual thing dependent on the larger reality of which it is merely a part? For Deleuze this comes down to a question of how being must be understood in a *genetic* sense of *difference making itself*:

The essential in univocity is not that Being is said in a single and same sense, but that it is said in a single and same sense, *of all its individuating differences or intrinsic modalities* . . . Being is said in a single and same sense of everything of which it is said, but that of which it is said differs (36).

What is common is the 'ground' from which individuating difference emerges, not the categories by means of which individual things are subsequently differentiated. And because they *participate in being* rather than receiving it, 'all things are in absolute proximity' (37). Against a rational and sedentary division, there is an imminent and 'nomadic' distribution, 'a division among those who distribute *themselves*' (36). Through this active differentiation,⁷ the diagrammatic space in which distribution occurs can no longer be considered a neutral, empty backdrop against which measurement and comparison can take place amongst distinct things, but an active and proximal zone which itself is churned up and congealed or realized in actual individuated forms. Univocal being said of 'differentiating difference' allows us to grasp the real relations, as opposed to the merely representational relations between things – relations that continuously generate individuating processes that bring forth fresh differences from the univocal plane (see Figure 4.3). It is this common or consistent plane of being that accounts for the genesis of an individual, only subsequently represented in its empirical and structural difference from other individuals:

When we say that univocal being is related immediately and essentially to individuating factors . . . [we mean] that which acts in them as a transcendental principle: as a plastic, anarchic and nomadic principle, contemporaneous with the process of individuation, no less capable of dissolving and destroying individuals than of constituting them temporarily; intrinsic modalities of being, passing from one 'individual' to another, circulating and communicating underneath matters and forms (38).

The emphasis on plasticity as both creation and destruction (as in a ‘plastic explosive’)⁹ is important if we are not to regress to an organic and undynamic cosmic ‘oneness’ uniting all things. When Aristotle set a limit on the ability of conceptual identity and imagined opposition (the branching trunk) to account for differential relations as a whole, he introduced an epistemic fracture which has only widened over time. But, asks Deleuze, ‘is this not already a new chance for the philosophy of difference?’ (33). It is already the small breaks in continuity amongst perceptible series or ‘resemblances that differ’ (the leaves), and the large impassable breaks between analogous structures or ‘differences that resemble’ (the major branches) that offer a clue to, and necessitate the prizing open of these cracks, the breaking apart of the fixed branches, or (to further extend the metaphor) the digging of tunnels under the arboreal schema (as mycorrhizal symbiosis enables direct communication and transport between individual plants). Through these profound ruptures or tunnels we can reach the ‘irreducible ground’ (35) that constitutes the real and immediate connections between ever-emergent, ever-dissolving, self-differentiating differences. These connecting burrows beneath Porphyry’s tree threaten the fixed, classificatory relations of category logic and taxonomic difference as well as the structuralist approach that detects more abstract patterns. For Deleuze, it is only with Nietzsche that we reach true univocity whereby substance, or being, is ‘said of the modes and only of the modes’ (40) – there is no distinction between substance and its modes of expression. Action is not attributed to a pre-constituted identity or subject but attains the status of autonomous force. There is only intensive force, or difference making itself as it emerges from (whilst remaining attached to) a common ground. As Somers-Hall (2013: 40) relates, Nietzsche, with the linguistic example ‘lightning strikes’, shows how the seductions of language lead to erroneous subject-predicate reasoning, as if lightning were the subject and striking the action, whereas, of course, ‘there is nothing other to the lightning than its striking’. Deleuze wants us to think of everything, including ourselves, in this way: being as becoming; determination as a matter of active differentiation rather than (logical and hierarchical) comparison and sedentary distinction according to properties.

From Structuralist Abstraction to the Abstract Machine: Being as Becoming

We can now trace a route that leads from the depiction of difference according to resemblance and analogy directly to Deleuze’s own later use of the diagram concept. In *A Thousand Plateaus*, Deleuze and Guattari (1987) take Aristotle’s two notions of analogical likeness (perceptual resemblance and structural analogy, or

what Aquinas named 'proportion' and 'proportionality'), to describe how 'natural history' conceives of the relations between animals in terms of 'the sum and value of differences or resemblances' (234). By natural history they mean a pre-Darwinian, organic continuum, established through a unity of imagination and understanding, which unites and orders the world through a 'chain of being'. The way nature is represented is based in Aristotelian genus-species classification. Analogy of proportion refers to 'resemblances that differ' – we have a *serial* relationship: 'a resembles b, b resembles c, etc.' (234). Analogy of proportionality refers to 'differences that resemble' – we have a *structural* relationship: 'a is to b as c is to d' (234). Exactly as, for Aristotle, small differences exist amongst individual members of a species, so terms within a series 'conform in varying degrees to a single, eminent term, perfection, or quality' (234). Proportion therefore pertains to sensible differences amongst similar things and requires *imagination* in order to gradate what is similar, 'ward off false resemblances' and pay close attention for resemblances which may not initially appear as such. The second type, analogy of proportionality, is consistent with the leaps across Aristotle's major branches. The structural relating of two distinct sets of relations 'realizes after its fashion the perfection under consideration: gills are to breathing under water as lungs are to breathing air' (234). Proportionality, a more abstract matter of finding combinable variants and correlated pairings, requires *understanding* (234).

The classificatory distribution according to similarities and differences, which reaches a rational level of scientific formalization in Linnaeus' taxonomy, does not, of course, disappear with evolutionary development thinking (difference selected for according to contingent environmental factors). The two 'diagrams' continue to coexist, often in uncomfortable tension or confusion: as synchronic overview connecting organisms according to general taxonomic levels of kingdom, phylum, family, etc.; and as genetic and symbiotic diachronic production (including non-hereditary transmission of genes across taxa).⁹ Neither, as Deleuze and Guattari argue, do the problems of pre-scientific 'natural history' disappear with modern modes of thought; they simply take new shapes. They show how the relationships between animals are also bound up with their relations to humans and with relations between humans. This can be witnessed in twentieth-century psychoanalysis, where Carl Jung's theory of archetypes adopts the *series* relation; and anthropology, where Claude Lévi-Strauss' theory of totemic 'homologies' adopts the *structure* relation. For Jung, within dreams and myths (the imaginary), 'the animal is inseparable from a *series* exhibiting the double aspect of progression-regression, in which each term plays a role of a possible transformer of the libido (metamorphosis)' (Deleuze and Guattari: 235). Through these animal-human-animal analogies of proportion, nature and culture are caught up and brought together through 'cycles of conversion' (236). By contrast, Lévi-Strauss seeks to move beyond external resemblances by instituting 'a symbolic and structural order of understanding' (236). An analogy of

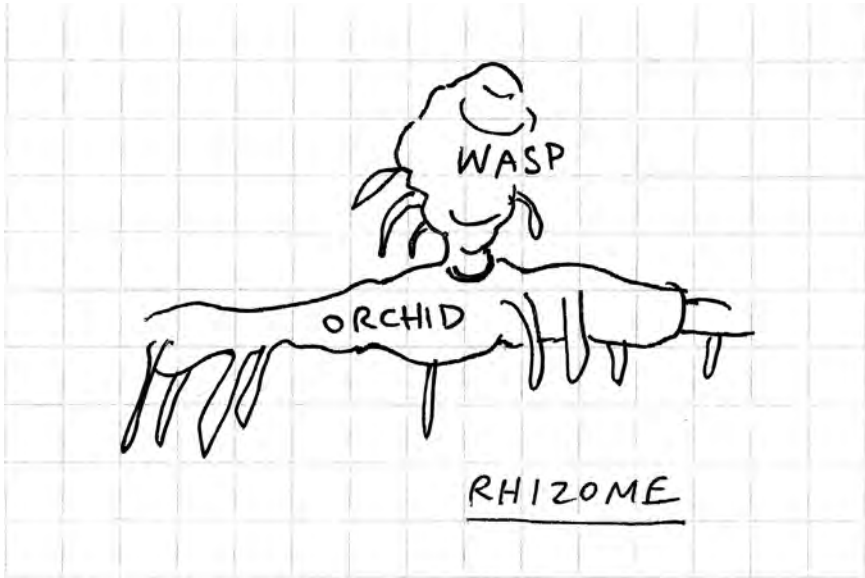


Figure 4.4 Block of becoming [Dean Kenning].

proportionality, or what I'm calling structural analogy, replaces a group's identification with an animal species: 'given two human groups, each with its totem animal, we must discover the way in which the two totems entertain relations analogous to those between the two groups – the Crow is to the Falcon . . .' (236); or, in the case of an individual, a man cannot say 'I am a wolf', but only, 'I am to another man what the wolf is to the sheep' (237). As reason infiltrates myth, the nature–culture continuum is replaced 'with a deep rift distributing correspondences without [imaginary or perceptual] resemblance between the two terms' (237). Resemblance still pertains between the corresponding terms, but it is of an analogical-structural nature (differences that resemble, rather than resemblances that differ).

Deleuze and Guattari reject both approaches – imaginary resemblances of the series type, and symbolic correspondences of the structure type. They opt instead for the *becoming-animal* relation, which is neither imaginary nor symbolic but 'real'. What is the nature of this reality and of this relation? If a becoming neither resembles nor corresponds in an isomorphic fashion, it is because it does not pertain to an independently identifiable thing which becomes – as if becoming were a property or action belonging to a subject. Becoming has its own consistency, and occurs when differences form alliances or symbiotic relationships, not in order to merge or produce descendants, but to create a new 'thing': '[t]here is a block of becoming that snaps up the wasp and the orchid, but from which no wasp-orchid can ever descend' (238). Deleuze and Guattari

name this form of connection a 'rhizome', a 'subterranean stem . . . absolutely different from roots'; 'any point of a rhizome can be connected to anything other, and must be' (6) (see Figure 4.4). A wasp trying to mate with a wasp-looking orchid could be read in terms of functional mimesis – the orchid's deceptive strategy means that its pollen is efficiently spread from flower to flower (the wasp, going on 'looks', is the dupe). From this evolutionary functionalist viewpoint, whilst a fascinating interaction takes place (which doesn't necessarily eliminate the factor of enjoyment), the distinct identities of wasp and orchid (not to mention gender stereotypes) are, if anything, reinforced. Likewise, becoming a wolf, cannot be a question of an iconic resemblance, any more than it is of a structural correspondence. It is not a question of holistic, ecological balance – all the parts working for the good of the whole. A becoming is a connection between heterogeneous elements as an active differentiation (a new difference has emerged). These becomings, then, are not distinct things but blocks of heterogeneous but co-functioning elements, contingent encounters amongst differences that connect or 'plug in' on condition of some consistent or shared field of being to which they remain attached. They are what the authors term 'multiplicities' (239), for example animal packs or populations, which interact with other multiplicities and, crucially, with territories within which they distribute themselves. Instead of classification according to the resemblances and differences of identifiable characteristics, as is the case with both natural history and natural science, Deleuze and Guattari are interested in the more dynamic and intensive processes of 'expansion, propagation, occupation, contagion, peopling' (239). By implication, the things which connect to form multiplicities are themselves multiplicities or becomings, which have been stabilized in a posthumous identity, but which may be deformed and reassembled through new alliances and symbiotic relations. What enables multiplicities to interact and form new multiplicities is the fact that they are all drawn on the same 'plane of consistency' which 'cuts across' and intersects 'all concrete forms' (251). Here, on this univocal plane, we reach a level of abstraction which is not the abstraction of classification or structural analogy. It is the 'abstract machine', or diagram:

The plane of consistency of Nature is like an immense Abstract Machine, abstract yet real and individual; its pieces are the various assemblages and individuals, each of which groups together an infinity of particles entering into an infinity of more or less interconnected relations . . . it is a plane upon which everything is laid out, and which is like the intersection of all forms, the machine of all functions. (254)

This consistent plane, then, is like the abstract or virtual ground from which difference emerges, but which remains attached to what is actualized or given concrete form so that new connections, and therefore new multiplicities remain

forever possible. Importantly, this abstract plane or machine presents difference not in terms of *extensive qualities* (visible or inferable distinguishing characteristics) but *intensive quantities*: 'a fixed plane upon which things are distinguished from one another only by speed and slowness' (254). Structural analogy may break the imaginary 'chain of being' diagram, but only on account of a more abstract resemblance. It is by means of the continuous machinic diagram, and not by 'scientific' structuralist isomorphism that the organic continuum of natural history is overcome. (This is not to expunge a structuralist approach entirely, although it has to take on a new 'genetic' or 'Ideal' character – as we will see.)

Let us briefly pause at this point to survey what has so far been churned up from the perspective of Deleuze's post-*Difference & Repetition* utilization of the term 'diagram'. Whilst Deleuze's diagram is idiosyncratic due to its non-iconic nature, his use of the term is neither arbitrary nor perverse because it maintains aspects which characterize diagrams in general: it is abstract, it concerns relations, it occurs on a 'plane', and it involves an active operation. Where his diagram concept differs, and what makes his use of the term seem incongruous, is a question of the nature of the abstraction and of the relations involved, and how these alter our conception of both diagrammatic agency and the plane upon which diagrams are 'drawn'. Firstly, *abstraction*: abstraction is not where we end up (the icon of relations) but where we begin (the nascent diagram). Deleuze's diagram is abstract neither in the sense that it strips back and generalizes from the messy contingency of particular empirical processes (e.g. Aristotelian or Linnaean classifications), nor in the sense that it makes visible 'real' (e.g. social or metaphysical) abstractions (economic, institutional or mythical structures; transcendental schemas). Deleuze's 'Real-Abstract' diagram is more like the bubbling of the inchoate – a non-graspable, virtual state of potential connection, the creative engine of becomings and catastrophes which underlays, envelops and determines actual forms and functions. Categorical thinking artificially introduces breaks between aspects of being, 'shatter[ing] the continuums of intensity' (Deleuze and Guattari 1980: 143). Foundational models of scientific truth (e.g. geometrical postulates) possess 'a deliberate will to halt or stabilize the diagram, to take its place by lodging itself on a level of coagulated abstraction too large for the concrete but too small for the real' (144). Axiomatic and classificatory diagrams miss reality from both ends: abstracting away from the sensuous without ever attaining to the level of the 'matter-function' – the creative 'moment at which abstraction becomes real' (145–6) and difference can be actualized.

Secondly, *relations*: the significant relations are not those that exist, or can be drawn, between pre-given, discrete things; they are relations between virtual elements or particles, relations which enable things to emerge in the first place. These relations are intensive rather than extensive, characterized by movements, forces, speeds, pressures and state changes. It is these intensive, kinetic

relations which give Deleuze's diagram a *living feel*, quite unlike diagrams drawn out within the bounds of an already given, and supposedly neutral, spatial field. The trouble with representation for Deleuze, writes Henry Somers-Hall, is that it 'cannot think its own ground' (2013: 23) – this ground being an intensive field of relations that generates difference. It is to the nature of these intensive relations that I will now turn.

Reciprocal Determination and Intensive Relations

Species do not resemble the differential relations which are actualized in them; organic parts do not resemble the distinctive points which correspond to these relations. Species and parts do not resemble the intensities which determine them . . . The egg destroys the model of similitude.

DELEUZE 1994: 251

The trouble with a system that proceeds by opposition is that it weaves 'an overly loose mesh' whereby 'the biggest fish pass by' (Deleuze 1994: 182). Against the formal structures of categorical reasoning, Deleuze proposes 'reciprocal relations' which don't rely on any prior identity. Unlike an analogical structure, an Ideal structure consists of virtual elements which have no independence but are determined purely in terms of the reciprocal relations they enter into. The connections they make are virtual in the sense that they are non-localizable. They reside on a virtual, univocal plane but are actualized in a variety of concrete forms. The Idea is a virtual 'problem' that becomes actualized in a 'solution' (where the solutions are potentially infinite and are not meant to indicate finality). The connections between virtual elements form a structure, but not in the sense of intelligible relations or categorization; in fact, the connections are of 'a structural-genetic nature' insofar as they determine the individual thing that will emerge in the actual (at which point a structural pattern may be recognized). With this mode of determination, whilst what is determined or actualized emerges as a result of the Ideal connections, the actual form bears no clear likeness, either perceptually *or* analogically, to the conditions from which it emerged. Between virtual relations and actual relations, there are 'correspondences without resemblance' (184). Unlike structuralism, the correspondences are not isomorphic, but 'asymmetric' and dynamic. What is actualized is something entirely new.

Deleuze provides as an example of an Idea 'the organism as biological idea'. It was the early nineteenth-century biologist Étienne Geoffroy Saint-Hillaire who 'seems to have been the first to have defended the consideration of elements

that he called abstract, taken independently of their forms and functions' (184). Geoffroy was working in a pre-Darwinian context, but while the mechanism of hereditary descent (natural selection) was unknown, the idea of common lineage amongst distinct organisms had already been proposed, for example by Buffon and Lamarck. Against the Aristotelian notion of species immutability (strictly held to by the church and, earlier in his career, by Linnaeus), these biologists claimed 'variability through modification (Perrier 2009: 74). Geoffroy's great rival, Georges Cuvier, shared this view of species creation through descent, although such mutability he deemed to occur only within four major 'embranchments', which he held to be absolutely discrete (Willmore 2012: 220).¹⁰ Taking a strict form-follows-function approach, Cuvier described what he called a *correlation of parts* whereby 'suites of characters' (the arrangement of organs, nerves, bones) 'were always grouped together', ensuring 'the animal is perfectly adapted to its environment' (Willmore 2012: 220). This environmental fit, or correlation occurring in each of the major groups, rules out the possibility of profound anatomical reorganization which would enable animal species to pass (in the passage of time) from one major branch to another.

Geoffroy took the opposite view, insisting that there could be no fundamental classificatory divisions amongst animals, as there existed, as a basic law of nature, a unified 'plan of composition' (Perrier 2009: 74). As Geoffroy wrote, 'By simply changing the forms of some of their organs animals can adapt them to new functions and extend or reduce their use' (quoted in Perrier 2009: 74). These changes operate according to what Geoffroy called a 'principle of connections', whereby parts could shift about, and even contort to extreme degrees, to form new body plans and determine new functions, but where the relations between parts would remain the same (Perrier 2009: 76). Deleuze calls these topological connections 'ideal connections beneath the cruder play of sensible and conceptual differences and resemblances' (1994: 185). He gives the example of the hyoid: humans seem to have lost four of the bones that make this structure up in a feline – that is until we realize that these four bones have simply shifted apart from the organs of the throat and now reside towards the skull, reoriented to the upright position, performing a different function (185). The elements of the animal may shift position, but they remain similarly related across diverse species. Elements are 'linked by ideal relations of reciprocal determination: they thereby constitute an "essence" which is the Animal in itself. It is these differential relations between pure anatomical elements which are incarnated in diverse animal configurations, with their diverse organs and functions' (185). Instead of distinct plans or blueprints, each correlated with the environmental conditions pertaining to the animals of the four major taxonomic branches, we have continuous morphological genesis and actualization according to a unified plan (or univocal plane). Classificatory organization of species according to similarity and difference *follows* from such genesis.

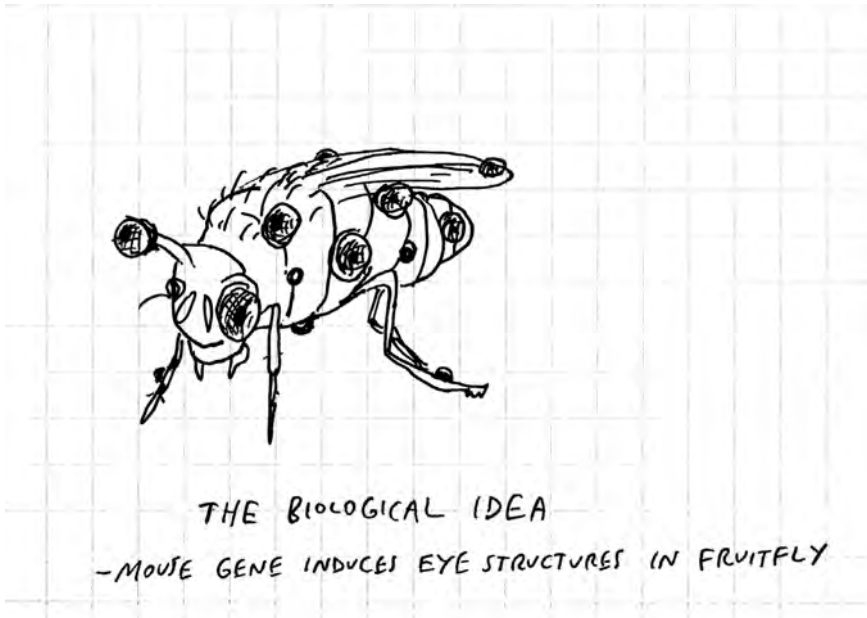


Figure 4.5 The biological Idea – genetic consistency across species [Dean Kenning].

Deleuze still wonders if this biological example of differential elements and ideal connections remains too structural – too anatomical or skeletal, we could say. Genetics might give us a better sense of how there are dynamic ‘correspondences without resemblance’. Rather than simply appearing as spatial locations within cells, as anatomical elements do within a body plan, chromosomes ‘appear as *loci*’, that is, ‘complexes of relations of proximity [whereby] genes express differential elements which also characterize an organism in a global manner’ (185). By ‘commanding several characteristics at once, and acting only in relation to other genes’, they display both complete and reciprocal determination (185). Following on from Deleuze’s thoughts here, we might propose a contemporary biological Idea from the field of genetic engineering. Whilst a gene is an instruction or determining factor, it is not a blueprint leading to identical forms; according to environmental contingencies the same gene can produce multiple protein forms, and can itself exist in alternative versions (alleles). There are genes, called controller or ‘homeobox’ genes, small in number, which determine when other genes (large in number and distributed over large areas of the organism) get ‘switched on’ during embryonic development. Signals from homeobox genes ensure that organs and body parts form in the right place and in the right order (head-to-tail segmentation; wing, leg and antennae growth; digit formation, etc.). The ‘actual’ incarnated animal form

is determined, not by a precise genetic template in the manner of a digital code, but by the ‘virtual’ material dynamics of proximity, chemical environmental and timing – with ‘wrong’ timing, ultraviolet light, etc. resulting in ‘deformity’ (legs sprouting from the head, extra digits). It is, in fact, an organism’s openness to ‘error’ that is crucial for evolutionary selection at species level. The fruit fly homeobox gene ‘eyeless (ey)’¹¹ triggers approximately two thousand genes that generate all the cells that make up a fly’s eye. What Walter Jakob Gehring and colleagues discovered in 1995 was that ‘ey’ bore a strong structural resemblance to homeobox eye genes in mammals (‘PAX6’ genes such as the human type Aniridia). Using a chemical activator, the ey gene was induced into various imaginal discs of an early-stage larval fruit fly – the pairs of discs that will go on to form body parts such as wings, antennae and legs. What resulted, as the fruit fly developed, were eyes all over its body, i.e. in the ‘wrong places’: ‘ectopic eye structures were induced on the wings, the legs, and on the antennae’ (Halder et al. 1995: 1788) (see Figure 4.5). This proved that ey was in fact the master gene for the development of fruit fly eyes, the gene which triggers the numerous other genes necessary to construct the various functional aspects of the eye organ. A further experiment was conducted by one of Gehring’s students: the homologous PAX6 homeobox sequence for eyes in mice (‘small eye’ or ‘Sey’), was now injected into the fruit fly larvae (*The Cell, The Chemistry of Life* 2011). Again, eyes sprouted according to where the mouse gene had been introduced, but these were not mouse eyes – they were fruit fly eyes. And, according to Gehring, these eyes could see. The fly’s genetic and cellular machinery had been able to read the PAX6 mouse gene (Sey) as if it was its own, on account of PAX6 being the pan-species determining ‘common ground’ by which fly eye structures – along with mouse eye structures, human eye structures, etc. – are created through the triggering of cascades of specific genes. The fly’s cellular machinery had been able to distribute eyes throughout the body due to the homeobox gene’s global character and its proximity to cells that are normally the site of other morphogenetic processes. The ability of such ‘universal’ genes to control morphogenesis not only of different organs within the same body or species, not even across species of a common class (e.g. mammals), but across the widest branches of animal classification, speaks to a deep homology, an Ideal animal or consistent animal plane acting beneath and across all possible variation in form and function. It is the reciprocal relations that genetic, molecular and other cellular elements are able to enter into that constitutes this morphological potential.

Intensive Diagrams

How does such actualization occur more broadly? According to intensive relations of space and time, or, as Deleuze says, ‘in accordance with reasons

and at speeds determined by the environment, with accelerations and interruptions' (185). Geoffroy was an innovator in this respect. The sorts of dynamic forces and anatomical deformations undergone by the embryo in its early development, allowed him to see how, by means of some turning and doubling over, a vertebrate might become a cephalopod; or, like a sped-up animation of evolutionary development, how a bird might develop from a lizard: 'a contraction toward the centre of the body . . . that separated the blood vessels in the thorax and base of the pulmonary sack in the abdomen from the rest of the body' (Geoffroy in Perrier 2009, 79).¹²

Deleuze describes embryological kinetics in the following way: 'the augmentation of free surfaces, stretching of cellular layers, invagination by folding, regional displacement of groups' (214). Dilating, contraction, pulling, folding and moving forces. It is 'the orientations, the axes of development, the differential speeds and rhythms which are the primary factors in the actualization of a structure' (214). The actualization of divergence across taxonomic categories is not on account of distinct anatomical plans, but the varying degrees by which composition occurs according to a common plan; the degrees of embryonic development before stoppages intervene to halt further change. '[B]eneath species and parts, we find only these times, these rates of growth, these paces of development, these decelerations or accelerations, these durations of gestation' (217). Everywhere, hidden from view, there are dynamic reciprocal relations amongst elements, and amongst the parts which those relations bring forth, in a continuous process of differentiation and actualization. We don't find true difference in diversity of sensible forms; diversity is rather the result, with active, differentiating difference being 'the sufficient reason of all phenomena' (222). And what defines difference is intensity; or, more precisely, a 'difference of intensity', intensity understood as differential: 'a system is constituted or bounded by at least two heterogeneous series, two disparate orders capable of entering into communication' (222). What 'bring[s] about the communication between disparate series, is a sign' (222) – or, I would suggest, a diagram. What appears as a form correlates with a heterogeneous series – there is correlation without resemblance. The insect eye (or the multiplicity of cells which compose it), does not resemble the series of genetic interactions ('switch' and 'interpreter' genes, etc.) which trigger its formation (we could not deduce one structure from the other). At the same time, this genetic system does not solely determine the physical organ, because the genetic machinery is dependent on non-chromosomal cellular factors (protein-producing machinery, cytoplasmic machinery, etc.). What appears is determined reciprocally, in terms of reciprocal relations between virtual and actual factors. Virtual in the sense that what gets actualized, the 'solution' to the (Ideal) 'problem' of cellular development, is not predetermined, but the result of contingent spatiotemporal dynamics (e.g. genetic switches for mouse eyes producing fly eyes at various points on the fly's

body). The *homeobox diagram* draws a connection between heterogeneous series so that communication can occur, not only amongst elements normally found in an individual animal's body, but in relation to the cells of widely divergent species – the bodies of various classes of organism now surveyed not as diverse, but as a consistent plane of possible connection points from which differentiation can occur. But intensive reciprocity between only two series is, of course, much too limited. In effect there can only be what Deleuze calls 'infinitely doubled difference', because each series 'is itself composed of heterogeneous terms, subtended by heterogeneous series which form so many sub-phenomena . . . each intensity is already a coupling (in which each element of the couple refers in turn to couples of another order)' (222).¹³ Think of the intensive relations required for a genetic sequence to emerge as a phenotypic trait, the way that the differentials which occur as a result of heterogeneous coupling can only lead 'down' to molecular and atomic (and beyond) relations between disparate series, and can only lead 'up' to intensive spatiotemporal relations between differentials at cellular and organic levels, and even – because genetic changes manifest behavioural changes within the species – environmental and population factors which may, in turn, affect individual genes in new dynamic and symbiotic couplings. Vast distances are covered, at micro and macro scales, instantaneously connecting up differential structures. It is difference all the way down, and all the way up too, or all around, because no gaps exist that would prohibit connection or communication on a continuous plane of being.

The limitation of conventional diagrams, we might say, is that they exist on an extensive rather than an intensive plane. Extensity, for Deleuze, is the qualitative shape taken by phenomena as a result of the intensive processes. The problem is not with extensive quality as such, but the way in which what we perceive in extensity can be taken for real differences themselves, independently of the intensive processes that bring them into actuality. 'Extensity as a whole comes from the depths' (229), that is to say, from the differential relations which connect and actualize. An extensive quality can be laid out and divided up 'without any change in the nature of what is being divided'. By contrast, '[a]n intensive quantity may be divided, but not without changing its nature' (237). Doubling the temperature is not equal to spending twice as long in the same temperature. Halving a certain velocity, or a force of pressure, is not like dividing a line in two. Or, rather, the division of a line is normally viewed extensively, in terms of an identity with the original line, and not as an intensive process which brings about something entirely different. Typological or categorical divisions are sedentary, leaving what is being divided intact and independent of the neutral spatial background which makes the division possible. The relations drawn between elements in an extensive structure tend to hide the differentiating differences that brought them into being in the first place. Compare this with an intensive diagram. Deleuze describes depth as destroying conventional figure-ground relations

where the ground is taken as neutral backdrop. He likens depth to 'the famous geological line from NE to SW, the line which comes diagonally from the heart of things and distributes volcanoes' (230), uniting sensibility [actual] and the Idea [virtual]. Like Redon's 'abstract line' (and the fork of lightning generated in a charged field), we are confronted with a creative-destructive agent which, on account of intensive differences, forges connectivity between disparate things.

Notes

- 1 See Part 2 of this essay.
- 2 In his critical guide to *Difference & Repetition*, James Williams argues that one of the two dominant principles of Deleuze's book is the principle: 'Connect with everything'. The second, related principle 'Forget Everything' points to a mobile and plastic conception of diagrams as both creative and destructive agents, and away from the usual account of diagrams as axiomatic schemas or tools for organizing distinct 'things'. (See Williams 2003: 5).
- 3 Peirce in fact distinguishes genuine (existentially connected) and 'degenerate' indexes: unlike a weather vane, the representational function of which is determined by wind direction (its object), the way an arrow drawn on a page *indicates* or points us to its object is more a question of symbolic convention and iconic resemblance.
- 4 For Peirce, diagrams are triggers for action in the form of inferential reasoning: in presenting an analogy of parts, the mind is capable of 'experimenting upon this image in the imagination, and of observing the result so as to discover unnoticed and hidden relations among the parts' (1992: 227).
- 5 It was the Scholastic philosopher St Thomas Aquinas, wrestling with the theological problem of God's divine separation from the human world (how could God's 'goodness' and man's 'goodness' be in any way similar?), who resuscitated Aristotle's ontological equivocacy and distinguished Aristotle's two versions of analogy with the terms *proportion* and *proportionality*. See Danby-Smith (1969: 17–18) and Somers-Hall (2013: 31–3).
- 6 For a flavour of the alternative diagram Deleuze will propose, let's consider the analogy 'as bricks are to a building, so words are to a statement'. In his book *Foucault* (2004), Deleuze will describe precisely the diagram which can overcome such analogical distances and immediately connect heterogeneous elements and series of elements. There he demonstrates how, for Foucault, disciplinary power is a question of a 'mushy mixture' of words and bricks, the 'articulable' and the 'visible'. For more on this, with respect to Louis Hjelmslev's linguistic model of 'expression' and 'content' relations operating in connection with a continuous 'purport', see the second part of this essay.
- 7 In *Difference & Repetition*, Deleuze distinguishes two modes of differentiation marking two distinct stages of the actualization process, spelling the second type 'differentiation' (with a 'c'). To avoid added complexity I am using only the single sense and common spelling.

- 8 I take the example of plastic explosives to draw attention to the destructive as well as creative aspect of (neurological, psychic etc.) plasticity from Catherine Malabou (2022).
- 9 See, for example, David Quammen (2018) and Lynn Margulis (1998).
- 10 Roughly corresponding to what are now called phyla, Cuvier's branches were: vertebrates, mollusks, articulated animals and zoophytes.
- 11 So called because controller genes tend to be identified in terms of an observable 'deformity' or 'abnormality' in the individual due to a mutant version of the gene – in this case 'the partial or complete absence of the compound eyes' in the fruit fly, first described in 1915 (Halder et al. 1995: 1788).
- 12 Geoffroy was the originator of teratology, the science of developmental abnormalities or 'deformities', which could be induced in the animal embryo or larvae by means of chemical or environmental factors.
- 13 'Every intensity is differential, by itself a difference . . . E – E', where E itself refers to an e – e" (222).

PART TWO

DIAGRAMS IN USE

5

DELEUZE'S LIVING DIAGRAM PT. 2: FROM STRUCTURAL TO NERVOUS ANALOGY (FRANCIS BACON)

Dean Kenning

What I want to do is to distort the thing far beyond the appearance, but in the distortion to bring it back to a recording of the appearance.

FRANCIS BACON in Sylvester 2016: 46

I'm just trying to make images as accurately off my nervous system as I can.

FRANCIS BACON in Sylvester 2016: 94

Roughly speaking, the law of the diagram, according to Bacon, is this: one starts with a figurative form, a diagram intervenes and scrambles it, and the form of a completely different nature emerges from the diagram, which is called the Figure.

DELEUZE 2005: 109

Introduction

As we saw in Part 1 of this essay, Deleuze's proto-diagram is of a structural-genetic nature, whereby the emergence of a particular form in extensity is conditioned by the intensive relations entered into by virtual elements. In so far

as they are determining, the virtual relations clearly must correspond in some sense to the relations amongst elements constituting the actualized form, but it is a correspondence 'without resemblance'. For example, genomic structures don't resemble the forms or traits that they determine, in the way that an architectural blueprint resembles the realized building (where the set of marked lines is isomorphic with the built structure). Furthermore, against any notion of representation or fixed forms, the form that emerges remains attached to the intensive dynamics which operate in the unformed material substrate. This connection to the same and single plane of being makes all concrete configurations subject to possible upheaval and mutation as new combinations are entered into between 'form' and 'matter', or 'figure' and 'ground'. It is as if the architectural plan operated as a continuously variable mould with an immediate physical connection to the building it continues to shape. Importantly, it is due to connection with the shared ground that apparently distinct concrete forms or figures can connect with and influence each other. Taking an example from Deleuze's book on Foucault, distinct institutions, such as the school, the prison, the barracks and the factory, connect up within the diagram of a more socially abstract and amorphous function: 'to impose a particular conduct on a particular human multiplicity' (Deleuze 2006: 29).

Early in *Difference & Repetition*, Deleuze draws from the field of visual art and Odilon Redon's 'abstract line' to describe this dynamic relation, where figures are 'abstracted' from a representational function, so that graphic marks can acquire a living and autonomous force by dissolution and reconnection with an intensive ground (what Redon calls an 'agent from a profound source'). Later (with Guattari), in *A Thousand Plateaus* ([1980] 1987) and in *Foucault* ([1986] 2006), Deleuze will describe the mechanisms that account for actualization from a univocal plane of consistency in terms of 'double articulation', a model of language devised by the linguist Louis Hjelmslev. Whereas Saussure joins the signifier (expression) and the signified (content) inseparably in a sign, Hjelmslev insists that the true system of a language is to be found at the level of non-sign sub units, which he calls 'figurae' (Hjelmslev 1963: 46). In English, the phoneme 's' may signify plurality if placed at the end of a word, but usually signifies nothing in itself if placed in any other position within a word. And so (at this level) expression and content don't cohere in a sign and must be considered separately, on a second plane of articulation.¹ Just as, for example, a limited number of genes can lead to a seemingly limitless range of bodily shapes and functions, so in language 'with a handful of figurae and through ever new arrangements of them a legion of signs can be constructed' (Hjelmslev 1963: 46). Each language provides us with a distinct set of elements to draw upon on the content and expression planes, but sense or meaning itself – 'purport' – is common amongst humans as an undivided and potentially infinite 'thought mass' or 'amorphous continuum' upon which 'each language lays down its own boundaries . . . and

stresses different factors in it in different arrangements' (52). As opposed to content and expression *substance* (and their manifest unity in a sign), this is a more abstract question of *form*: 'It is like one and the same handful of sand that is formed in quite different patterns' (52). In terms of content-form, Hjelmslev considers the colour spectrum, in reality a continuous rather than discreet phenomenon, upon which 'each language arbitrarily sets its boundaries' (52). To think or linguistically communicate a colour, different languages operate within the same paradigm or area of purport ('colour zone') but must select from the forms or patterns available (with different languages offering a larger or smaller range of colour words, and spectrum boundaries overlapping to various degrees rather than matching across different languages). The same is true with the expression-form, where a similar continuum exists in terms of the phonetico-physiological range selected, emphasized and therefore made available for speech: 'each language lays down its boundaries within [an] infinity of possibilities' due to the 'extraordinary mobility of the tongue' (55). Hjelmslev emphasizes the primacy of the more abstract, formal operation with respect to the actual determined expression and content substance (signifier and signified) which subsequently 'appear by the form's being projected on to the purport, just as an open net casts its shadow down on an undivided surface' (57).

What Deleuze calls 'strata' or 'concrete assemblages' are an effect of a similar laying down of boundaries whereby, from a shared field of forces, discrete, segmented units arise. However, Hjelmslev's metaphor of sand to describe the shared, continuous 'thought mass', seems too homogeneous and undifferentiated for what Deleuze is presenting. Deleuze's diagram aims for a higher degree of abstraction than that provided by form (the forming of matter). The diagram or abstract machine is operating already on, or as, the common field, constructing 'continuums of intensity', combining particles and conjoining flows (Deleuze and Guattari 1987: 70). Because the intensive diagram connects the virtual ground to the actualized form, it remains the anarchic agent that can dissolve and diffuse that which is given as distinct and stable, determining new realities (new forms, new functions). The act of combining, distributing and conjoining which the diagram performs is not about imposing order on matter; but this doesn't mean it is a merely chaotic or random act: 'There are rules, rules of "plan(n)ing," of diagramming' (70).

If we turn to Deleuze's book on Francis Bacon, we can get another, perhaps clearer look at how the diagram operates, and what these rules consist of. Because painting is a plastic art consisting of manifest, material elements; because, to a high degree, it carries its accidents and its moments of emergence with it into view; and because there is a 'subject' behind it, making decisions and 'creatively' bringing formal aspects into relation – we may finally be able to 'see' the diagram, or at least to trace more clearly the moments of its operation.

Except that, similarly to Redon's abstract 'agent from a profound source', Bacon's entire problem seems to be how to *escape* conscious creation and find a technique whereby he can channel or give himself over to another source or force, to an 'irrational' mark. Bacon's diagram nevertheless operates on a more intensive level than does Redon's, whose particular use of chiaroscuro, whilst escaping the modelling of a figure through light and shadow, cannot attain the sensual intensity of pure colour combinations. Furthermore, whilst Redon's abstract line dredges up the fantastical, Bacon is focused on 'fact'. He too wants 'the ground to [rise to] the surface without ceasing to be ground' (Deleuze 1994: 29), but he wants to achieve this by means of figurative clarity. Describing a work he has in mind to make (originally imagined as a kinetic sculptural relief) depicting an everyday scene of people in the street, Bacon says, 'It would be a kind of structured painting in which images, as it were, would arise from a river of flesh' (Sylvester 2016: 97). Bacon is not an abstract painter; he wants to capture a sense of fleshy reality, to make a fact, the fact of a body, *appear*. He aims for *resemblance*. It is this question of resemblance which seems to challenge Deleuze's philosophy, and his theory of the diagram, given how much effort has been devoted to fighting against representation. Beyond imaginary resemblance (how one thing can be compared to and located within the same specific category or series as something visibly similar) Deleuze criticizes, even more harshly, resemblance of a structural or rational kind, proposing in its place structural-genetic correspondences without resemblance, sets of relations involving only mutual presupposition or determination free of any prior model. Structural resemblance, as we have seen, comes under the heading of *analogy*, a form of judgment utilized, according to Aristotelian logic, when impassable gaps separate things which can find no common categorial genus. It may then seem even more odd that, in his book on Bacon, Deleuze himself introduces the concept of analogy as a way to account for how such resemblance is brought about in the figurative painting he is championing. This might all threaten his univocal system if it were not for the fact that Deleuze qualifies both resemblance and analogy in such a way that they mean things quite at odds with any classificatory distribution of difference under identity or isomorphism across categories. Resemblance becomes 'resemblance by non-resembling means', whilst analogy becomes 'aesthetic analogy'. Key to all this is the diagram. Let's see how it unfolds.

How to Trap a Fact

Deleuze's diagram never begins with a blank or neutral surface, any more than it traces the points of an already established object. It rather finds itself in the midst

of actual forms, as well as virtual matters – a dynamic space. The diagram acts at the most abstract level of maximum possible connection, where, in making such connections, it promises to destroy or deform the actually existing forms and functions in new acts of creation. In modernist painting, the existing forms may or may not be visibly present on the canvas. But, at the start of the painting process, they haunt what only appears to be a blank and neutral canvas, possessing and steering the artist's hand like persistent, 'rational' spirits. They are what Deleuze calls the 'figurative givens' (61), illustrative and narrative clichés which domesticate painting, and thereby stifle it in its role of directly capturing reality. It is the task of the diagram to destroy these givens in a sort of exorcism and, in doing so, to plant the seed from which more vital figures may emerge.

There are, according to Deleuze, painters in the twentieth century whose diagrams succeed in destroying the figurative givens, and yet fail to achieve full intensity. This is either because they submit the manual and plastic form of painting to an abstract code of oppositional elements (this is the case with abstract painters like Piet Mondrian), or else because the manual mark sweeps away the optical, illusory space in a diagram which covers the *entire* painting, so that no new figure can emerge from it (this is the case with abstract expressionist painters like Jackson Pollock) (Deleuze 2005: 73–4). It is not that Bacon rejects 'abstraction'; it is rather that he utilizes abstraction, in the diagrammatic sense that I have been describing, as a means of harnessing intensive relations that underlie what is given in actuality. Bacon is not interested in abstraction as an end point (an abstract painting as either the result of formalist autonomy, or the index of an action), but as a moment in a process which aims to connect him and the viewer to life more viscerally. As he makes clear throughout his interviews with David Sylvester, Bacon's entire problem is one of resemblance: how to make 'a recording of the appearance' (Sylvester 2016: 46); how to go about 'reporting fact' (76). But the reality that Bacon wants to portray is opposed to the illustrative figure, or to narrative depictions of life, which may imitate the form or depict the situation, but which fail to capture the sensation or nervous experience of life (or certain intense moments of life). Bacon wants to capture reality directly at the level of the body, and so must avoid the mental mediation or rational organization of the material that can occur as much through narrative scenarios and familiar figuration, as through abstract forms. He says that painting has a capacity beyond photography to report fact, as it is able to 'unlock the areas of feeling which lead to a deeper sense of the reality of the image' (76). Crucial to this capacity is what we might call the *vital* or *nervous analogy* which Bacon draws between the deeper sense of lived reality he wants to depict and the auto-plasticity of paint. Because oil paint is 'such an extraordinary supple medium that you never do quite know what [it] will do' (Sylvester: 108), painting, unlike illustration, 'has a life completely of its own. It lives on its own, like the image one's trying to trap' [17]. It's as if the spectral 'figurative givens' were now to do

occult battle with vital forces emanating from the paint itself – a battle for control of the artist's hand. For these immanent painterly forces to win out, and true appearance to be recorded, a trap must be set – not only because (true) 'appearance is like a continuously floating thing' (136) but also because the figurative givens are powerful, and almost unavoidable. The trap is a diagram, or what Bacon calls a 'graph'. Such a graph is completely at odds with any rationalistic, organizing diagram, for example a system of perspective or geometric transformation, or Aristotle's 'overly loose mesh' which seeks to capture diverse reality by a method of identity and opposition, but around which 'the biggest fish pass by' (Deleuze 1994: 182). Fundamentally Bacon's painterly diagram involves the relinquishing of reasoned manual control in an 'accident' that distorts, deforms or destroys the illustrative figure, and through which new possibilities suggest themselves as ways to capture sensation in an image. 'Involuntary marks' are made 'out of sheer exasperation' – Bacon throws paint onto the figurative image which he has failed to avoid forming at a certain moment; or he scrubs out an area using rags or brushes – destroying the illustrative figure.² But 'by not knowing at all the marks I was making within the image – suddenly I have found that the thing comes much nearer to the way that my visual instincts feel about the image I am trying to trap' (60/2).

It is precisely through the tactical use of what Bacon calls 'irrational marks' that he is able to 'set a trap with which one would be able to catch the fact at its most living point'. But the irrational manual disturbances of the existing image is only the first (destructive) moment of a generative diagrammatic process. It is the moment of pause and consideration that follows, brought on by nervous connection to a sensual fact, that justifies the use of the term 'diagram'. In Bacon's words: 'the marks are made, and you survey the thing like you would a sort of graph. And you see within this graph the possibilities of all types of fact being planted' (63/5). Whilst the abstract, involuntary marks do not resemble a graph in any conventional sense, they offer Bacon a sense of alertness to possibilities – similar, in fact, to that which C. S. Peirce describes in respect to an iconic diagram open to logical transformations (see Part 1). In Bacon's case, however, the graph does not offer these suggestions to the mind, but to the nervous system. Bacon gives an example: 'if you think of a portrait, you maybe have to put the mouth somewhere, but you suddenly see through this graph that the mouth could go right across the face' (65). The mouth going right across the face may not resemble the subject in an illustrative or photographic sense, and yet it may 'capture' the vital or nervous reality of that person, or the intensive feeling one has about that person (these two aspects being, in effect, inseparable). It catches a more profound resemblance, one capable of unlocking 'all kinds of valves of sensation' in the viewer.³

The diagram operates as an agent of creative destruction in a two-part act. First, there is a deformation at a particular point on the canvas which, when surveyed, can be 'deeply suggestive or deeply unlocking of areas of sensation'

(65), sensations which the original figuration, still too illustratively 'realist', failed to attain. But secondly (as Deleuze is keen to point out), something has to emerge from the accident, so that nervous reality can be manifested in an image. The diagram is then, as Bacon describes his efforts, part of 'the construction by which this thing will be caught raw and alive' (76). For Deleuze, this second moment also pertains to the operation of the diagram and has to do with the fluid vitality of paint, and the modulating intensity of pure colour tones. As we will see, Deleuze accounts for this emergent process in terms of analogy.

Avoiding both Figurative and Abstract Form

For Deleuze, Bacon's diagram is a 'catastrophe', a violent upheaval whereby blind manual marks 'break up the sovereign optical organization' (71). The figurative forms have been destroyed in a chaos of irrational lines and colour patches: 'assignifying traits' of 'confused sensation' (71). For this chaos (born of frustration) to become a 'chaos-germ' (72), for the 'possibility of fact' to become a 'fact' (a mouth stretched across a face), the diagram must remain operative – you need to be able to get out of it; or rather the assignifying traits need to 'be reinjected into the visual whole' so that they may 'evolve into a Figure' (72).⁴ Gaining autonomy from their representational function, the manual lines and colour tones can take on an intensity that can be harnessed to manifest a sensation in a Figure, thus moving from confused to 'clear and precise' sensation (77).

The diagram is not the destruction of the figurative form itself, the scrambling of an area of the canvas – a face, a body. It is the pause, the act of surveying, that makes the irrational marks a diagram, to the extent that those marks open up possibilities to attain a higher degree of resemblance, a likeness which would be felt, or registered on the nervous system. If the painter remains at the level of the manual marks, by making the marks themselves the reality (Pollock), then resemblance – in cases where the image is not read merely formally – does not get beyond direct evidence of an action (the indexical sign). Alternatively, if the painter codifies abstract marks, homogenizes them in terms of rational binaries – horizontal vs. vertical lines, etc. (Mondrian), then the relations in the painting remain merely formal. In both cases, a new and vital resemblance cannot emerge from out of the painterly process. The diagram either becomes a rhythmic, manual one-to-one map covering the canvas entirely, or else the diagram becomes suppressed in an order system, digitized by manual means.

Deleuze, drawing on Gregory Bateson, claims that abstract painters such as Mondrian are dolphins, mammals whose bodies were adapted to streamlined

ocean living and were thereby forced to abandon many 'analogical' modes of communication pertaining to facial and gestural expression possible on land (137). Bateson is adamant that dolphins do not, on this account, escape analogical language, e.g. by developing an organized symbolic system of referential phonetic units. Whilst their vocal whistles and clicks may have been interpreted by some humans as constituting a syntax, they are in fact a vocal codification of an analogical function, which is not symbolic, but pertains to the immediacy of dependency relations amongst the group. If the pioneers of painterly abstraction do the same, it is because painting by its nature is analogical, 'the analogical art par excellence' (80). Abstract painting follows a logical, cerebral code, but it is neither geometry (there is no algebraic referent) nor an algorithmic transformation of a prior object (such as a Photoshop filter). Applied with a brush, Mondrian's manual painterly relations 'will pass through a code rather than passing through a diagram' (82). It will be an intrinsic code of formal (colour and line) relations.

Analogical Language

We can see how Deleuze takes his cue from Bateson to describe painting's analogical function. Mammals (although it is not limited to mammals) communicate kinesically and paralinguistically, through bodily and vocal signals such as tail wagging, muscle tension, eye movement, ears pricking up, hair standing on end, growls, flared nostrils, etc. (Bateson 2000: 370-1). This is what Bateson calls 'analogic communication', and it is 'primarily about the rules and the contingencies of relationship' (367). The great linguistic achievement of humans is, according to Bateson, 'the discovery of how to be specific about something other than relationship' (367). Human symbolic language, which Bateson calls 'digital communication', can refer to objects, people and events in the abstract. And yet, the invention of digital or symbolically coded communication 'has scarcely affected the behavior even of human beings' (367). A couple of examples that Bateson gives show how human language still pertains to relationships through analogic expression: someone tells you when the plane is scheduled to leave; someone tells you they love you. The first statement communicates clear, objective and useful information, and yet one can't help reading into it, and wondering what the speaker is *really* saying – not about the plane but about your relationship. The second statement is a clear declaration of the nature of a relationship, and yet *is it real?* You listen to the speaker's tone of voice, you 'read' their body language and the way it changes over time. Furthermore, you enter into a reciprocal communication which, beneath digital communication pertaining to objects, occurs on a level of the nervous system, and which involves mutually

determined modulation of bodily and vocal response and expression, perhaps letting 'instinct' get the better of you as sensations and affects erupt and enter into their own shifting relations (caution, distrust, anger, passion, embarrassment, shame, fear – although such terms only retrospectively communicate these embodied, analogical modes as symbolically communicable, linguistic objects).

Does analogic communication constitute 'resemblance by non-resembling means'; or, as Deleuze writes in *Difference & Repetition*, 'correspondence without resemblance'? For Bateson himself, there does in fact appear to be analogical or iconic ('diagrammatic' i.e. structural) resemblance to some degree. He gives the example of wolves, who are weaned off regurgitated meals when they are ready to hunt, by means of a technique common to the dog family: the adult clamps its jaws on the back of the puppy's neck and pushes it down. It was observed amongst a zoo pack that when an adult male wolf was caught mating with a female, the pack leader performed upon it the exact same action. Through this act, the leader 'does not "negatively reinforce" the other male's sexual activity. He asserts or affirms the nature of the relationship between himself and the other'; he does not say 'Don't do that', but rather 'I am your senior adult male, you puppy!' (Bateson 2000: 366). But how far does this diagrammatic or metaphorical iconicity in analogic language take us? If a dog growls and its growl grows louder, is the dog getting angrier? If my cat meows louder or more frequently, is she getting hungrier or more annoyed? How far must the wolf's head be pushed down; how many times? Bateson is sympathetic to the idea of a certain analogical correspondence, similar to the way an analogical computer functions (a certain physical measure or movement corresponding to the quantity being calculated or induced): 'the magnitude of the gesture, the loudness of the voice, the length of the pause, the tension of the muscle, and so forth – these magnitudes commonly correspond (directly or inversely) to magnitudes in the relationship that is the subject of discourse' (374). This suggests an indexical correspondence, whereby a sign (changing magnitude of a voice, pause, etc.) indicates the direct presence of an immediately corresponding physical cause.

We have made no leap to a new conception of the analogical if we are defining it in terms of structural similarity (adult is to puppy as leader is to wayward adult) or indexical correspondence (louder = angrier). Here we can return to Bacon, and his claim that, with his famous images of screaming Popes and screaming heads (e.g. *Study after Velasquez*, 1950), he 'wanted to paint the scream more than the horror' (Sylvester 2016: 57). For Deleuze, 'a scream no more resembles what it signals than a word resembles what it designates,' (80) and this is why the analogical cannot be opposed to the digital in terms of resemblance (resemblance vs. convention, or, in Peircean terms, the icon vs. the symbol). With Bacon, we do not see the horror, but we experience the nervous affect through an image of what it does to the head, body and mouth. Why doesn't the analogical function then pertain to an indexical resemblance indicating the direct presence of a

causal object? Again, Deleuze rejects the idea that what distinguishes a digital code from analogical communication is that the former must be learned. Why is this? Because ‘the analogical requires an apprenticeship as well, even in animals’ (i.e. not only in painters) (80). Which is to say that things are not clear cut when it comes to communicating physically about relationships. In contingent situations of continuously modulating signals, there can be no one-to-one correspondence between a relational ‘fact’, and the physical signal that fact produces. Relations are always a question of tentative, exploratory advances and withdrawals, modulated by the continuously fluctuating feedback of external signals and internal sensations which themselves may get overloaded or ‘set off’ as a type of ‘positive feedback’. One wolf may acquiesce when having its head pushed down so far, where another may ‘snap’ making a fight inevitable (and it may of course be the same wolf at different times). Perhaps silence, rather than a raised voice, is the measure of a person’s anger (but is it really a ‘measure’? Perhaps only sometimes, depending on the situation, and to different degrees). You do not necessarily scream louder the more terrifying the object that you are responding to is, or the more terrified you feel. Are we to infer from Bacon’s figure of the Pope that there is even sound at all, or have the vocal chords frozen in the face of horror? In any case, there is no way of telling what the scream is designating, either in terms of an external or internal object-cause, or whether it’s a scream of fear, despair, hysteria, etc. Evidently there is no horror depicted in the painting – it is not ‘sensational’ in that way, there is only a body distorted into a scream. If it does resemble at all (if there is in fact an analogical relation of some kind), it resembles neither iconically, nor indexically, but nervously, or sensually – on the plane of ‘sensation’; the scream as bodily spasm. The analogical function of paint is to make us feel, at the level of our own body, this sensation: ‘As a spectator, I experience the sensation only by entering the painting, by reaching the unity of the sensing and the sensed’ (Deleuze 2005: 25). A screaming body, such as the Pope’s, or, in the case of Cezanne, the body of an apple, appears on the canvas ‘not insofar as it is represented as an object, but insofar as it is experienced as sustaining *this* sensation’ (26) – i.e. the nervous spasm of the scream; the ‘appleyness of the apple’.⁵ What sustains the sensation, what defines the ‘aesthetic’ mode of analogy, or the analogical diagram, is a question of relations – not intelligible but intensive relations: relations on the canvas, and the relation between those relations and the relations determining the object to be sensed.

Resemblance by Non-Resembling Means

Deleuze compares painting to (analogue) photography to distinguish two versions of the analogical, one where resemblance is the producer, the other where

resemblance is the product. 'Resemblance is the producer when the relations between the elements of one thing pass directly into the elements of another thing, which then becomes the image of the first – for example, the photograph, which captures relations of light' (80). Despite all the claims made for the index as a way for abstract painters (taking photography as their model) to engage with the real as mute, uncoded evidence, and thus escape formalist composition without returning to representation,⁶ it would seem that, for Deleuze, the optical regime of resemblance is upheld. We can say that the engagement remains too passive – 'producer' referring in this analogical operation not to something active, but to the inevitability (within a margin of error) of the image produced: the isomorphism that holds between light *producer* (the object being photographed) and light receiver (the photographic film). To put it another way, a visual impression is recorded (like a fossil or something cast from a mould), but no 'fact' has been captured which pertains to a nervous intensity. By contrast 'one says that resemblance is the product when it appears abruptly as the result of relations that are completely different from those it is supposed to reproduce: resemblance then emerges as the brutal product of nonresembling means' (81). This abrupt appearance can be put down to the diagrammatic operation, the 'surveying' of the 'accident' or distorted area which suddenly reveals the possibility of stretching a mouth across the entire face, thus destroying the iconic resemblance but capturing, in that deformation, a trait that is closer to the lived reality of the person, or one's sense of the person. But this is only a 'possibility of fact', until resemblance emerges and is actualized. How such emergence occurs – that is the second stage of the diagram. To put it as a more precise question: what do the relations that enable non-resembling resemblance to emerge consist of, in terms of both the product (the painting or Figure) and the object to be captured (the 'subject' of the painting – a body or bodies, which, as we have seen relay the 'fact' of a certain nervous sensation)? What are the elements which connect, and how do they connect?

Capturing Forces

Let's start with the body. As Deleuze is keen to emphasize, Bacon criticizes his own earlier screaming Pope paintings for still implying a horrific narrative, even while he paints the scream rather than the horror. A narrative diminishes the power of paint, its living capacity to capture a force. This does not, of course, make Bacon a formalist; quite the reverse. Deleuze says that with painting, and plastic art and music more generally, 'it is not a matter of reproducing or inventing forms, but of capturing forces' (40). This is why Bacon is always talking about trapping facts alive. Forces condition sensations through exertion on a body, but

the forces themselves remain invisible. This does not make the sensation a passive index of the forces because 'the sensation "gives" something completely different from the forces that condition it' (40). What I feel has an affective reality of its own, and I may remain unaware of the forces 'behind' or 'beneath' the sensation. What is interesting is the way that the terms in which Deleuze talks here about sensation can apply equally to bodily and artistic sensation, the two senses in fact merging in the term 'aesthetic'. The painting wants to be captured too, to be a force and to unlock our 'valves of sensation'. But to do so – to be captured on condition of capturing forces – it must, so to speak, modulate its nets: 'How will sensation be able to sufficiently turn in on itself, relax or contract itself, so as to capture these nongiven forces in what it gives us, to make us sense these insensible forces, and raise itself to its own conditions?' (40).

How do forces press in on and deform a body? Cezanne, through his own analogical diagram, 'render[s] visible the folding force of mountains, the germinative force of a seed, the thermic force of a landscape' (41). Van Gogh constructs a diagram, capturing analogous intensities of nature by means of 'straight and curved hatch marks that raise and lower the ground, twist the trees, make the sky palpitate' (72). What of Bacon? Although his figures may appear, due to their disfigurement, to imply some torture or violence, they are in fact 'ordinary bodies in ordinary situations of constraint and discomfort' (xii); the 'violence', by which Bacon says he wants art to return him to life, signifying not subjects of horror but only nervous resuscitation. In the paintings, at least from the sixties on, a natural posture 'has been reorganized by the simple force being exerted upon it: the desire to sleep, to vomit, to turn over, to remain seated as long as possible . . .' (42). The wiping or rubbing of an area of the image is itself the application of a force generating the sensation of possibilities. These diagrammatic zones themselves then become 'forces of deformation' (44) by means of which sensation can 'turn in on itself' and render visible the forces which exert themselves on a body: 'the flattening force of sleep' (44), for example. The clear agitation of Bacon's heads and bodies comes not so much from movement in extensity, but from 'the forces of pressure, dilation, contraction, flattening, and elongation' which intensify and modulate a static body. As a 'zone of indiscernability' (42) the scrubbed zone disorganizes the body's structure, debones it, relaxes and contracts the flesh the better to make it receptive to living forces it can capture and 'give back' as a new sensation.

Here we see the 'aesthetic analogy' whereby a resemblance (of and in a body) is produced on canvas, not by means of iconic or structural similarity, but through a capturing of forces that induce a sensation (of and in a body). But what are the elements of Bacon's paintings and how do they relate in such a way that a Figure can emerge? Just as Bacon wants to depict 'figures arising out of their own flesh' (Sylvester 2016: 97), so he draws an analogy with the vital and semi-autonomous powers of oil paint whereby a brushstroke 'breeds another form that the form

you're making can take' (Sylvester 2016: 112). Analogy here is clearly a question not of representation but of parallel but asymmetric germinative structures.

Elements of Intensity

Throughout his book on Bacon, Deleuze is concerned to describe and analyze the relations that constitute the image. These relations are not structural but intensive; or, at least, they involve a modulation and deformation of a structure – they are 'structural-genetic' (Deleuze 1994: 184). At its most basic, there exists a *Figure* and a *field* (or 'material structure'). The Figure is a deformed piece of flesh, and the field is a flat plane of colour. But there is a third element that Bacon employs, and that is the round area or *contour* which encloses the figure or a part or parts of the figure. The contour (which has many analogues – rugs, sinks, stages, shadows – and is not always round) mediates between Figure and field, constituting a 'common limit' (4) where the two connect on the same plane, thus destroying the perspectival figure-ground relation, and ensuring only a 'shallow depth' can be achieved (for example, by the inclusion of hanging curtains or blinds in close proximity to the Figure). Bacon does not want to place figures *in* a space, as such illusionism would domesticate the bodies and diminish the paint's vital capacity. Bacon constructs what Deleuze calls (taking the term from the art historian Alois Riegl) a 'haptic' space (4), a frontal and close view where the eye is made subordinate to the hand, so that the field of colour does not exist 'behind' or 'beneath' the figure, but 'to the side' or 'all around' (4), like a relief. Given this haptic co-existence on a single plane, the contour is able to function 'like a membrane through which [a] double exchange flows' (9). This 'flow' brings to mind the 'curious' fluidity Bacon identifies as the capacity of paint to 'breed another form'. Indeed, the biological metaphor of the membrane suggests Deleuze's description in *Difference & Repetition* of the embryo or 'larval subject' who is able to fold in on itself and 'live the unlivable, to sustain forced movements of a scope which would break any skeleton' (1994: 215). It is the state of the body prior to organization (Deleuze 2005: 32).⁷ The movement in the case of Bacon's painting is a systolic-diastolic rhythm of mutual contraction and expansion mediated by the contour-membrane (20). 'In many paintings, the field is caught up in a movement . . . it curls around the contour . . . [and] envelops and imprisons the Figure' (10). In this act, the field dilates whilst the Figure is constrained in its cell. But in the next act (perceived simultaneously in a painting) the Figure expands towards a contracting field: 'the body . . . attempts to escape from itself by means of . . . a spasm' (11). There are, Deleuze goes on, 'scenes of love, of vomiting and excretion' where 'the body attempts to escape from itself *through* one of its organs in order to rejoin the field or material structure' (12).

There are other relations too, where elements confront and reciprocally determine one another, or are flattened into a common zone. The deformation that dismantles a face allows animals to emerge – not animal forms, but animal traits: ‘the quivering trait of a bird spiraling over the scrubbed area’ (16). What is indiscernible in the diagrammatic zone is the trait that may emerge to restructure the entire painting. This is one way in which distinctions between human and animal collapse or combine in a ‘becoming’. Another way is in the treatment of the body as meat. ‘Meat is the common zone of man and beast’ and ‘the chief object of Bacon’s pity’ (17). (Bacon famously wonders why it is not him that is hanging from a hook in the butcher’s window). But there is another dynamic relation or tension involved, because ‘Meat is the state of the body in which flesh and bone confront each other locally rather than being composed structurally’ (16). These are not the *extensive* organic relations of anatomy, but the *intensive* relations of opposing vectors operating in the fertile confusion of meat: ‘In meat, the flesh seems to *descend* from the bones, while the bones rise up from the flesh’ (the teeth being little bones which arise from the gums) (16). In Bacon’s many prone figures, a ‘raised arm or thigh is equivalent to a bone, so that the drowsy flesh seems to descend from it’ (17). Finally, and most crucially, it is colour, the relations between pure tones, that animate all the other relations and rhythms and make them resonate. Bacon gives loving attention to painting flesh, following the Post-Impressionists in using broken tones, which have the effect not only of manifesting an intensity of the body, but which are capable of forming a chromatic connection between the fields of one colour and the contours of another. As Deleuze writes, ‘The colour system itself is a system of direct action on the nervous system’ (37). This would then constitute a nervous analogy, connecting together, in the body of the viewer, the sensation of a body ‘out there’, with the sensation of the body of the painting.

Modulation

Let us now return to the analogical diagram, because if painting is analogical in the way Deleuze claims, that is to say, if it is concerned with intensive relations which affect us immediately and continuously, then this is due to the use of colour. It is Cezanne, according to Deleuze, who leads the way here with his analogical, rather than digital, geometry, and his application of pure, rather than mixed, tones. Cezanne wanted a geometry that was concrete (felt) rather than abstract, and a sensation that was clear and enduring rather than confused and ephemeral (as he considered Impressionist painting to be) (79). Cezanne’s diagram undertakes a collapse of figurative givens out of which emerges an indissoluble connection between geometry and colour (78). We know how a

certain tone of voice, or a modification or modulation in that tone, can 'touch a nerve', put one into a state of high tension or deep relaxation, or trigger all kinds of confused sensations, or else cause one to respond decisively 'on instinct'. In painting it is colours or colour relations that constitute the tonal frequencies that plug into the nervous system. But Deleuze first takes a sonic example as a way to get to grips with the analogical diagram – the example of analogue synthesizers. He starts by differentiating analogue from digital synthesizers on the basis that the first is modular whereas the second is integral. Whilst this is not strictly true (most analogue synthesizers are partly integral for practical purposes – there are set wave patterns, a piano keyboard, etc. – whilst still allowing for 'patching') the important difference is clearly stated: analogue synths 'establish an immediate connection between heterogeneous elements . . . on a [single] field of presence . . . whose moments are all actual and sensible'. Digital synths, by contrast, pass through 'a homogenization and binarization of the data, which is produced on a separate plane . . . and whose sound will only be produced as a result of conversion-translation' (81). The analogue connects difference immediately without separation; the digital translates via a homogenous code at a distance. Deleuze next moves on to synth filters, the function of which is 'to modify the basic colour of sound, to constitute or vary its timbre' (81). 'Digital filters proceed by an additive synthesis of elementary codified formants, whereas the analogical filter usually acts through the subtraction of frequencies ("high-pass", "low-pass". . .). What is added from one filter to the next are intensive subtractions' (81–2). It is these intensive subtractions, especially when several are in operation, that constitute tonal modulation. Effectively, by turning the 'voltage controlled filter' knob you are changing the point on the wave at which frequencies are cut off; whilst the 'resonance' knob allows you to amplify frequencies near the cut off.⁸

Colour Knobs

Returning to painting, Deleuze claims (with Cezanne particularly in mind) that, in so far as it is an analogue language, painting has three dimensions: the planes, colour and the body (82). The catastrophe of the diagram – the destruction of figurative and narrative representation – is precisely what liberates all three dimensions of painting. First, 'the connection or junction of planes . . . replaces perspective'. Second, 'the modulation of colour [subdues] relations of value, *chiascuro*, and the contrast of shadow and light'. Third, 'the mass and declination of the body . . . exceeds the organism and destroys the form-background relationship' (82). Here, with respect to each of painting's dimensions, we can see how the analogical diagram, if successful, operates in its *two* moments:

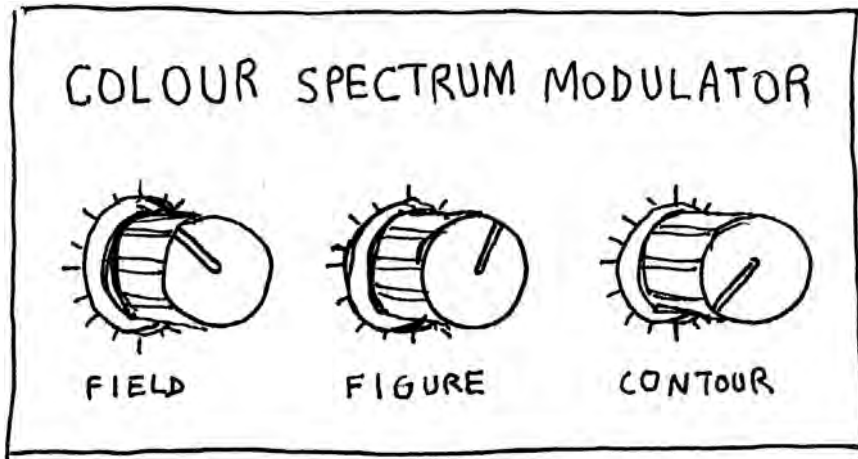


Figure 5.1 Colour knobs [Dean Kenning].

catastrophe (the surveying of a catastrophe), followed by the emergence of a more profound resemblance made possible by oil paint's vital capacity. First dimension: planes collide in the anti-optical chaos, but then 'maintain their junction' in a new, sensual structure. Second dimension: colour becomes confused when it no longer delimits or moulds objects, but then 'invents a new type of relief' through 'a juxtaposition of tints'. Third dimension: bodies fall, but then 'integrate the imbalance in a deformation' (83).

We might imagine, in place of brushes, three synthesizer knobs corresponding to paintings' three dimensions – analogue visual knobs that would i.) shift planar fields, ii.) juxtapose marks of pure colour, and iii.) deform bodies. But in fact, it would be better to make them all colour knobs. Why is this? Because it is colour that constitutes tone and modulates the dimensions and elements of the entire painting, performing an expansion and contraction through tonal relations of 'warm' and 'cool' colours; and establishing resonance between different areas of the image through the repetition of a colour from one area in another locality. It is colour, according to Deleuze, which 'must act as a variable and continuous mould'.⁹ This is not to say that the line or the contour is forsaken. The Figure is delineated, and the manual line prevails because sensation must be given clarity. But the line itself derives from colour, is a colour, including black, which (like white) is as much a colour tone as any other, with as much presence and autonomy: it neither traces a shape (to be 'coloured in') nor designates a shadowy backdrop (as Bacon's voluminous shadow contours confirm in their active presence). So, let's imagine a machine – the analogical diagram – with colour modulator knobs for each of Bacon's three major elements (see Figure 5.1). Each knob covers the entire tonal spectrum and all three operate immediately

on a single plane: the field knob, the Figure knob and the contour knob (the contour designating the common limit or cutoff whereby the Figure and the field resonate). When turned, these knobs affect the elements and their tonal sub units, contorting, combining and distributing them, scrambling regular configurations, pushing the image to the verge of entropic collapse.¹⁰ Collapse (abstract 'noise') is avoided by controlling these tonal knobs, or by manually and 'instinctively' responding (by means of another turn) in real time to what is happening at a nervous-sensual level when each knob is turned (what Bacon calls the 'continuous . . . fight between accident and criticism' (Sylvester 2016: 140)). In this way the possibilities opened up in the catastrophe zone can be reinjected into the whole as new structural and tonal relations are established and a sensual or nervous resemblance emerges.

Let us now consider how this machine would work with Hjelmslev's 'open net which casts its shadow down on an undivided surface'. For Hjelmslev, language seeks to capture meaning by laying its boundaries and dividing up the common continuum of meaning into discreet shapes. The analogical diagram would not produce a given set of shapes, or 'mould' discreet 'casts' for a second level of articulation, but would, as Deleuze says, 'establish an immediate connection between heterogeneous elements' through continuous modulation over time. We capture the image 'alive' when the 'net' (the form) is not separated from the surrounding matter or mass (just as the operations of an analogue synthesizer are not separate from the voltage that is actualized as sound). We turn the knobs and witness how the grids or grid shadows of the single net-surface are continuously squeezed and pulled at, contracting, expanding and distorting differently at different points and areas, with each grid and region of grids being affected by what is happening in neighbouring and more distant (but contiguous) zones.

Diagram of a Diagram

'The three elements of painting', writes Deleuze, 'communicate and converge in colour' (106). Let's illustrate this intensive modulation, actualized or 'captured' in a finished image (which yet 'lives'), by drawing a conventional diagram of Bacon's 1976 painting *Figure at a Washbasin*.¹¹ As argued in Part 1 of this essay, Deleuze is no more averse to drawing (graphic or, more usually, mental) diagrams than he is to drawing analogies as a means to describe and explore his ontology, allowing one to see its operation across many aspects of reality. If it seems paradoxical for me to make a black and white image to describe the aesthetic operations of colour, then this is entirely the point, and clarifies the difference between the intensive and the iconic diagram (see Figure 5.2).

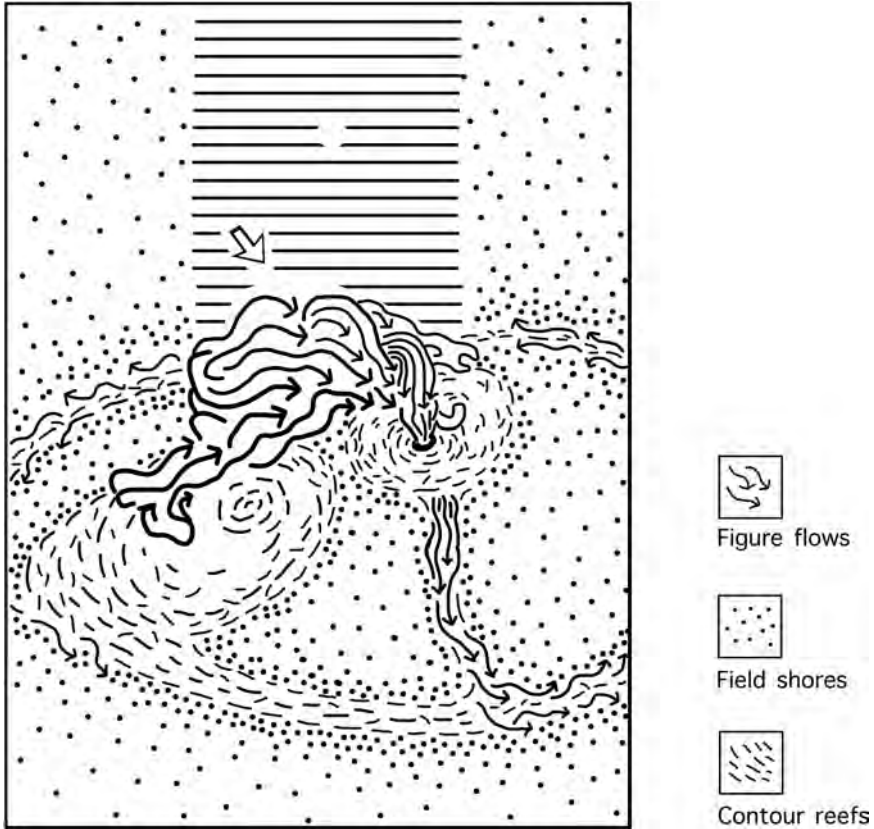


Figure 5.2 Figure at a Washbasin diagram [Dean Kenning].

A fleshy figure appears ready to vomit into a sink – gripping the taps to stabilize his spasmodic, retching body (there is even an arrow indicating the direction of force). He stands on a slightly raised crimson oblong (a mattress or rug?) which is combined with a black oval (like a second plughole) and crumpled bits of newspaper (Bacon applied jumbled transfer lettering to achieve an indiscernible clarity). The sink is plumbed in (another piece of newspaper lies beneath) and the pipe appears to extend two ways to form a large white curve which wraps itself around the crimson platform and round the back of black blinds which hang behind the figure and from which emanate a few yellow rays of electric bulb light (the blinds establish a shallow depth). A monochrome ochre ground spreads across the canvas.

Deleuze follows Marc Le Bot who utilizes a watery terminology to describe *Figure at a Washbasin*. Deleuze uses this imagery (which is consistent with Bacon's comments on the liquid vitality of oil paint) to describe the modulating

function of colour in Bacon's work in general. Taking Bacon's three major elements, Deleuze says that the Figure is a *flow*, the field is a *shore*, and the contour is a *reef* (102). Bacon's fleshy bodies are not modelled in shades with blended colours but consist of broken tones which retain their integrity and generate sensual relations of chromatic variation which move with a pulsating rhythm of contraction and expansion (Bacon follows Van Gogh in achieving a kiln fired ceramic intensity through the use of broken tones). The field consists in a bright monotone. 'The whole problem of modulation', writes Deleuze, 'lies in the relation between the two, between the fleshy matter and the large uniform panels' (99). The contour, which is not 'coloured in' but is rather determined by colour, and which marks the limits of field and Figure, acts as 'a coloured pressure that ensures the Figure's balance, and makes one regime of colour [broken tones] pass into another [bright monochrome]' (106). In *Figure at a Washbasin* the contour of the red rug is repeated, first, in the white sink which encloses the figure's head (like a halo), and second, in the curvilinear white pipe which cuts across the ochre field. The Figure contracts in a retching spasm to escape its own body, to squeeze headfirst through the plughole, becoming liquid, before expanding into the field via the curvilinear piping. The field takes the opposite route and makes the complementary motion, expanding to encircle the Figure via the large contour then wrapping itself around it in a tightening squeeze. But how does this work in terms of modulation? The chromatic variation of broken tones in the Figure (pinks, whites, ochres, blues and reds) makes the meat flow. But these tones also resonate with the other elements, marking a passage from the red reef upon which the Figure stands, to the broken blues of the inner part of the sink, a second reef towards which the Figure is heading (the pure white of the sink's edge and the curved piping resembling bones that ascend as the meat flows down). The ochre tones of the Figure are repeated in the ochre patches on the white of the third contour-reef, which wraps itself around the other two contours. And the ochre tones of both Figure and contour act as zones of proximity for the pure ochre field, connecting them and making the field resonate, constituting a virtual dissipation of the body in the field, or a coagulation of the field in the body. The diagram ensures that, as Deleuze put it in *Difference & Repetition*, a Figure 'participates in the ground all the more violently in that it distinguishes itself from it without the ground distinguishing itself from the [Figure]' (1994: 29). Singular nervous Figures emerging from one and the same pool of flesh.

Notes

- 1 In *Foucault*, Deleuze describes the relation between content and expression – what, in the case of the disciplinary diagram he calls 'the visible' (the prison) and 'the

- articulable' (penal law) – as a 'mushy mixture' (2006: 33). The elements of content and of expression which constitute the operations of power, do not cohere (one neither manifests, not represents the other), but intermix in unforeseen and amorphous ways, remaining on separate planes in the midst of a common social field of forces.
- 2 'I just wipe it all over with a rag, or use a brush or rub it . . . or . . . throw paint . . . to break the willed articulation of the image, so that the image will grow, as it were, spontaneously and within its own structure, and not my structure' (Sylvester 2016: 181).
 - 3 Bacon speaks of the way an Old Master painting he views at the National Gallery 'unlocks all kinds of valves of sensation within me which return me to life more violently' (Sylvester 2016: 161).
 - 4 Deleuze adopts the term Figure (with a capital 'F') from Jean-François Lyotard as a way to distinguish Bacon's non-representational, non-narrative figures from figurative (with a small 'f') works which conform to the clichés of representational and narrative relations. Abstract painters, by contrast, overcome these 'figurative givens' by avoiding the figure altogether (Deleuze 2005: 2).
 - 5 Deleuze (26) takes this quotation from D.H. Lawrence's essay on Cezanne.
 - 6 See Krauss 1977.
 - 7 The reference is to Antonin Artaud's 'body without organs' – a constant point of connection for Deleuze, including to the discussion around non-symbolic, analogic language, which Artaud manifests with a nervous intensity in his Theatre of Cruelty.
 - 8 This enables, for example, wah-wah effects, or the creation of much-used spatial dynamics when music seems to come 'into focus' as if, hearing muffled or 'distant' sounds from a corridor, you'd opened a door and entered a room where the music is playing. For a practical guide to typical analogue synth controllers that you can (digitally) try out, see https://www.joelstrait.com/what_all_those_knobs_on_your_synthesizer_do/
Deleuze's book was first published in 1981, on the cusp of the major popular shift from analogue to digital synthesizers.
 - 9 A profound influence on Deleuze is Gilbert Simondon and his critique of Aristotelian hylomorphism – physical reality conceived as a forming or moulding which acts upon passive matter. The first chapter of Simondon's book on individuation (originally published in 1964) covers many of the concepts Deleuze is grappling with here in terms of painting, and in other places: modulation, deformation, force, becoming, resonance, etc. See Simondon 2020.
 - 10 As painting, unlike sound, is actualized over time in spatial rather than temporal extension, we'll need to add a location and area size mechanism – perhaps a joystick with button – to specify local zones of the image for modulation, fixing and release.
 - 11 A digital image of the painting can be found at <https://www.francis-bacon.com/artworks/paintings/figure-washbasin>

6

INTERSECTIONS BETWEEN ART, DIAGRAMS, TIME AND TECHNOLOGY

Mary Yacoob

Introduction: Visualizing Time

This chapter considers the ways in which artists and graphic designers have deployed the properties of diagrams to visualize time or temporal processes. The ways in which diagrams can assist the schematization of sequential, speculative or simultaneous conceptions of time will be discussed with reference to three examples in a range of media. The album cover for *Unknown Pleasures* (1979) by the band Joy Division, created by the graphic designer Peter Saville, features an appropriated diagram of pulse sequences from a pulsar. The work presents an opportunity to discuss the relationship between clarity of information and the creative possibilities presented by ambiguity and associative images. The ink drawings of the artist George Widener combine calendrical charts with schematics of machines and drawings of cities, in works that foreground connections between time and space. Widener's artworks encompass predictions about future events and speculations about time travel. The artist Ami Clarke's artwork incorporates simultaneous displays of multiple live data streams relating to the interactions between financial speculation, social media, and the environment.

These works will be considered in the light of the art historian Susanne Leeb's observations about the use of diagrams as a means of expression in Western twentieth- and twenty-first-century culture as a reflection of the influences that technological developments have had on modern subjectivity (2011: 41). A theme that emerges is the relevance of science fiction to imaginative engagements with diagrams in an age of rapid technological change.

Elements of cognitive research will be used to identify and analyse how diagrams can communicate ideas and activate interpretative encounters in the visual arts. This chapter references the cognitive psychologist Barbara Tversky's working definition of a diagram as 'an arrangement of marks on a virtual page (stone, paper or screen) that represents a set of ideas and their relations', a definition that includes graphs, charts, models, visualizations, and other graphic representations (2017). Tversky explains that visualizations of any kind, including artworks, artefacts, maps and diagrams, are means of externalizing thought. They reflect and affect thought and they facilitate revision, contemplation and communication (Tversky 2014: 99).

Unknown Pleasures: 'Like "clocks" dotted throughout the galaxy'

As Tversky argues, the intention to communicate clearly can clash with the intention to encourage inference and discovery. Clarity in a diagram may encourage a single interpretation, whereas ambiguity may encourage multiple interpretations and avoid fixity of thought. For example, designers may prefer ambiguous sketches in the preliminary stages of a project in order to encourage perceptual and conceptual engagement, reconfiguration, and the associative leaps that lead to new discoveries (Tversky 2017).

An example that can be used to discuss the relationship between clarity and ambiguity is the diagram used for the cover of the *Unknown Pleasures* album. The original diagram was designed by radio astronomer Harold D. Craft Jr. and was included in his 1970 doctoral thesis at Cornell University which, in turn, was based on his work as a graduate student at the now-closed Arecibo Observatory in Puerto Rico (Craft, personal communication, 2023). The diagram charts a series of radio signals from the first pulsar discovered. Originally designated CP 1919, the pulsar was detected in 1967 by the astrophysicist Jocelyn Bell Burnell. Pulsars are rapidly rotating neutron stars which are formed when stars of a certain size catastrophically explode. Their magnetic field and rotation cause them to emit radio beacons which can be recorded by radio telescopes.

Emphasizing the relationship between time and the observation of pulsars, Bell Burnell says:

Pulsars are visible because they swing a beam of radio waves around the sky, a bit like a lighthouse, and when that beam shines at a radio telescope, you pick up a very accurate pulse, pulse, pulse, pulse – like 'clocks' dotted throughout the galaxy.

WALSH n. d.

6.7: *Successive pulses from the first pulsar discovered, CP 1919, are here superimposed vertically. The pulses occur every 1.337 seconds. They are caused by a rapidly-spinning neutron star.*

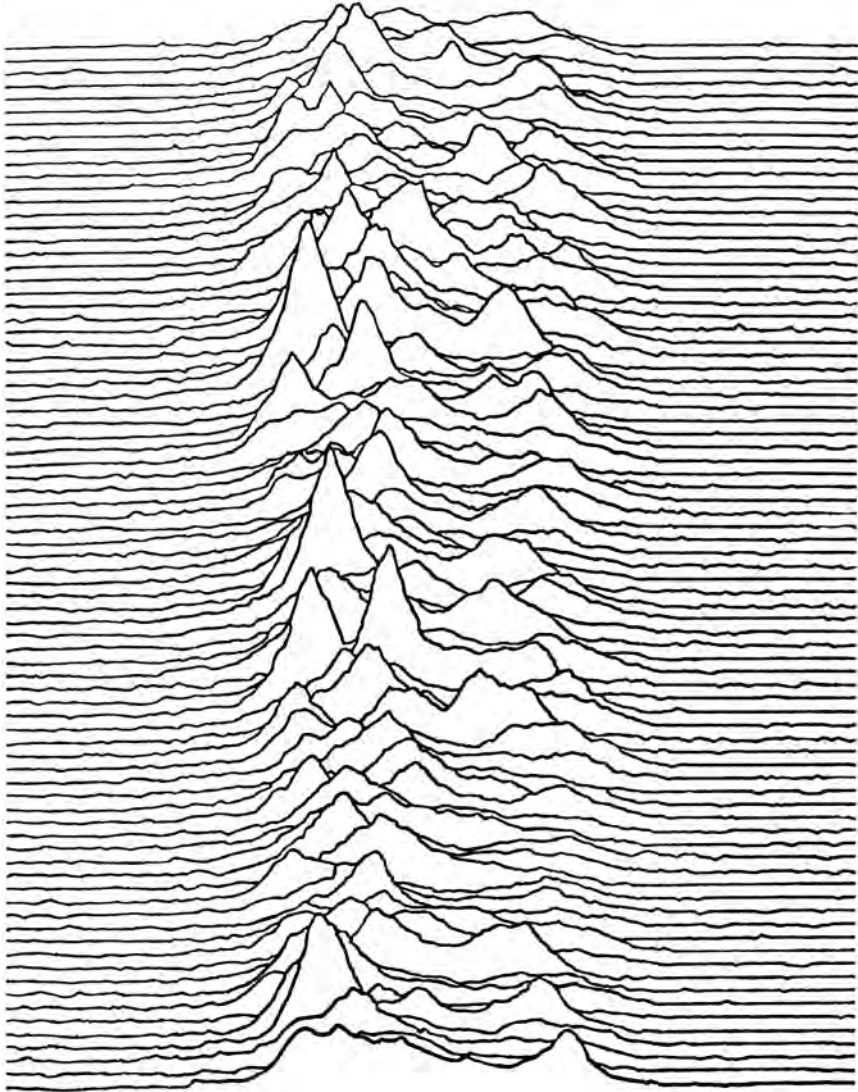


Figure 6.1 *Successive pulses from the first pulsar discovered, CP 1919, Harold D. Craft Jr., The Cambridge Encyclopaedia of Astronomy, 1977. All rights reserved.*

The diagram was included in *The Cambridge Encyclopaedia of Astronomy* in 1977. The text accompanying the diagram explains that CP 1919

is a radio source which flashes regularly every 1.33730 seconds with each flash lasting only 50 milliseconds. In fact, the flashes are so regular that the pulsar could be used as a clock that is accurate to one part in a hundred million.

MITTON 1977: 111

In semiotic terms, in the sense defined by Charles Sanders Peirce, the diagram is highly indexical in that the shapes of the inscribed lines are visual translations of the radio signals. Electrical signals were converted into a stream of numbers with magnitudes that corresponded to the strength of the signal, and so each line is a graph of the strength of the signal as it varies with time (going from left to right) received from the pulsar (Craft, personal communication, 2023).

The stacked plot of lines directs attention to the sequential nature of the phenomena being observed. The arrangement of lines, one above the other, shows variations within the overall configuration, so that the patterns between the pulses can be grasped in a single image. This was an important aspect of the research, as Craft was seeking to find out if specific features within a pulse repeated in subsequent pulses. He and his colleagues, such as the astronomer and astrophysicist Frank Drake, were questioning whether there might be ‘drifting sub-pulses within the major pulse’ that might explain the physics of what was causing the emissions (Christiansen 2015).

Visualizations can offer more immediate forms of communication than purely linguistic descriptions. Tversky explains how sentences are linear means of communication that unfold over time. Diagrammatic form can communicate salient features in a way that would be much harder to convey by linguistic means. Words and numbers are symbolic and rely on prior knowledge for us to connect words and meaning. In contrast, images, such as pictures or diagrams, rely on resemblances between sign and signifier, and can therefore provide more direct, intuitive and immediate means of communication. Tversky (2017) says:

Because diagrams use marks and place to represent thought that is literally or metaphorically spatial, they convey knowledge more directly and efficiently than strings of words that bear relations to meanings that are primarily arbitrary. Thus making sense and making inferences are often faster and more productive from well-designed diagrams than from language.

Craft’s process of designing the software that generated the diagram can be said to indicate a tension between aesthetics and clarity in the design of diagrams. He describes an earlier iteration of the diagram that was abandoned

in favour of the version that appeared in his PhD thesis and *The Cambridge Encyclopaedia of Astronomy*:

I also wrote a program that, instead of having these lined up vertically like this, I tilted them off at a slight angle like that so that it would look like you were looking up a hillside – which was aesthetically interesting and pleasing, but on the other hand, it just confused the whole issue.

CHRISTIANSEN 2015

As Craft explains, in the earlier version of the diagram he experimented with the aesthetics of the image. He enjoyed the computing challenge and was curious about how things would look from a different perspective. He shifted each line by a number of data points to the left, so that the lines would appear one above the other on a diagonal slant across the page, with the angle of the slope depending upon the number of data points that were shifted. This gave the diagram the appearance of a ‘hillside seen from a distance’. He subsequently decided to omit the diagonal tilt from the version he included in his PhD thesis because it did not reveal anything new and because the diagonal slant made it more difficult to spot patterns between the pulses (Craft, personal communication, 2023).

The visual metaphor of a hillside, nevertheless, is still a strong feature of the vertically stacked version of the diagram that appears in his thesis. The connotation of hillsides implicitly creates a parallel between cosmological and geological timescales. It facilitates the visualization of otherwise invisible natural phenomena such as radio waves by associating them with the more familiar visual languages of landscapes. Craft’s program generated an image in which areas are blocked out if the ‘hill’ in front of them is high enough (Christiansen 2015), giving this schematic of radio waves an impression of a three-dimensional perspective of space.

Craft’s work took place at a time when radio astronomers were transitioning from analogue to rudimentary digital technology (Christiansen 2015). Nevertheless, analogue drawing techniques were adopted for the dissemination of the diagram. The image from the plotter was re-traced by a draftsman in the space sciences building at Cornell University. Black ink was used to produce darker lines that would reproduce better in print (Christiansen 2015).

The major alteration Peter Saville made to the diagram’s appearance was to print the image in negative. In Saville’s iteration, white lines stream against an expanse of black background, recalling the diagram’s relation to deep space. This theme of transmission across deep space is echoed in the images and title used for the seven-inch single version of Joy Division’s *Transmission* (1979), also designed by Saville, which features a photo of the Orion Nebula on the front, and an image of a powerful electrical discharge on the reverse.

In his work for the *Unknown Pleasures* album cover, Saville removed the caption from the diagram's original entry in *The Cambridge Encyclopaedia of Astronomy*, which appeared as follows:

Successive pulses from the first pulsar discovered, CP 1919, are here superimposed vertically. The pulses occur every 1.337 seconds. They are caused by rapidly spinning neutron star.

MITTON 1977: 111

The removal of this information means that the diagram can no longer serve its original purpose of conveying the collection, filtering and structuring of data. Taken out of its original context, the diagram is transformed into an ambiguous visualization.

The front cover exhibits a minimalist approach to design and is free of any other information, contributing to the image's mysteriousness and interpretative



Figure 6.2 Peter Saville with Joy Division, *Unknown Pleasures*, Joy Division, 1979. All rights reserved.

potential. The typographic representation of the band's name and of the album title appear on the back cover. The white text on black background is formatted so that it takes the same position as the image on front, as if the text mirrors or decodes information about the image. Both front and back cover designs are centrally placed within a large black space, further conveying a sense of isolation.

Saville's work encourages the formation of multiple interpretations and imaginative projections. Collections of marks combine in the mind to form the perceptual objects which convey real meaning. The artwork connects experiences of landscape and of biological processes with emotional experiences of alienation, of awe and of the sublime, induced by the immensity of space and time. Visualizations of radio pulsars also recall the pulses of heartbeats displayed on cardiac monitors, and representations of sound waves. Networks of associations may be catalysed when we engage with a visualization, even one we do not fully comprehend. Saville says, 'I was aware how a single image could evoke an entire train of thought' (Lipez 2019).

The diagram was in fact chosen by the band who, as Saville says, recognized it as an 'enigmatic symbol' for the record cover (Klotz and Besseling 2012). Used in this way, the diagram communicates aspects of the emotional and intellectual tenor of the music, and the cryptic nature of the lyrics, which imply themes such as claustrophobia, longing, illness, vulnerability, hope, love, suffering, shame, reality and dreams. The album was written in the context of a British post-industrial landscape scarred by unemployment and rapid social and economic change. The artwork can be said to be transmitting a form of knowledge about the experiences of people from a particular time and place, as opposed to the kind of scientific knowledge it was originally intended to convey. The music journalist Paul Morley links the music of *Unknown Pleasures* with the zeitgeist of the city:

It was almost like a science fiction interpretation of Manchester. You could recognise the landscape and the mindscape and the soundscape of being in Manchester. It was extraordinary that they'd managed to make Manchester international, if you like. Make Manchester cosmic.

GEE 2007

Morley's comment highlights the aptness of using a schematic of the cosmos as an emblem for this music, on to which both personal and social narratives can be projected. Band member Bernard Sumner echoed the science fiction associations:

In Joy Division, I had insomnia and stayed up very late. I was building synthesisers – they took months to build, soldering all the components, and I'd have *2001: A Space Odyssey* playing in the background. If you take the obelisk out of that movie, it has that same black shape.

RADIO X 2020

In *2001: A Space Odyssey* the mysterious monolithic entity, like a pulsar, also transmits signals through deep space. Sumner's associative leap could be extended to loudspeakers transmitting messages across a space. The film's director, Stanley Kubrick, explains that the monolith was imagined to have been programmed to signal humanity's first steps into the universe. He likens it to a 'kind of cosmic burglar alarm', created by ancient and highly advanced extra-terrestrials who search for other beings and seek to advance their evolutionary progression and the development of their technology (Gelmis 1970: 396). Kubrick says the monolith is 'something of a Jungian archetype, and also a pretty fair example of "minimal art"' (Gelmis 1970: 170, 398).

There are additional science fiction references in Joy Division song titles, such as *Atrocity Exhibition* (included in the album *Closer*, released in 1980), which takes its title from a novel by J. G. Ballard.¹ The novel explores the psychological impacts of relationships which are mediated by new media technologies. Ballard's novel includes a section about quasars, some of which also emit radio waves. The passage indicates the impact on the imagination of new technologies in radio astronomy. Ballard questions whether radio waves from space may constitute a kind of music or a form of meaningful communication:

The time-music of the quasars. A huge volume of radio signals reaches this planet from space, crossing gigantic distances from the far side of the universe. It's hard to accept that these messages are meaningless, as they presumably are, no more than the outward sign of nuclear processes within the stars. Yet the hope remains that one day we will decode them, and find, not some intergalactic fax service, but a spontaneously generated choral music, a naive electro-magnetic architecture, the primitive syntax of a philosophical system, as meaningless but as reassuring as the pattern of waves on a beach.

BALLARD [1969] 2014: 36

As the writer and designer Matthew Robertson explains, until the mid-nineteen eighties, Saville's broader practice included the appropriation of images from art historical and technical or scientific sources (2006: 15).² Addressing the semiotics of communication design, Saville discusses using the codes to be found in one image and applying them to another context. Some of the 'qualities or spirit' of the original source are retained (Wilson 2003: 31). However, the image's recontextualization generates a new set of relationships. In the case of the *Unknown Pleasures* artwork, the image forms a complex set of relationships with the music, with the band, and with their cultural and social context. As Leeb writes, artistic explorations of diagrams can be less about communicating rational procedures than about creating a constellation of relationships (2011: 41).

The *Unknown Pleasures* cover design represents a time and a set of conditions that afforded Saville an unusual measure of creative freedom as a designer. Saville notes that graphic design is usually an articulation of someone else's message and is dictated by the marketing strategy of the employer. However, the album's publisher, Factory Records, were reluctant to impose design briefs. Tony Wilson, co-founder of Factory Records, saw the label as a 'laboratory in popular art', and was keen to promote the design of beautiful artefacts as a means of communication with its public (Robertson 2006: 10–11). This philosophy enabled Saville to work with a degree of creative freedom more commonly associated with that of a fine artist, rather than a graphic designer.

The cover of *Unknown Pleasures* points to the emotional and symbolic meaning of the music in oblique ways. The unique way in which this music and this design worked together, contributed to the powerful influence that the cover has had on popular culture (Robertson 2006: 10). As Robertson writes:

Saville talks about a 'hearts and minds' theory, the proposition that design was able to cross over into the consciousness of a new generation via popular music. The music inspired a more direct and passionate and physical response, while the design suggested a lasting cerebral dimension. (2006: 13)

The *Unknown Pleasures* album cover has become 'a pre-digital meme' that has been reappropriated in a plethora of unofficial merchandise, such as T-shirts, posters, tattoos, shoes, bags, etc., and as such, the artwork is an example of the porous cultural boundaries between music, fashion and science. As Saville says, the design can be likened to a kind of palimpsest or template, which 'people continue to interpret in either deeply serious, melodramatic, or quite comic ways. It's the endless possible interpretations of this diagram that makes it so powerful and useful for something like an album cover' (Klotz and Besseling 2012).

The album cover can be seen as an example of how diagrams have escaped the confines of their disciplinary fields and entered into dialogue with wider cultures. In Saville's practice, imagery drawn from scientific diagrams, computer and machine technologies, electrical discharges, etc., indicate how the visual cultures of scientific research and of new technologies have informed developments in creative expression. Indeed, Leeb argues that diagrams in twentieth- and twenty-first-century artworks signal a modern subjectivity in which 'body and technology, desire and scientific rationality' interact (2011: 41).

The Times of George Widener

The artist George Widener's drawings combine diagrams of ships and planes, aerial drawings of urban plans, number squares, tables, calendars, and lists of dates. Widener collects facts about the past to make predictions about the future. His drawings question our relationship with time and fate. Widener says, 'I've been interested in disasters as an anthropology project of sorts' (2017). For example, in *Sunday's Crash*, Widener's searches for the patterns in the dates of plane crashes that have occurred on a Sunday to predict on which Sundays in the future we should avoid flying.

Widener's drawings seem to propose that mathematics can unlock the secrets of how historical events unfold. His search for patterns in historical dates is perhaps connected to his experience of using his pattern recognition skills to analyse imagery whilst working in the U.S. Air Force as a young man. Widener's practice reflects how artworks can adopt diagrammatic and mathematical strategies and methods of enquiry borrowed from empirical disciplines to propose speculative or unreliable forms of information. Some of Widener's artworks are inspired by the connection he feels with the dates of certain historical events. For example, a series of drawings investigate the Titanic, the British passenger liner that sank in 1912. In some works, he catalogues the supplies held on the ship. His personal connection with the Titanic was reinforced when he discovered that his namesake died in the tragedy.

Blauer Montag (Figure 6.3), which translates as 'Blue Monday' in English, is a work created in 2006. It is one of a series of drawings that are reminiscent of engineering blueprints. The work can be said to both utilize and subvert linear notions of time. A drawing of a ship appears over a sea of blue text and numerals which list the dates on which a Monday will fall over a one-hundred-year period.

Widener describes how he visualizes the phrase 'blue Monday', having seen the term in some literature: 'what I was seeing in my head constantly was the different "Mondays" in the colour blue. There's 52 Mondays in a year, so 5200 Mondays in a Century or nearly 15 years of pure Monday' (Henry Boxer Gallery 2009: 30). This approach can be seen as a playful means of compressing notions of time, or of creating connections across time through calculations. This is illustrated in two 'magic squares' which appear on the side of the ship. The large numbers in each box add up to the same total if counted along any column, row or diagonal. The boxes also include the dates on which the days of the week fall on a Monday. These number squares can be seen as alternative calendars, or as subjective means of reckoning time.

Widener comments upon on how the phrase 'blue Monday' relates to the emotion people may feel on a weekly basis upon their return to work after the weekend break. He says, 'if it gets too blue I'll just get on a ship and get out of there' (Henry Boxer Gallery 2009: 30). The title of Widener's drawing connects

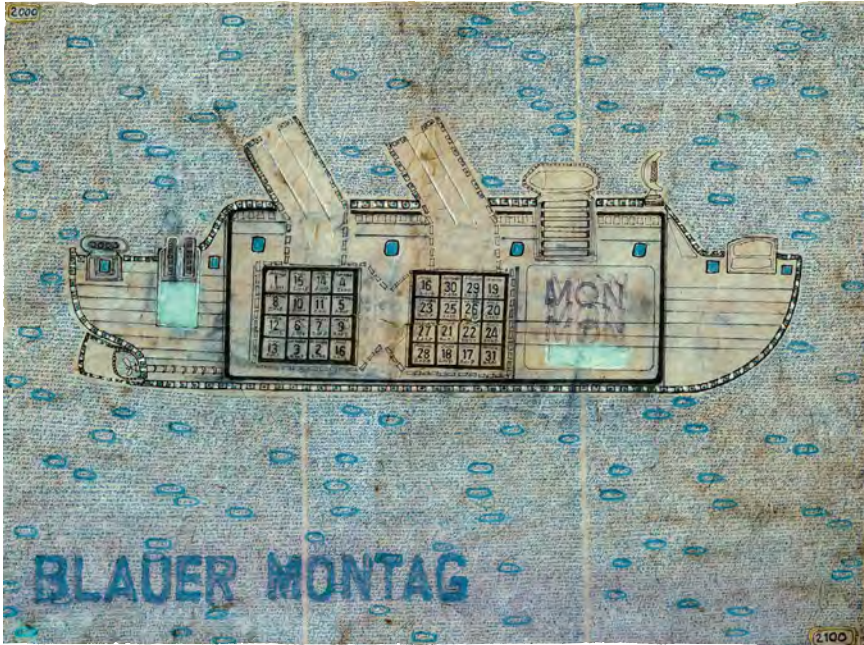


Figure 6.3 George Widener, *Blauer Montag*, ink on paper, 17 x 15 inches, 2006, abcd collection. All rights reserved.

the experience of weekly routines with the laborious activity of listing the dates and circling the years from the year 2000, which appears on the top left, to the year 2100, which appears on the bottom right. In this way, the work combines a meditative and gestural response to time with an imaginary means of escape.

Diagrams are a ‘privileged’ form of visual communication in that they can include words and symbols as labels and annotations to elaborate ideas (Tversky 2017). In Widener’s works, annotations can serve to connect schematic drawings of machines to projections about the future. For example, in *Blue Monday (Reversal)*, a drawing of a ship is combined with calendrical tables. The word ‘SING.U.CLARITY’ is written at the top. This play on words alludes to Widener’s interest in the singularity, his prediction of a future, around the mid-point of the twenty-second century, when machines have developed to the extent that they have become intelligent. He speculates that his drawings may become a resource for, and a means of communication with, these beings (Bellos 2013). In this sense, his drawings can be seen as a form of science fiction in which the artist prefigures a society with which he attempts to connect.

Widener’s drawings explore the spatial aspect of his calculations. He says, ‘these things, they have space, they have numbers. I think the way I see calendars sometimes, it’s like I take the space and divide it up’ (Decharme 2007). For

example, if the numbers of the year 1771 are reordered so that they read 7117, a relationship is created between two years, and Widener mentally calculates that the days of the week shift by one day. This is visualized in his mind as a shift of one place to the side (Newkirk 2011). Widener's advanced ability to visualize and spatialize complex calculations in his mind is rare, which is why people externalize and manipulate calculations in written or diagrammatic form. Recalling his childhood, and referencing the issue of neurodivergence, Widener says:

Functional MRI have shown that my brain is wired slightly differently; it seems to have unusual activity that results in some innate math, memory, and drawing skills. I've calculated dates and specific number systems since I was a child. I'd see common numbers around me (a license plate, a house number) and immediately transform them into dates.

RICCO/MARESCA 2022

The artist explains how his mental visualizations of time as spatial structures are tested in conscious mathematical calculations and then externalized in artworks:

Dreams and subconscious images of time would always be proved correct by conscious calculations. I saw time in my subconscious as a geometric form or a crystalized structure. Ever since, my work has attempted to convey these visions.

WIDENER 2017

Widener connects the externalization of his ideas in artworks with his wish to communicate with other people, something that became important to him following a period of relative isolation. Underlining the crucial role that images and diagrams play in the formation of communities and the social transfer of ideas, he says, 'it took me time. I learned the artwork is an outlet for me to socialise and interact with people' (Newkirk 2011).

The surfaces on which the artist draws reference their theme of time. Glued together paper napkins are stained with tea and coffee to give them an aged appearance. These are then drawn on with ink pens. This choice of material reflects his memories of an earlier stage of his life during which he lacked paper on which to work (Decharme 2007).

As the art historian Roger Cardinal says, the logic behind Widener's workings is often cryptic. Widener's work can encompass both a tragic sense of the human condition and a wry sense of humour (Cardinal 2005: 46). Whether we relate to Widener's works in aesthetic, psychological, narrative or experiential registers, his works draw attention to imaginary or subconscious relationships with time. Widener says:

There is a time shape shifting of sorts, a going back and forth, that always exists in my work. I believe that this is not an uncommon experience and that many people have either a past life experience or a subtle remembrance of the unfamiliar. Time travel, different realities, parallel universes seem to be embedded within our human experience. So perhaps, even if the calculations in my drawings are too complex to be understood, the subject matter of my work is embedded within every individual's subconscious.

WIDENER 2017

In a drawing called *V.A.L.I.S.*, created by Widener in 2014, two calendar tables loom in the centre of a city plan. Their central placement indicates their importance. They are framed in fractured heavy black lines, as if abstract numerical data have taken expressive and material form in the shape of skyscrapers.

If the main part of the drawing is akin to an architectural illustration rather than a diagram, Widener includes diagrammatic components in the form of arrows, demonstrating how elements of diagrammatic practice have extended into artistic practice in the visualization and materialization of thought. Arrows are included in Tversky's definition of what she terms 'glyphs', 'abstract geometric forms, notably dots, lines, boxes, and arrows that derive meanings from their geometric and gestalt properties and convey meanings that are readily understood in context' (2017). Tversky writes that glyphs are commonly used in diagrams to facilitate the communication of ideas that are difficult to convey by likeness (2017). They can show relationships and organize by theme or category (2014: 99, 108). The forms of glyphs are not arbitrary, their geometric properties are grounded in our perceptual relationship with the world. For example, arrows in diagrams reference the ways in which wooden arrows travel in the direction they point. Pathways look like lines from a distance, and buildings may look like dots in the distance (2014: 108–110).

Tversky explains that cognitive research has revealed that whereas labelling parts of a diagram can elucidate structure, arrows can elucidate changes over time. Labelling can clarify the spatial arrangements of parts of a system. Arrows can convey information about direction, movement, causality, sequence, the behaviour of a system or processes in action (Tversky 2017). In *V.A.L.I.S.* (Figure 6.4), a calendar table on the left represents the year 1974 as well as its numerical opposite 4791. The two dates are connected by red arrows pointing in both directions, suggesting that time can travel forwards or backwards, or that time is interwoven.

In *V.A.L.I.S.*, underneath the calendar on the right, the palindromic date 20.02.2002 is inscribed, with arrows connecting the first and last number of the date, reflecting Widener's interest in numerical reversals and symmetries that have causal relationships with the material reality of the city. The drawing conjures

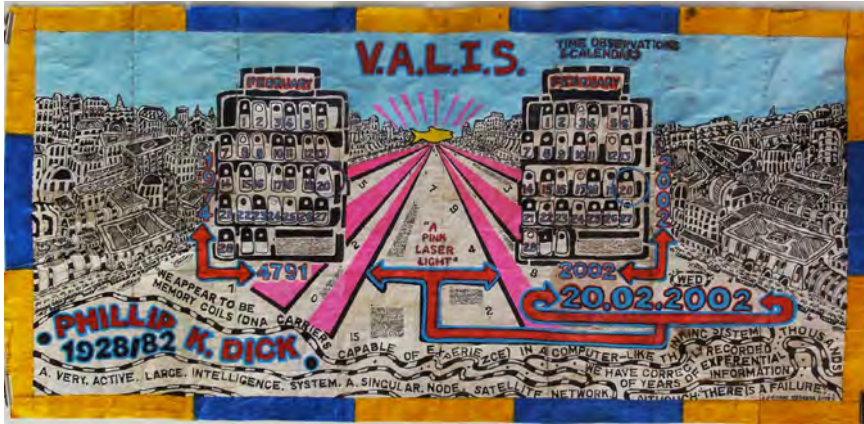


Figure 6.4 George Widener, *V.A.L.I.S.*, mixed media on paper, 50 x 102.9 cm, 2014. All rights reserved.

a future in which the spatial symmetry of urban design is governed by the numerical symmetries to be found in dates. As Widener says, 'I had visions of futuristic intelligent machines, cities created with symmetry and balance, governed by a calendrical order I discovered in my dreams' (Ricco/Maresca 2021).

Widener uses another diagrammatic strategy in the form of boldly drawn lines which seem to form conceptual relationships, rather than physical pathways, between the calendar tables and the city. Lines radiate from a central perspective point, connecting the centre of the city's horizon to the calendar tables. The lines are drawn in pink and reference the science fiction novel *Valis* by Philip K. Dick, whose title the drawing adopts. In the novel, *Valis* stands for Vast Active Living Intelligence System, a satellite from which a character in the novel, Horselover Fat, believes he receives information from God through the medium of pink lasers. The character speculates that the true god, and the universe, is living information. He considers whether time can turn into space, or whether he has managed to overcome both amnesia and time, as memories of his past and future selves superimpose themselves upon one another. One of the years inscribed in Widener's drawing is 1974, the year in which the character in the novel believes he experiences a time disfunction that take him back in time to ancient Rome. The novel explores technology as a means of divine revelation in a quest to address questions about the reasons for suffering and death. Widener inscribes a quotation from the novel at the bottom of the drawing:

We appear to be memory coils (DNA carriers capable of experience) in a computer-like thinking system which, although we have correctly recorded and stored thousands of years of experiential information, and each of us

possesses somewhat different deposits from all the other life forms, there is a malfunction—a failure—of memory retrieval.

DICK [1981] 2001: 268

The quotation is written on the drawing in wavy lines that are reminiscent of the 'memory coils' mentioned in the novel. This inscription reflects Widener's interests in scientific research in the fields of 'nanotechnology, microchips, neurology, computing, artificial intelligence' (Henry Boxer Gallery 2009: 49). It connects the drawing to broader themes such as the universe as an information system, the ways in which the human mind works, and the analogies that can be drawn between artificial and biological intelligence and memory systems.

Ami Clarke – *The Underlying*

Ami Clarke's installation, *The Underlying*, is a multi-media installation created in 2019. The work is an 'assemblage' which includes an eight-screen audio-visual work entitled *Lag Lag Lag* and a virtual reality work entitled *Derivative*, both of which include live sentiment analysis, which will be discussed below. There are also clusters of hand-blown glass eyes entitled *The Prosthetics*, a mound of sand, and a sound work.

The Underlying installation focuses on Bisphenol A (BPA), a chemical compound which is used in the production of plastics, such as food packaging and clothing. Bisphenol A is a xenoestrogen that mimics the effects of oestrogen in the human body. Concerns have been raised over the polluting effects that prolonged exposure to the chemical has on the physical and mental health of humans and on plants and animals.

The audio-visual work *Lag Lag Lag* can be understood as an animated diagram that displays on one plane a set of unfolding data streams, bringing them into relation with each other. An eight-screen monitor interface, reminiscent of financial dashboards, displays different kinds of data visualizations, including maps, bar charts, animations of molecular models, live data feeds, online news, and Twitter feeds. The installation proposes to map the rise and fall in reputation of the top one hundred polluting companies in the world.

Lag Lag Lag deploys a speculative pricing model. Clarke consulted with former derivatives trader Jennifer Elvidge and programmer Rob Prouse for their expertise on this aspect of the work. The work uses sentiment analysis, a technique used in the world of finance. It is used to analyse emotional responses to news stories in order to determine the severity of a crisis, to inform trading strategies or investments, and it can therefore also be used to analyse the rise and fall in the reputations of companies, for example. Screens display live



Figure 6.5 Ami Clarke, *Lag Lag Lag* (detail) arebyte gallery, 2019. Part of the body of work: *The Underlying* by Ami Clarke. Commissioned by arebyte gallery 2019. Video interface with live sentiment analysis. Courtesy of the artist. All rights reserved.

sentiment and emotion analysis in response to mentions of Bisphenol A, with ‘readings’ such as joy, anger, disgust, sadness, and fear in relation to posts on social media and online news sources. The information is shown numerically, on a spectrum between one to minus one, via emojis and fluctuating bar charts. Maps display the geolocation of social media interactions. Screens display live news feed updates about Bisphenol A. Information is displayed from the Chicago Mercantile Exchange about weather futures contracts, which are financial instruments by which analysts quantify the risk of financial losses due to unusual weather events. The system also displays information about the fluctuations in stock market prices of the top one hundred polluting companies in the world. Finally, the work includes air pollution data relating to the geographical location of the gallery in which the work is shown, creating a relationship between complex global processes and the time and location of the gallery visitor.

Elements of *Lag Lag Lag* operate in real time. The media theoretician and historian Charlie Gere writes that artists have been exploring the use of real-time systems since the 1960s, in computer, new media and internet art. Gere defines real-time systems as the ‘information, telecommunication and (multi)media technologies that have come to play an increasingly important part in our lives, at least in the so-called ‘developed’ countries’ (2006). Gere argues that even when artists are not using real time systems in the material medium of their work, the



Figure 6.6 Ami Clarke, *Lag Lag Lag* (detail) London Open, Whitechapel Gallery, 2022. Part of the body of work: *The Underlying* by Ami Clarke. Commissioned by arebyte gallery 2019. Video interface with live sentiment analysis. Courtesy of the artist. All rights reserved.

history of Modern Art, and particularly that of the avant-garde, can partially be seen as a history of attempts to respond to the ‘increasing speed and accelerating evolution of technology in the modern era’ (2006). Examples include the Futurist and Vorticist movements, or, as Leeb argues, the adoption in Modern Art of diagrams and self-determined systems as modes of expression (2011: 41).

Clarke describes *The Underlying* as an assemblage of human and technological relations. The unfolding of live data feeds foregrounds the temporal connections between bodily, financial and technological processes. The literary critic N. Katherine Hayles argues that both biological and technical systems are cognitive entities, and they work together in assemblages that are in constant transition. Hayles highlights the issue of temporality in her discussion of how the balance of agency has changed in the 'human-technical cognitive assemblages' that drive financial capital. The algorithms that drive high-frequency trading and the trading of derivatives contracts compete to 'draw inferences, analyze contexts, and make decisions in milliseconds' (Hayles 2017: 142). This gives these machines an increasing amount of autonomy, as humans do not have the capacity to process information at these speeds. Hayles calls for a reassessment of these 'temporal ecologies' so that humans can reassess the interpretations and choices that are being made in the world of finance, and their ethical, political and environmental repercussions (Hayles 2017: 3, 142–143).

In her essay *A Cyborg Manifesto*, Donna Haraway argues that communication technologies and biotechnologies are recrafting bodies and myths about bodies, and they are forming new social relations (2016: 33). Haraway contemplates the image of the cyborg as it appears in feminist science fiction. The cyborg is a means to question the boundaries between organism and machine, nature and culture, mind and body, and between science fiction and social reality (Haraway 2016: 6, 32). For Haraway, interrogating how these boundaries are constructed, and how they can be deconstructed and reformulated, is fundamental for a process towards political transformation (2016: 66). In an interview with Laura Netz, Clarke explains that the relations between industrial chemicals, the global economy and pharmacology has a personal significance for her. She was prescribed synthetic oestrogen during adolescence in an attempt to stop her growing (Netz 2019). She refers to this as impressing upon her 'knowledge of a certain plasticity with regards hormones, at an early age, which informed the beginnings of a cyborg, replicant, or posthuman understanding, i.e. if you have knowledge of how things are constructed, you can choose to engineer them differently, should you wish' (Clarke, personal communication, 2023).

Citing the work of the philosopher Paul Preciado, the artist and writer Emily Rosamond writes that following the discovery of hormones in the early twentieth century, the body could be seen as a 'complex signalling device' transmitting millions of chemical messages. This idea could be understood within the wider context of emergent telecommunications technologies such as the telegraph, the radio and telephone, etc. Clarke's work explores the convergences between bodily and technological signalling systems (Rosamond 2022). These relations can be seen as a feedback loop on a molecular level as human online interactions about Bisphenol A feed into sentiment analyses that affect trading decisions about the production of Bisphenol A, which can, in turn, affect the body.

The work considers how past economic and social developments have led to certain aspects of today's financial capitalism, and it visualizes how real time information is used to speculate about the future. As Clarke says:

I've tried to grasp something of the complexities, multi-temporalities and scales that coalesce around these new, and very old power relations that come of, and are revealed by, the technologies associated with the interdependent ecologies of social media, finance, and the environment.

NETZ 2019

Lag Lag Lag's diagrammatic aspects are constantly fluctuating. Clarke applies several strategies to direct the viewer's attention amidst the flow of information. As Tversky explains, conveying dynamic information about change and process or causality is more challenging than using a static diagram to convey structural information about the interrelations between parts, for example, in a map or circuit diagram. Cognitive research also shows that animated diagrams are more difficult to comprehend than static diagrams as too many changes happen at once. It is therefore important to adopt strategies to direct the attention of the viewer and to encourage interaction (Tversky 2017). In Clarke's artwork, pre-recorded animations of a rotating model of the Bisphenol A molecule periodically appear, drawing the viewer's attention to the theme of the work. An icon that resembles the split circle seen in a camera viewfinder appears over the data on four of the screens, symbolizing the role of surveillance in the commodification of data collected from private individual online interactions. Below the downward scrolling text data, the viewer's eye is also drawn to phrases in a larger font, that scroll horizontally across the bottom of the screen, in the manner of live news broadcasts. These feature online exchanges such as 'chemicals are in your popcorn – and your blood' and 'toxic chemicals to avoid on makeup'. Intermingling amongst these online exchanges are textual extracts from Clarke's artwork *Error Correction: An Introduction to Future Diagrams*, which is an aggregate text compiled from hundreds of excerpts from theorists, artists and writers exploring the influence of calculus and probability theory in speculations about the future.

By blurring the distinctions between pre-recorded videos and live data analysis, and by including different combinations of text and images with social media interactions, the work 'considers the multiple ways that form and medium, as well as the content of the information we receive, influences reception of what is being transmitted' (Clarke, personal communication 2023). The work questions how we observe and absorb information in an 'attention economy' in which technological advances have increased the amount of information that is specifically aimed at capturing our attention.

Lag Lag Lag plays with the relationship between close reading and 'hyper reading', modes of engagement described by Hayles as characteristic of an

increasingly digital age. The viewing of multiple screens, each featuring different streams of information, resembles the act of speed reading, between, for instance, open tabs on a web browser, or the scanning of juxtaposed or fragmented texts, to identify relevant elements of information (Hayles 2012: 12). However, in Clarke's work, the sets of information are presented in more stabilized forms, which are designed to invite contemplation and deeper engagement with the work's meaning.

The use of green and red text on dark blue backgrounds across all the screens in *Lag Lag Lag* creates a coherent visual field. This shows how gestalt strategies such as similarity and proximity function as operative features within display systems, as they capture attention and invite interpretations about the connections between information points (Tversky 2014: 113).

Clarke's multi-media approach enables her to use varied artistic strategies to transform data analyses into multi-sensory and material experiences. Blown glass sculptures are reminiscent of prosthetic eyes and allude to the theme of surveillance. For the artist, these also evoke the condition

of the posthuman that is aware of being produced through prostheses that blur and trouble the definitions of 'natural' and 'artificial'; a posthuman subject that acknowledges that the chemicals that allow for pain relief and birth control, for instance, and for standards of living that are otherwise unattainable, can also give rise to negative effects on the environment.

CLARKE, personal communication, 2023

Again, the notion of the posthuman invokes Haraway's writing about the ways in which science fiction has explored the merging of biological and technical systems (2016: 60). Clarke explains that the sculptures were made with the assistance of glass expert Phoebe Stubbs, who states that glass blowers are concerned about the diminishing supply of sand (Edwards 2019). Drifts of sand underneath *Lag Lag Lag* allude to the impact of microscopic pollutants. The large scale of *Lag Lag Lag*, and the emission of a deep bass sound work Clarke created with the artist and musician Paul Purgas, add to the immersive nature of the experience.

The installation's virtual reality work, *Derivative*, also offers an immersive experience. This participatory mode of engagement reflects the role of the individual as consumer or citizen. The viewer can navigate the streets of a deserted financial district by using hand controllers whilst an HUD (a status bar) appears in the virtual reality work showing live sentiment and emotion 'readings' of the tweets and news articles relating to BPA, being analysed via *Lag Lag Lag*, alongside a rotating model of the Bisphenol A molecule superimposed upon the cityscape. The depiction of the urban landscape was influenced by the dystopian futures depicted in the film *Blade Runner 2049*.

In its redirection of the use of financial tools and data, *The Underlying* aims to protest the present and imagine an alternative future. The work aims to draw our

attention to the process whereby public opinion and legal challenges have led to the increasing reluctance of insurance companies to underwrite fossil fuels which could mean that they become toxic assets (Netz 2019). This suggests a possible future in which fossil fuels are no longer financially viable due to the pressure of public concern.

Conclusion: ‘Structured Speculation’

Gere identifies a need for artists to explore our changing relationships with time in an era in which the evolution of technology is accelerating and is causing a mixture of ‘anxiety and euphoria’ (2006). Diagrams provide a means to explore our relationships with abstractions such as time, as they facilitate the mapping of time to the space of the page (Tversky 2017).

Different notions of time are explored in the works discussed. In the pulsar diagram, the stacked plot of lines facilitates the visualization of successive pulses in one image. The diagram’s metaphorical resonances associate it with music and the geological timescales of mountainous landscapes. In Widener’s work, notations of dates serve as mediations on time. The juxtapositions of multiple dates within drawings of cities suggest interwoven conceptions of time. Widener and Clarke take different approaches to speculations about the future. Widener creates speculative fictions in which symmetries in calendar dates drive the design of urban planning. In Clarke’s work, simultaneous feeds of information from various sources foreground the temporal aspects of financial speculations which may have damaging environmental consequences in the future.

The works discussed raise questions about the roles of aesthetic play in diagrams and the varying extents to which artists and scientists convey clarity or ambiguity in diagrams. Widener’s drawings can be cryptic because their number calculations may be difficult for viewers to understand. However, he expands their interpretive and aesthetic possibilities by incorporating them in his drawings of machines and cities. In earlier iterations of his diagram, Craft experimented with aesthetics and the materials of his research, the computer programme and data that generated visualizations. He was curious to see things from different perspectives. These can be seen as creative processes that are shared by artists, suggesting that, in the early stages of discovery and experimentation at least, there are commonalities between artistic and scientific visual research. However, in this thesis, Craft included the diagram that he thought was ‘clearest and uncontaminated by image manipulation’ (personal communication, 2023). As the art historian Martin Kemp says ‘if we look at their processes rather than their end products, science and art share so many ways of proceeding: observation, structured speculation, visualisation, exploitation of analogy and

metaphor, experimental testing, and the presentation of a remade experience in particular styles' (Kemp 2000: 4).

The works discussed relate to the visual representations of twentieth and twenty-first-century technologies, such as radio telescopes, ships and aeroplanes, satellites, and data visualizations from high-frequency trading. In these works, science fiction has exercised a direct influence on their creators or has been relevant in acts of interpretation and reception. Science fiction provides a useful model for how we can narrate and reimagine our changing relationships with time in an era of rapid technological change. Science fiction narratives about time travel, time anomalies, speculations about future artificial intelligence technologies and posthumanism serve to reflect the concerns of the times in which they are made or received.

Notes

- 1 For an essay about the influence of authors like J.G. Ballard, dystopian visions, the Second World War and themes of guilt and helplessness on the lyrics of Ian Curtis, lead singer of Joy Division, see Jon Savage, 'Introduction', in *So This is Permanence* (2014). The name of the band, 'Joy Division', is a reference to a novel that Sumner read called *House of Dolls* by Yehiel De-Nur, a holocaust survivor (also known by his pen name Ka-Tzetnik 135633) about sections in Nazi concentration camps in which women were forced into sex work. Responding to criticism of the band's name, Sumner says that it did not indicate fascist sympathies and places it in the context of a punk movement that prioritized provocation and controversy. Sumner writes, 'now in my more mature years, I probably wouldn't pick it, because I know it would offend and hurt people, but back then I was very young and, well, selfish' (2014: 83–4).
- 2 Another example of the appropriation of images and of the reuse of visual codes found in technical processes can be seen in Saville's design for the cover of *Power, Corruption & Lies* by New Order, released in 1983. The front cover shows the painting *A Basket of Roses* (1890) by Henri Fantin-Latour. The name of the band and the album title appear as a colour-blocked scheme which refers to a colour wheel at the back of the sleeve, contrasting nineteenth-century painting with printer's marks and television transmission test cards.

7

THIS IS NOT A DIAGRAM: APPLYING GENERAL SEMANTICS TO CONTEMPORARY ARTS PEDAGOGY

John Cussans

Defining ‘diagram’

The appeal to a class to perform the services of a proper entity is exactly analogous to an appeal to an imaginary terrier to kill a real rat.

ALFRED NORTH WHITEHEAD quoted in KORZYBSKI 2000: 244

The authors of this book regularly discussed whether they needed to agree upon a shared definition of ‘diagram’ in their collaborative writing. Though we all recognize the value of such an agreement, we also understand that no single definition is broad enough to encompass all diagram-like things, that given definitions are often contradictory relative to others, and that strict definitions tend to limit and constrain our thinking about, and with, the range of things that can be identified as diagrams. We generally agree that diagrams are ‘icons of intelligible relations’, a definition derived from the work of Charles Sanders Peirce. But this definition, like any other, is limited in particular ways. What about diagrams made to be performed rather than understood? Or non-visual diagrams, such as those proposed by David Burrows in this volume.

The limiting character of strict definitions was an important area of concern for Alfred Korzybski, the Polish-American mathematician and engineer who created

the educational discipline of General Semantics in the 1930s. For Korzybski, all definitions are 'working definitions', provisional and agreed linguistic summaries used to identify, categorize and think about the objects of experience and thought. Korzybski differentiated between *intensional* definitions, which presume a fixed and necessary relationship between words and the things they refer to, and *extensional* definitions, which acknowledge the active, context-specific, practical and ever-changing relation between words, the world and our minds. From an extensional perspective, words are practical labels attached to experiential phenomena that help us discuss and understand them better. That such understandings inevitably involve a shared use of words should not mislead us into assuming that certainty resides more surely in the fixity of language, signs and images than in the ambiguity and uncertainties of the perceived world. Korzybski's most famous dictum 'the map is *not* the territory' is a precise expression of this perspective.

For Korzybski, intensional definitions are symptoms of a mode of thinking that has dominated Western philosophy and science since Aristotle which assumes a logical identity between the word and its referent. Conventional use of the verb 'to be', the 'is of identity' ('x' is a diagram) and the 'is of predication' ('x' is correct) in everyday language instil habits of mind and speech that lock words and their referents together with a false sense of fixity.¹ Such fixity is a consequence of imagining words and signs as emblems of an absolute order of unchanging relations rather than descriptive approximations of relations-in-process. Just as things are not what people say they are, a thing identified as a 'diagram' in a specific context, and from a particular definitional perspective, is *not* that identity nor limited by *that* definition.

For Korzybski, an intensional use of language inverts the actual order of relations between perceived object-events and the conventional labels used to identify them.² It is only in the Ideal realm of abstract discourse and formal logic that 'diagram' can be assumed to have an irrefutable, fixed meaning or a definition of it to be all-encompassing. There is always more going on with any diagram-like thing than its identification, the category into which it is imagined to belong or its formal definition. This 'more than' is summed up in the second principle of General Semantics (GS): 'map is *not all* the territory'. On the other hand, collectively arriving at precise definitions regarding those matters that most concern us is essential for developing shared understandings about the world, our experiences and the processes that shape them. For Korzybski, although the map is not the territory, the more accurate it is, the better it works.

Diagrams understood as 'icons of intelligible relations' have a central place in Korzybski's writing and the practice of GS. As will become clear, whether the term is understood as a category of similar things or a specific mode of representation, it necessarily refers to an *abstraction* from the world of immediate, *pre-verbal* experience. As such diagrams, however we define them, operate on

the map side of the map-territory relation, offering approximations of what is going on in the world and in themselves. Diagrams then, from a GS perspective, are maps of what is going on within a particular 'semantic environment' between a subject's perception of things and their thinking about them.

The greatest difficulty for revising Aristotle's legacy in Western thought was the great quality and breadth of his work. Korzybski also hoped to create a general, systemic and universally applicable philosophy that would help mankind adapt to the changes in the environment it had brought about. The old orientation was however entrained into our mental functions through the habitual use of intensional thinking in educational and cultural institutions. We do not however have to think *either* intensionally *or* extensionally. Rather, both modes of thinking play a role in our coming to understand our being-in-the-world. The great damage done by centuries of intensional thought within philosophy and science, however, particularly either/or, dualistic and binary thinking, does require a major retraining of human thought towards an extensional mode. The goal of GS then, articulated in Korzybski's magnum opus *Science and Sanity: An Introduction to Non-Aristotelian Systems and General Semantics* (1933), was to train students in the practice of extensional thinking, a mode of attention and awareness from the perspective of an 'organism-as-a-whole-in-an-environment'.

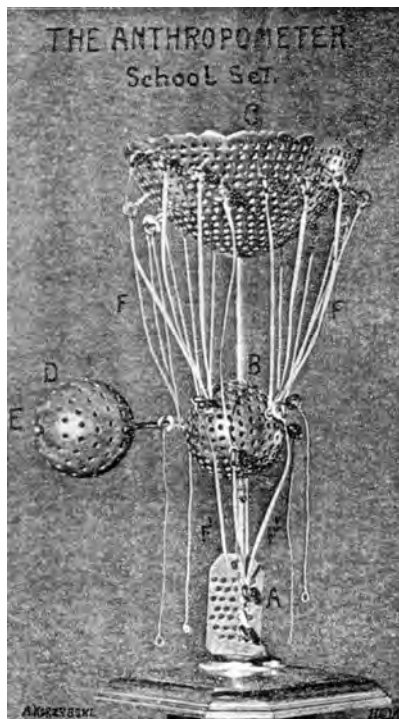


Figure 7.1 Structural Differential School Set.

In this chapter, I focus on the Structural Differential (SD), a physical diagram devised by Korzybski in 1922 to train students in extensional thinking. The SD was designed specifically to facilitate the transition from the outdated mode of thought to the new Non-Aristotelian, extensional orientation in accordance with contemporary developments in philosophy and science (notably Einstein's theory of relativity and Alfred North Whitehead's process philosophy). Importantly, the SD is a three-dimensional device that can be adapted through use. As such it exceeds the Peircean definition of diagram by altering the iconic fixity of a two-dimensional image into the four-dimensional space-time of practical processes. This challenges traditional understandings of diagrams as stable, graphic representations of non-apparent structures. Instead, diagrams are better understood as tools for improved human engineering, orientation, navigation and understanding that correlate structures of mind with those of natural processes via reflective observation and discourse. Defined as such, diagrams share common characteristics and aims with works of art that explore similar correlations and methods, notably those associated with abstraction, conceptualism and the effects of new media environments on human experience and perception.

Time Binding

History is an expansion of memory, and like memory it alone can explain the present and in this lies its most unmistakable value.

KORZYBSKI 2008, 29

Count Alfred Habdank Skarbek Korzybski (1879–1950) was a Polish-American mathematician, engineer and independent scholar who is perhaps most well-known for coining the phrase 'The Map is Not the Territory', the first premise of GS. Though rarely discussed in contemporary academic and artistic circles, Korzybski was widely read and influential in the decades after the Second World War, attracting followers and supporters from a range of creative practices and academic disciplines, including architecture, cybernetics, linguistics, literature, media theory, neuroscience, psychology and semiotics. The Institute of General Semantics, created by Korzybski in 1938, continues to host annual commemorative lectures and to publish the quarterly journal *ETC: A Review of General Semantics*.

Korzybski was born into an aristocratic Polish family in Warsaw fifteen years after the final suppression of the Polish insurrection against Russia in 1879 (Pula 1996: 59). As working aristocrats, his family included artists, economists, engineers, scholars and scientists. His father, an engineer and agriculturalist who



Figure 7.2 Alfred Korzybski.

held a post as Minister of Communications for the Russian government, taught his son to think mathematically and scientifically from an early age (Pula 1996: 61–63). He grew up in a household where four languages were spoken, learning quickly the arbitrary but necessary relation between *things* and the *words* we use for them. As a young man, Korzybski would be left to run the family estate when his father was away, supervising field workers and overseeing the construction of new farm buildings. His practical involvement in their construction earned him the name ‘golden hands’ amongst the workers, for whom he also served as a ‘doctor’ (Pula 1996: 64). Unable to attend university because of his lack of Latin and Greek, Korzybski studied chemical engineering at Warsaw Polytechnic and then became a committed autodidact, learning to read in Italian, Spanish and English. During the first Russian Revolution (1904–07) Korzybski supported the striking workers and in 1907 he built a schoolhouse on the family estate to educate the peasants in languages, mathematics and physics (Pula 1996: 67).

At the beginning of the First World War he joined the Russian 2nd Army as an intelligence officer, witnessing corruption at the highest levels of command. In December 1915, he was sent as an artillery expert from Petrograd to Canada to arrange the manufacture and delivery of weapons to Russia, where he learned to speak English. Following the collapse of the Imperial Russian Army in 1917 and the start of the Bolshevik revolution, Korzybski decided to stay in the US, subsequently accepting invitations from the government to give public lectures about the war in Europe. Shortly after the armistice in 1919, he had a revelation that formed the basis of his two major works: *Manhood of Humanity* (1921) and *Science and Sanity* (1933).

Korzybski first outlined his theory of human beings as a time-binding class of life in *Manhood of Humanity*. The idea was born from an epiphany on top of the Woolworths Building in New York, where, looking down at the streams of humans in the canyons of buildings below, Korzybski asked himself: 'What makes human beings human?' (Pula 1996: 74). Mulling over the question, Korzybski began a long and heated discussion with his wife, Mira Edgerly-Korzybski, an artist who had passionate ideas about how the world should be run. Alfred insisted that despite her good intentions, these were private opinions and that until humans become aware of the natural laws of their environments, as Leibniz and Newton had done for physics, there could only be clashes of personal opinion about the future of humanity (Schuchardt Read 1955: 55). This was the beginning of an argument that went on for two days, Alfred insisting they remained on different sides of the room until the problem was resolved. In the middle of the second night Mira found her husband wide awake with tears of joy running down his cheeks. 'Man is *not* an animal', he said 'Man can transmit his accumulated knowledge from generation to generation, and a man or a generation has the capacity to begin where the former one left off' (Schuchardt Read 1955: 55). This was the insight that would inspire *Manhood of Humanity*, a book written on a wave of intellectual urgency over the next few months.

The problem of 'Man', Korzybski wrote, must be addressed from a scientific-mathematical point of view. The most important task was to ascertain the laws of human nature. Once discovered, all the other problems would be easily solved. Careful and precise use of language was the key to arriving at those laws. Quoting Cassius J. Keyser in *The Human Worth of Rigorous Thinking* (1916), he defined mathematics as the science of exact thought characterized by 'precision, sharpness, completeness of definitions' (Korzybski 2008: 13).

Korzybski's ambition for *Manhood of Humanity* was to create a new science and art of 'Human Engineering' that would direct the energies and capacities of human beings 'to the advancement of the human weal' (Korzybski 2008: 9). Developing a science of human welfare was, he wrote, 'an understanding of immeasurable importance' that must be based on 'a right understanding of Man's place in the scheme of nature' (Korzybski 2008: 9). It was obvious to

Korzybski, following the cataclysms of the First World War and the Russian Revolution, that contemporary humanity did not know what it was. Traditionally two answers had been given to the question ‘What is Man?’: either ‘Man is an animal’ or ‘Man is an animal combined with something supernatural’. Not only were both answers radically wrong, they were responsible for ‘all that is dismal in the life and history of human kind’ (Korzybski 2008: 10). The correct answer is that ‘man is a *time-binding* class of life’, one that ‘determines its own destinies, establishes its own rules of education and conduct, and thus influences every step we are free to take within the structure of our social system’ (Korzybski 2008: 11).

Although mathematics is essential for both engineering and precision in thought, *Manhood of Humanity* was not a mathematical treatise. Two ideas from mathematics were, however, essential for understanding his general orientation: simple arithmetic progression and simple geometric progression. In the former, such as a historical timeline, a sequence of numbers increases in a linear and regular way (e.g. 2, 4, 6, 8, 10, etc.). In the latter, a sequence of numbers increases by a specific ratio (e.g. 2, 4, 8, 16, 32, etc). Korzybski uses the difference in increasing magnitude between the two number sequences to represent how the speed of technological change is outpacing change in other areas of human life. Progress in different fields of human endeavour – such as economics, ethics, fine arts, governance, jurisprudence, law and philosophy – takes place at different speeds. Human failure to recognize these differences, to keep abreast of them and make adjustments accordingly leads to global disorder, disharmony and conflict (Korzybski 2008: 18). The great ruptures in the development of human society can be understood as periods when technology has outpaced social and cultural development.

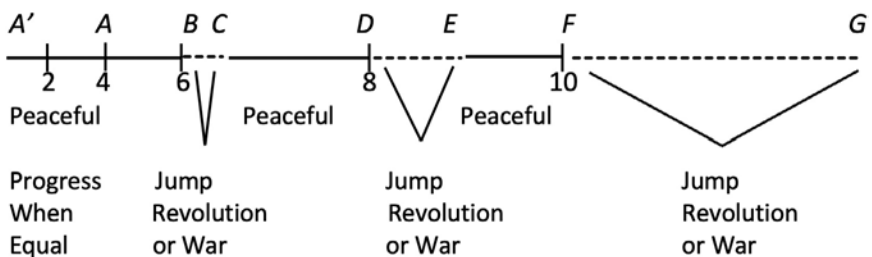


Figure 7.3 Arithmetical Evolution of the social sciences.

The theory of time-binding is predicated on a separation between organic and inorganic levels of matter. The latter involves the elements of hydrogen, oxygen and carbon, which produce an unlimited number of chemical reactions generating heat, light and electricity. Organic matter is the basis for new and unique reactions associated with life, mind and instincts. Following the example of

the bio-physiologist Jacques Loeb and German zoologist Wilhelm Roux, Korzybski identified these life processes as autonomous, self-propelling and synthesizing of their own complicated material from simple elements in the surrounding milieu. Mind, from this perspective, is defined as an energetic property of organic matter with its own specific dimensionality (Korzybski 2008: 51).

From the division between inorganic and organic material processes, Korzybski proposed three classes of life: plants are an *energy-binding class of life*, able to synthesize inorganic compounds and energy from the external environment into the complex material it is made of and which it uses to survive and reproduce; animals are an *energy and space-binding class of life* that have the capacity to move freely through space and create territories that optimize their survival; and humans are an *energy, space and time-binding class of life* that can transmit knowledge, technology and information between generations. Not accepting this cardinal distinction between classes of life meant no progress could be made in discovering the laws of human nature and ‘no measure or rule

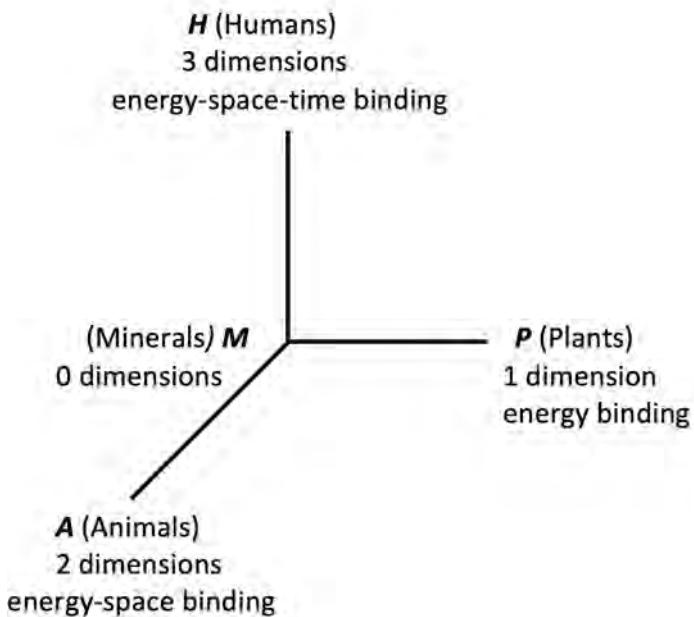


Figure 7.4 Diagram of the three classes of life

of one class can be applied to the other, *without making grave mistakes*' (Korzybski 2008: 52). To treat humans as a mere space-binder (animal) is like treating a cube as a square because it has surface properties. It was absolutely essential, he insisted, for the future of humanity, to understand this difference.

Korzybski created a diagram to illustrate the three classes of life and the dimensions they inhabit. Minerals have zero dimensions of life, indicated by the point *M*. Plants, which can grow autonomously towards light, have one dimension of life (*MP*). Animals, with the capacity to grow and move around in space, have two dimensions (*MAP*), and humans, with their capacity to be active in time, have three (*MAPH*).

The Structural Differential

It works with the reader who has understood it. If it does not work, the reader has not understood.

ALFRED KORZYBSKI, *Time Binding: The General Theory* 1924

Korzybski first conceived of the Structural Differential during a symposium at the New School of Social Research in New York in 1922–23 while speaking to an audience that included the renowned psychologists John Dewey and John B. Watson. Struggling to convey his ideas to a sceptical audience, his whole theory suddenly coalesced into a visual form that he drew spontaneously on the blackboard naming it the 'anthropometer'. Later he would change the name to 'Structural Differential', acknowledging that the device does not in fact measure a difference between animals and humans but demonstrates it in the form of a diagram. Korzybski went on to construct mahogany models of the SD filing for a patent in 1923.

The SD is made up of several movable and detachable elements indicating different levels of abstracting done by the human nervous system. These are based on the first two-dimensional drawings of the SD and Korzybski's guidance on its use.

- 1 The process parabola (sieve) represents the infinite flux of 'what is going on' (WIGO) for a perceiving being in the present. Its edge is serrated to indicate that it extends indefinitely. The holes in the sieve represent the sub-microscopic characteristics of the parabola indicating that there is always *more going on* at the WIGO level than can be perceived by any organism ('The Map is not *All* the Territory'). An organism's capacity to perceive is limited by its biology. A fly, for instance, will not understand the meaning of the words I am using in a lecture or the looks of attentiveness or boredom on the faces of the students. But it will be able

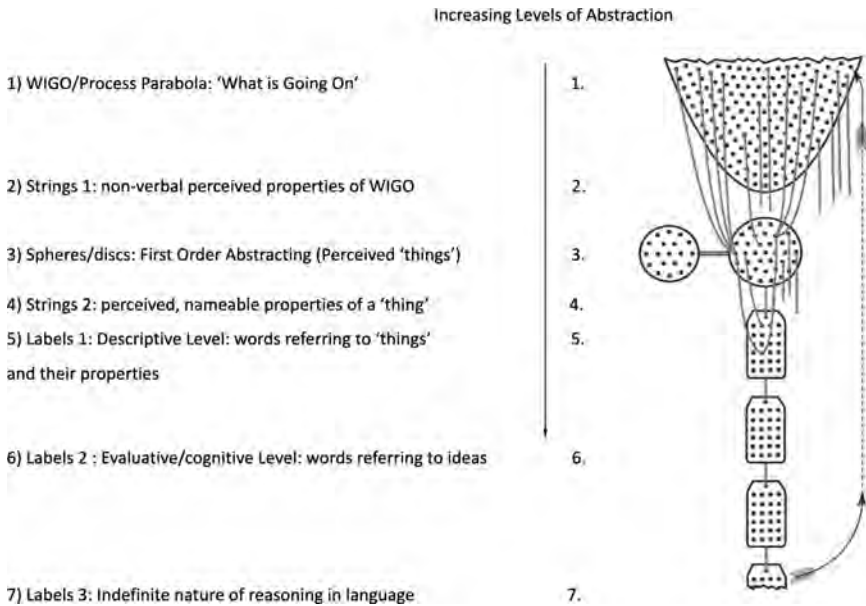


Figure 7.5 The Structural Differential (two-dimensional version).

to sense the subtle smells and pheromones of our bodies, which we cannot. It is experiencing a simultaneous space-time event to ourselves, but what it perceives is entirely other than what we perceive as humans. In other words, it has a different internal map of the same territory. WIGO for any entity, then, is an *abstraction* from the flux of all that is happening determined by their particular biological needs and the apparatuses that have evolved to realise them. Neither the human nor the fly can perceive *unaided* what is going on at a molecular or atomic level.

- 2** The first strings descending from the parabola represent those properties of 'what is going on' that are perceivable to us and whose combination constitutes for our nervous systems a perceivable 'thing'. Strings not attached to the sphere represent qualities missed out by the perceiving being. At each level of the diagram, the strings represent the limited number of characteristics abstracted from WIGO. The further we move down the levels of abstraction the more is left out.
- 3** Two detachable spheres represent a 'first order abstraction' from WIGO, i.e. the 'object-event' or 'thing' we perceive in the most general sense (e.g. 'a university lecture'). Because the experiential qualities that come together to create a recognisable thing are perceived *without language*, Korzybski described this as 'the silent level'. A dog, for instance, can recognise a ball, distinguish it from another, and can sense its material

properties. But it does not (as far as we know) have words for them. Thus Fido's sphere has no strings attached.

The similarity between the two spheres is important for illustrating Korzybski's understanding of 'individuality' and 'identity'. Although the two spheres share characteristics that make them identifiable as 'spheres' this does not make them 'the same'. Each sphere is a unique space-time event that cannot be reduced to the category it is identified by. Confusing things in the world with the conventional words (labels) we use to identify them (categories) is an erroneous consequence of intensional thought. 'Identity' then is an effect of language, rather than an essential property of any particular thing. No two things in the world are actually identical and one never draws *the same* diagram twice.

- 4 The second set of strings represents those properties of the perceived object that we have words for. The unattached strings represent those perceivable qualities left out of a description.
- 5 The first level labels are words used to describe the properties of the perceived world as present to the senses. This includes internal sensations and feelings. Korzybski called this the 'descriptive level'. At this level we can name the properties of a perceived thing. Each descriptive name label is connected to another name label at a higher level of abstracting. I call this the conceptual level. The word 'circular' for instance refers to a perceived property of the perceived object (a particular sphere) and to the category of 'forms' at a more abstract level (spheres in general). Such categories are mental rather than physical objects. As such they are governed by psycho-logical rules rather than natural laws.
- 6 The proceeding levels of labels refer to other psycho-logical concept words. This is the level of cognition, reason and complex communication with other language-using beings. Our ability to operate at this level of cognitive abstraction means that humans can discuss the identity and properties of perceived things, the nature of our perception, the functions of language and the faculties of mind.
- 7 The serrated edge of the final label indicates that reasoning in language can go on indefinitely. To be of practical human value, however, the conceptual tools developed by humans must be re-applied to 'what is going on'. Hence the arrow leading from the serrated label back to the parabola.

At each stage of the abstracting process, increasing amounts of information are left out. Thus, vastly more information about the world is available to a perceiving 'organism-in-an-environment' using all its senses than one operating only on an image and word level. The further one travels down the chain of abstractions the

more removed one's perceptions and understandings are of what is actually going on.

Using the SD

We cannot argue as to whether the sun is shining, we must go and see. In the case here presented, arguments *alone* are also not legitimate.

KORZYBSKI 1921: 5

I have been using an SD to teach art writing, art history and art theory since 2004 when I created a DIY version made from objects found in a local store. I use it to physically demonstrate in real time some of the major ideas that have shaped the discourse of contemporary art since modernism: abstraction, conceptualism, difference, empiricism, idealism, identity, originality, materialism, mechanical reproduction, performance, phenomenology, quantum physics, semiotics and structuralism.

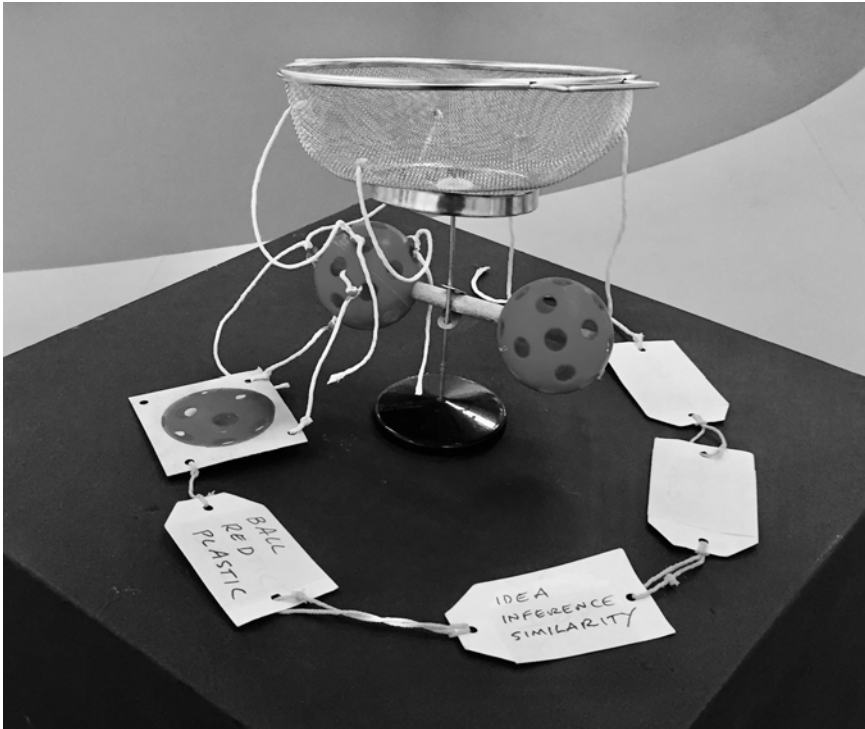


Figure 7.6 DIY Structural Differential.

Korzybski insisted that, to function properly, the SD must be a physical object. Unlike most traditional teaching tools (whiteboard, blackboard, digital screen, etc.), the SD can be handled, manipulated, felt, dismantled and reconstructed. This is particularly valuable in art schools where students are engaged in the creation of physical and visual artefacts designed to exist in three-dimensional space, use different kinds of materials and are asked to reflect on their making processes in writing. The SD helps students to approach language as a practical tool for communication with implications for the things they make and the processes they use, and to understand differences between its descriptive and conceptual uses.

The teaching of contemporary art is vexed by an historical dichotomy between 'practice' and 'theory', the former referring broadly to what goes on in the studio and gallery and the latter to what takes place in the seminar room, lecture theatre and library. The dichotomy tends to push all those activities associated with theory into the areas of language, concepts and high-order abstraction, while activities operating on the silent, non-verbal and physical level become associated with practice. The SD explicitly challenges the basis of this unhelpful dichotomy by reorienting conventional (intensional) approaches to language, often associated by students with external academic constraint and 'correctness', towards a primary, sensual experience of the world and a playful interaction with words in relation to it. Language is approached as a medium to be manipulated for expressive communication rather than a mode of mental and institutional discipline.

Introducing the WIGO to students in a classroom setting helps them understand that all experience occurs in a time-space which is ever changing. Although the world appears to be constituted by objects more or less solid in their form and constitution, the matter from which they are made is in constant flux. A snowflake's form lasts a short time relative to the life of a human, but a human life is the blink of an eye relative to a mountain which, in the long, distant future, will also no longer have form. Change never stops at any level of reality. The millions of biological processes which take place every second within an individual organism, like the constant sub-molecular dance of atoms in all matter, happen largely unnoticed.

The objects that are meaningful to us are those we depend upon for the continuance and quality of our existence, things we have found and brought into our worlds to make them more liveable. They have meaning *for us* because of what *we are*: a highly social, bipedal primate with a complex brain structure that has evolved the use of language and technology to help it survive and flourish as a species. Our difference from other kinds of things in the world has to do with our constitutive natures and the relative speeds of our formal transformations. All 'objects', including 'us', are constantly changing. From this perspective 'Jocelyn1' who reads 'these words1' on 'computer1' is different from 'Jocelyn2' who reads 'these words2' on 'computer2'.

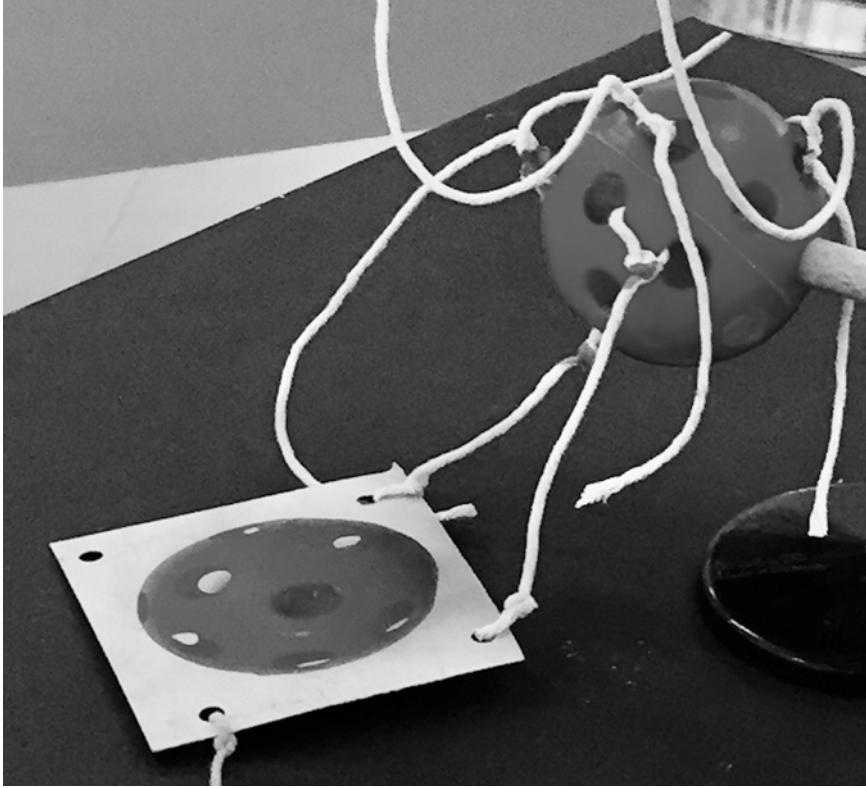


Figure 7.7 Additional Image layer.

Korzybski suggested that the SD should be adapted by those who use it as its effects sharpened their non-Aristotelian awareness. To these ends, I introduced an image level to the original design, indicated by the photograph attached to the plastic ball.

Distinguishing between two-dimensional images and three-dimensional objects is a common convention in contemporary arts education because of the traditional fine art practices of painting and sculpture from which contemporary art evolved. Whatever medium or mode an artist works within, the materiality of the artefact and experience of the perceiver or audience is of utmost importance. An artist therefore must be highly attentive to the material properties of objects and materials and what senses are involved in the perception of them. Including an image-level component to the diagram shows that a two-dimensional image represents only one view of a physical object which has no depth.

The conventional understanding of abstraction in art history is the simplification of the perceived properties of an object in its translation into an artwork. For

Korzybski, abstraction is dimensional, and simplification on the visual level should not be confused with abstraction at the linguistic level. Fido and other space-binding beings can recognize images and feelings, and develop specific sounds to identify them. But without symbolic language (i.e. sounds encoded into a standardized, visual and storable form) and the abstract mechanisms of cognition and time-binding it makes possible, they do not have the capacity to reflect upon complex, systemic change over time. For Korzybski, humans who are unaware of the abstracting process of their nervous systems and operate wholly on the intensional level of image-label identification exist in the world like animals. They can perceive signs and put names to objects but cannot understand how either function psycho-logically or how they came into being.

To illustrate the ‘anthropometer’ function of the SD, I detach one of the spheres and throw it for a student to catch. Like most of our behaviour, this is a learned reflex that happens without recourse to language. I then ask the student who caught it what they have in their hands. ‘A ball’, they reply. ‘What colour is it?’, I ask. ‘Red’, they reply. ‘What is it made of?’ ‘Plastic’, etc. At this point, I will explain that despite the fact that Fido or Baby Jocelyn can recognize a red plastic ball, they do not have words to label it and identify its properties. So although perception and experience *precede* their encoding in language, without words we cannot discuss them.

The words we do use, like ‘red’, are the products of consensus and agreement that have evolved over long periods of time within a particular language system to refer to a range of colours in the human visual spectrum (crimson, scarlet, ruby, magenta, etc.). Students may differ in their identification of the specific type of red but agree on ‘red’ as a general term that encompasses the differences. The example illustrates Korzybski’s assertion that constructive conversation depends on precise but extensional definitions of what we are discussing. Seemingly intractable disagreements are often caused by unacknowledged differences in the meaning of the words we are using.

To illustrate that ‘red’, ‘plastic’ and ‘ball’ are arbitrary labels for the properties of the object we are in agreement about, I ask if there are students in the class from cultures that speak a language other than English. How would they label a ‘red plastic ball’? ‘Raudonas plastikinis rutulys’, a Lithuanian student responds. ‘Ppalgan peullaseutig gong’, a Korean student says. This opens up a conversation about shared and root words across different language groups, differences between alphabetic, ideographic and phonetic alphabets and how these affect the way we think.

Having clarified that words are primarily conventional labels used to identify shared experiences of perceptual phenomena, I set students a series of descriptive writing exercises in which they are asked to describe an object in purely descriptive terms for someone who can’t see it. Once the exercise is complete we discuss the descriptions as a group, identifying those words which



Figure 7.8 Rene Magritte *Treachery of Images* 1929.

are more than descriptive (evaluative, contextual, subjective). The exercise helps students differentiate between those qualities that are present to the senses and those which move to higher levels of abstraction. For the second part of the exercise, students are asked to make a drawing based on their colleague's description which is then compared to the actual object. The exercise shows that the more accurate the linguistic map, the clearer the picture of the terrain in the minds of the reader.

To illustrate the importance of the SD's three-dimensionality I accompany the demonstration with an image of Rene Magritte's iconic *The Treachery of Images* (1929), which conveniently illustrates the map-territory relation (i.e. The word 'pipe' is not a pipe' and the 'image of a pipe' is not a 'physical pipe'). Because images are sensed almost entirely through sight rather than the other senses, they are abstractions from other possible perspectives, angles, levels and scales from which an object could be experienced. More significantly, the entire third and fourth dimensions of the object are inaccessible to the image user. To understand the world as image is like mistaking a cube for a square because it has flat surfaces. That such faces are conventionally made through the vertical plane of an object and presented at eye-level – like the page or screen you are reading this from – is a consequence, I explain, of their development by organisms

with a particular biology and anatomy. The conventional forms and modes of artistic display can be understood as rooted in human physiology.

Because each negation in the chain of abstracting refers to a different level of technological reproduction, I use the example to illustrate Walter Benjamin's thesis in 'The Work of Art in the Age of Mechanical Reproduction' (1935) that an image's reproduction erodes the aura of the original artwork. The aura, from this perspective, can be understood as those properties of a unique artwork *in situ* that are present to all the senses. Thus a photograph differs from an actual painting ('This is not a painting'), a digital reproduction differs from an analogue photograph ('This is not a photograph') and the screen image from a digital print ('This is not a print'). So, no matter how naturalistically photographic and digital reproductions resemble the objects they represent, and are identifiable by the same name, each is in actuality a unique existence. This can be clearly shown by asking students to handle and reflect upon the detachable spheres of the device: they are similar but not identical and each is a unique existence in its own right.

Whether they are drawn in sketchbooks, printed in books, displayed on walls or on screens, and no matter how similar they are to the objects they represent, all images involve a massive sensory reduction of information from 'what is going on' with the actual, three-dimensional object they depict. Digital displays of artworks reduce the information about them to the minimal requirements of the presentation and the capacities of an LCD screen display. Therefore any reproduction of a physical artwork seen on screen carries vastly less 'information' about the object than is available to the senses in the presence of the original. The lesson is illustrated by zooming into an image of the red ball taken on a digital camera.

Removing the Fido ball from the SD and passing it to the students, I ask them to look at it through a printer's loupe, explaining that no matter how close one looks at an object through the naked or aided eye, one never arrives at a 'pixel level'. This happens only with digital images. And all images on the internet, no matter how large the file size, are digital. This then forms the basis for a discussion about optics, the origins of photography and digital technology, print processes and the concepts of analog and digital.

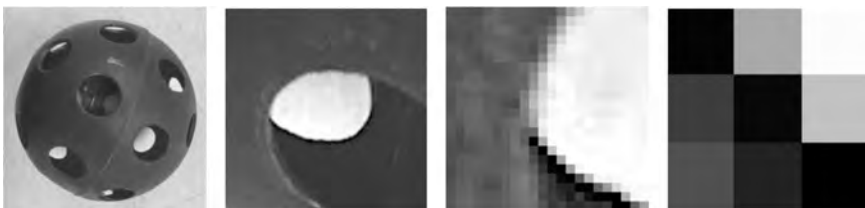


Figure 7.9 Three stage zoom.

‘You are not an Identity’: GS and Contemporary Cultural Theory

My system is very limited. I limit myself to the Western world because it's the only world I know.

ALFRED KORZYBSKI quoted in KLUKHOHN (1956)

Contemporary readers of Korzybski may be surprised by his overly optimistic view about the positive world-changing power of science and the primacy of precise language use for realizing progressive utopian ends. His philosophy may seem like a dangerously outmoded one that ultimately serves the interests of a technocratic, industrial elite. As such, Korzybski can be read as a typical representative of a male, modernist outlook that is both patriarchal, logocentric and, by implication, Eurocentric and colonial. Although I won't engage these critical perspectives in depth here, I recognize there are important issues to address regarding some of Korzybski's inherited and context specific orientations and values that might be assumed to taint GS as an educational discipline. I refer the reader instead to criticisms levelled at GS by its users at the annual Alfred Korzybski Memorial Lectures, *ETC: A Review of General Semantics* and the two recent volumes *Korzybski and . . .* (2012) and *The Book of Radical General Semantics* (2016) which attempt to redress some of these concerns.

As well as being used to demonstrate and discuss a range of important ideas and philosophies which have shaped the history and development of contemporary art and its associated discourses, the SD can also be used to illuminate more contemporary discussions about postmodern social and cultural theory within which contemporary arts practices are embedded. GS, as I have shown, is explicitly designed to make us conscious of the psycho-logical abstractions that language makes possible, and the dangers of these becoming fixed in ways that prevent us from perceiving what is actually going on in the world as knowable to the senses. As such it makes primary the lived experience of the perceiving subject rather than the logical and limiting categories created by



Figure 7.10 You Are Not an Identity.

an intensional use of language. Outmoded, dangerous and divisive ideas are often the product of habitual language use that has congealed into simplistic and fixed ideas about the world that are perpetuated within our working environments and the cultural contexts we share. As such GS is an ally of semiotically-oriented critical theories discussed in Chapter 1. Like structuralist and post-structuralist thinkers, Korzybski recognized that modes of thinking about the world, and the social relations derived from them, are informed at a deep, and largely unconscious level, by the invisible effects of language. It is incumbent upon us, as conscientious language users seeking to avoid the negative impact of stereotypical and inflexible thinking, to be mindful of how images and language over-code perception with simplistic identity-based reasoning. As Colin Campbell has recently argued, GS involves training in a set of devices aimed at facilitating a person's capacity to 'positively alter prejudices, hatreds, addictions, and other damaging perceptual-linguistic habits based on self-confirming generalizations' (Campbell 2016).

To explain some of the problems with intensional thinking and to help them differentiate 'individuality' from 'identity', for instance, I ask students to write a list of categories of social type they personally identify with (ethnicity, gender, nationality, personality type, social class, etc.). I then differentiate between *identifying* as a social type and being identified as one. Jocelyn, for instance, may be identified as a young, introverted, Black British man from a middle-class background. But they may not identify with those categories. More importantly, Jocelyn *is not* the categories by which they are identifiable. They, like everyone else, are a unique, singular, embodied being whom another embodied being can get to know only through physical, communicative engagement using multiple senses and faculties. Mistaking a person for the labels used to identify them involves a profound and pervasive error that reduces a unique 'living-being-in-an-environment' to a list of abstract psycho-logical categories. It is also the basis for much prejudicial thought and stereotyping. At the same time, we need to remain mindful of the lived experience of people who have experienced social aggression, oppression or advantage due to being identified by others as a particular social type, and to support the identity-based politics that proceed from the collective recognition of these differences.

Korzybski's ideas have significant implications for the fields of environmentalism and ecology, directly shaping the ecological thinking of writers like Gregory Bateson and Neil Postman. The separation between the different levels of matter-energy processes, the three classes of life and the dependence of each class on those prior to it identified by Korzybski can usefully be illustrated by Anthony Wilden's diagram of the four orders of complexity (Wilden 1987: 74). The laws which govern processes at the inorganic level also apply at the organic level. The same principle applies to each new level in the diagram, i.e. no level is independent of those which precede it.

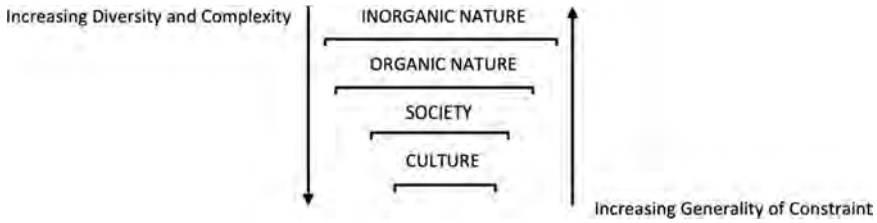


Figure 7.11 Orders of Complexity (after Wilden).

At each new level of material process, new behaviours emerge that are governed by different sets of laws, giving rise to increasing complexity and diversity of behaviours. Applying the rules that govern a higher level of organizational complexity to a lower one is not only a logical error, but one that can lead to catastrophic cultural, social and environmental impacts. Echoing Korzybski, but reversing his orientation, Wilden argued that the major socio-political problems of the twentieth century were a consequence of dominant ideologies that assumed the laws governing culture and society were applicable to those governing the preceding levels. In other words, they imposed ideological and anthropocentric maps onto organic and inorganic territories.

Korzybski, the progressive humanist, emphasized the necessity of distinguishing humans from other classes of life. Wilden, the environmentalist, recognized the anthropocentric error of assuming the world was made for humans. For both, the belief that truth resides more properly in the abstract realm of ideas, language and mind is a disastrous epistemological error whose consequences are evidenced on a daily basis when 'the order of things' (Foucault), governed by ideology and fixed-ideas, is taken for 'reality' rather than scientifically oriented understandings based on reflective lived experience and careful, non-verbal observation.

Korzybski's theory of the potentially catastrophic disjunction between the rapid pace of technological-scientific know-how and the slow pace of change in other social systems and institutions is a clear precedent for contemporary accelerationist perspectives. In his essay 'Korzybski and Cyberculture' (Anton and Strate 2012), Thierry Bardini has traced the influence of Korzybski on postmodern currents in 1980s and '90s cyberculture from which accelerationism emerged. According to Bardini, cyberculture was shaped primarily by new-wave science fiction writers like Philip K. Dick, William S. Burroughs and William Gibson. Korzybski's influence on Dick came through the work of A. E. Van Vogt, an alumnus of GS, who wrote the first of his Null-A (Non-Aristotelian) trilogy *The Voyage of the Space Beagle* in 1950. Burroughs, a graduate of the General Semantics summer school in 1939, praised the effectiveness of the method for clear thinking and effective action. GS informed Burroughs's idea that language

was a form of virus that led to mutations in the human nervous system. Like Dianetics, which Burroughs also practised, GS taught that our automatic semantic reactions to words could be broken, a theory put into practice through the fold-in and cut-up writing method he developed with Brion Gysin. Bardini suggests that it was through the work of Burroughs and Dick that Korzybski's ideas were indirectly introduced to the French Theory of Jean Baudrillard, Gilles Deleuze, Felix Guattari and Jean-Francois Lyotard, which in turn shaped accelerationism. The ideas of the philosopher and writer Nick Land, a central figure in the movement, processed the cyberpunk fictions of William Gibson, Terence McKenna's psychedelic-numerological theory of novelty (Timewave Zero) and the schizoanalytic thought of Deleuze and Guattari, into an apocalyptic, anti-human version of Korzybski's diagram in which a coming AI singularity, that would supersede humans, was 'feeding back from the future' (Land 2011).

Korzybski's use of the word 'Man' and the metaphor of 'Manhood' stand out as outdated sexist conventions. Derived from the Old German word *mann* meaning 'person', the term's usage has alternated historically between the meanings 'adult male' and 'human person'. At the time of his writing *Manhood of Humanity*, use of the term 'Man' to label humans-in-general was a literary and philosophical convention of the latter kind. Throughout the book, it is used synonymously with 'human beings', 'human kind', 'human species' and 'men and women'. Where he does refer specifically to 'men' in the singular it is in reference to labour-power, scientific invention and war. The extent to which repeated use of a linguistic convention may solidify unconscious sexist inferences is an effect GS was designed to make us conscious of. According to Anthony Wilden, use of the word 'man' to label the human species tends to confuse the male organism with the male person, confuse society (a product of history) with the species (a product of natural evolution) and implies that 'man' is the same in all times and all places (i.e. ignoring the diversity of the social record and the role of novelty in history) (Wilden 1987: 71). In Korzybski's terms, the word 'man' should be extensionalized, i.e. 'man'¹⁹²¹ is not 'man'²⁰²¹.

Although Korzybski believed that time-binding is a defining characteristic of humans as a whole, that the structure of science is 'interwoven with Asiatic influences, which through Africa and Spain spread over the continent of Europe', and that an extensional orientation left no place for race prejudice (Korzybski 2000: xxxii), his frequent references to the 'white race', 'Aryan race' and a 'time-binding race of man' more capable of grasping the new extensional orientation than 'savage peoples', have clearly racist and Eurocentric connotations (Kluckhohn 1956). Korzybski was not systematic in his use of racial terms and the meaning of 'race' varied with context. Korzybski also wrote of 'national or race aims' (Korzybski 1921: 125). According to Ashley Montagu, Korzybski's use of the term follows a formula developed by Francis Bacon in the *Novum Organon* (1620) who uses it interchangeably with 'tribe' (Ashley Montagu 1944). The

ambiguity between *a* race and *the* race in Korzybski's work is an essential General Semantics problem. It is also embedded deep in the concept and theories of 'race' as they emerged within Eurocentric, colonial modernity.

In her essay 'Unsettling the Coloniality of Being/Power/Truth/Freedom: Towards the Human, After Man, Its Overrepresentation' (2003) Sylvia Wynter identified a 'new descriptive statement of the human' that emerged in the Renaissance: a concept of 'Man' as a rational, political agent of secular modernity posited as distinct from 'other' or 'less-than' human 'genres' within the 'species'. Contemporary identity politics are all facets, she argues, of a central conflict between 'Man' as representative of a specific ethno-class and 'Human' in a wider sense (Wynter 2003: 261). From this perspective, Korzybski's work could be seen as representative of a profound intellectual contradiction within modern Western thought, beginning with the European 'discovery' of 'the New World', when a particular ethno-class of humans began to define 'Man' according to their own situated and cultural perspectives: a definition which has been 'over-represented' in Wynter's terms.

As a white European man with a profoundly secular, materialist and biocentric view of human nature, Korzybski's use of the term 'Man' can be read from this perspective. Wynter's essay aims to unsettle the dominant definition of man created over several hundred years of Western colonialism and science, outlining a 'redescription of the human' as a 'language capacitated form of life' (Wynter 2003: 270). Wynter's use of the extensional device of the subscript – Man₁, Man₂, – to differentiate between descriptive statements, suggests a familiarity with GS which may have come via her reading of the environmentalist and cybernetician Gregory Bateson.³ Wynter's notion of a 'descriptive statement' of man is drawn from Bateson, who gave the annual Alfred Korzybski lecture in 1970. Despite being inspired by GS, Bateson was critical of Korzybski's overly optimistic view of scientifically oriented human progress achieved through a precise use of language (Bateson 1970). He did however acknowledge, as did Wynter, the importance of approaching beings (including other-human-beings) as 'Organisms-as-a-whole-in-an-environment', a perspective which aligns ecological thinking with Critical Race Theory.

Conclusion

The Structural Differential is a practical device for thinking about the time-binding mechanisms of language, the abstracting process of human perception that are filtered through it and how these differ in specific historical and cultural contexts. It proposes that diagrams in general are maps of what is going on within a particular semantic environment between a subject's perception of things and their thinking about them. This is particularly valuable for teaching contemporary

art because it shows that the practice of art making and the culture of art appreciation have both a silent, physical and sensual dimension and a verbal, intellectual and discursive one. Though neither is superior to the other, the non-verbal is primary in terms of the development of human subjectivity, lived experience and the range of senses involved. Language is not 'truer' than non-verbal experience, but without words, we would not have arrived at a shared understanding of either.

Diagrams share common characteristics and aims with works of art that explore similar correlations and methods, notably those associated with abstraction, conceptualism and the effects of new media environments on human experience and perception. Attuned to the critical and socially engaged currents within contemporary arts practices, General Semantics can be a powerful tool in the struggle against racism and bigotry, especially that encoded into habitual patterns of normative language use. It offers a way to understand human knowledge as necessarily situated within the cultures and semantic environments in which it was created and is used, showing us how, from an intensional orientation, the map can come to dominate and determine the territory in potentially catastrophic and violently unreasonable ways. Moreover it grounds our knowledge of the world in our pre-verbal, lived experiences rather than the logical concepts and categories we have created, through language, to represent it. At the same time it recognizes that our capacity to understand our present 'reality' is aided by the vast archive of knowledge that history has bestowed upon us. It is an archive that teaches us the great errors of humankind as well as its myriad gifts for understanding and maintaining the wellbeing of humans and other beings.

Notes

- 1 Colleagues often attempt to go beyond the problem of the semantic diversity of 'diagram' by using the definite article form *'the diagram'*. This habit, which seems to be derived from French post-structuralist theory, suggests an abstract meta-diagram containing or expressing the function of all others. But this merely reifies the category 'diagram' at a higher level of conceptual abstraction, reducing a multiplicity of differences in the world to a singular unity in mind. Following Korzybski we might respond that *'The diagram is not a diagram'*.
- 2 In his presentation 'The Myth of General Semantics' at the General Semantics Symposium in New York, October 2017, Colin Campbell showed that the inverted structural differential becomes a diagram of Aristotelian epistemology. <https://www.youtube.com/watch?v=dGFoOXdTiyg> (accessed 4 Nov. 2022).
- 3 Another important essay by her is 'On How We Mistook the Map for the Territory, and Imprisoned Ourselves in Our Unbearable Wrongness of Being: Black Studies Towards the Human Project', in Gordon and Gordon (2006).

8

AURALTECHNICS: TOWARDS AUDIO DIAGRAMS

David Burrows

There is, at least potentially, more isomorphism between the visual and the conceptual, even if only by virtue of the fact that the morphe, the 'form' implied in the idea of 'isomorphism', is immediately thought or grasped on the plane. The sonorous, on the other hand, outweighs form. It does not dissolve it, but rather enlarges it; it gives it an amplitude, a destiny, and a vibration or an undulation whose outline never does anything; the sonorous appears and fades away into its permanence.

JEAN-LUC NANCY, *Listening* (2007)

Introduction: Resonant Frequencies

I am sitting in a room, laptop open, facing a partially open window. Birds can be heard above the sound of a bus, which I can't see but know to be passing because of the noise its tyres make on wet asphalt. The birds are also not visible and only their staccato chirping signals their presence. These sounds are barely audible and fade as I listen to Alvin Lucier's *I am Sitting in a Room* (1969), which is a recording the artist made of his voice using two tape recorders. In another century and another country, audio tape captured Lucier speaking and trying not to stutter (he can be heard to stutter twice though). His recorded words describe a process:

I am sitting in a room different from the one you are in now. I am recording the sound of my speaking voice and I am going to play it back into the room again

and again until the resonant frequencies of the room reinforce themselves so that any semblance of my speech, with perhaps the exception of rhythm, is destroyed. What you will hear, then, are the natural resonant frequencies of the room articulated by speech. I regard this activity not so much as a demonstration of a physical fact, but more as a way to smooth out any irregularities my speech might have.

Through constant re-recording, as Lucier promised, his stutter is smoothed out by the end of the composition: the artist's speech, clear at first, then distorted and eventually intelligible, is not so much destroyed as diminished by the rising audibility of the room's frequencies. If Lucier's words are the focus of the composition at the beginning of the piece – marking a figure speaking in a room – then by the end of the recording, when speech and resonant frequencies merge, the room that was once background is foregrounded. And as Lucier's speech becomes smooth and I no longer listen for the meaning of his words, the noise of birds and traffic seems to become audible and grow louder in the room I am sitting in.

I think about this – the two rooms, the one Lucier sat in to make his recording and the one I am sitting in now – and whether their resonant frequencies are similar. I think about acoustics and analogue technology and how repetition degrades fidelity to produce something different though not necessarily inferior, and whether digital recordings produce absolute fidelity (I am listening to an MP3 file). I also think about a human voice – how it is something different to the words that it articulates – and whether Lucier's stutter, conventionally counted as unwanted sound, is part of his voice? When listening to *I am Sitting in a Room*, I register many intelligible relations – Lucier's work is didactic in this way, even if not intended as such. If Lucier's sonic composition facilitates diagrammatic exploration of numerous relationships, can it be described as a diagrammatic sound work if not an audio diagram, in which figure becomes ground, and ground becomes figure as the soft rhythm of Lucier's voice becomes an unearthly-sounding communication?

I am Sitting in a Room is reminiscent of the first electroacoustic work made for public presentation, a composition by Halim El-Dabh called *Expressions of Zaar* (1944), made from a wire recording of the singing and percussion of a healing ceremony in Cairo, the musician's birthplace. The field recording was transformed through 'reverberation, echo chambers, voltage controls, and a re-recording room that had movable walls to create different kinds and amounts of reverb'; a series of processes that isolated 'the high overtones so that in the finished recording, the voices are not really recognizable anymore' and 'only the high overtones, with their beats and clashes, may be heard', revealing the field recording's 'inner sound' (El-Dabh quoted in Holmes 2012: 156). More abrasive than Lucier's composition discussed above, El-Dabh's pioneering audio work is

made all the more strange by the knowledge that *Expressions of Zaar* presents the sounds of a purification ritual to pacify spirits. El-Dabh's experiments were made possible by newly available equipment, which allowed the musician to explore ways of listening and sound making that exceed habits of hearing and the conventions of musical composition. In this, *Expressions of Zaar* marks a historical development in which sound is explored through recording and editing, repetition and rearrangement.¹

Do the practices of El-Dabh, Lucier and other sonic experimenters point to the potential of audio diagrams registering physical, social, sacred, historical and imaginary relations, as well as virtual or mathematical arrangements? To investigate this, it is necessary to think about the distinction between 'the diagrammatic' and 'a diagram', as well as the similarities and differences between opticality and aurality and whether analogies can be drawn between visual and sonic compositions. The chapter proceeds through discussions of diagrams and sound and image compositions, which are shaped, in part, through an engagement with what Francois J. Bonnet names *The Order of Sounds* (2016). To further focus the chapter's speculations, an investigation of diagrammatic scores feeds into a discussion of how listening is a creative and reflexive practice developed in parallel with the advent of recording technologies and expanded musical practices. This in turn informs the chapter's discussion of whether sound making and listening techniques – *auraltechnics* – exist that are inherently diagrammatic and generative of audio diagrams.

In investigating whether sound has diagrammatic potential that the visual does not, this chapter addresses whether sonic compositions have temporal, social and embodied aspects that escape the disembodied and didactic techniques of optical schemas. By way of pointing to these possibilities, attending to the thoughts of Salomé Voegelin on the epistemological and corporeal aspects of listening is helpful. Voegelin writes that listening to soundscapes can 'produce locations on sonic maps':

Such maps pronounce a different notion of geography, one that is not captured with a compass and guided by meridian lines, but that starts from my body wherever I am. Indeed, this geography cannot result in maps but is a constant mapping: building and taking apart, a mobile practice of individual existence as motility.

VOEGELIN 2010: 136

I suggest another name for an embodied process of sonic mapping that produces no map is audio diagramming. Rather than rushing to conclusions and definitions though, this chapter takes it time to grasp the diagrammatic potential of sound making and listening before exploring specific sonic works as diagrams, gathering concepts to support the cause of audio diagrams along the way. What can be

stated at the outset of this investigation is that it is envisaged that audio diagrams, should they be found to exist, offer something different to graphic diagrams; and if audio diagrams can be said to exist, it will be because there are sonic compositions that register, through time or duration,² various structural, architectural, social or cosmic relations.

Two Tribes

Are diagrams defined as visual and graphic design, as an ordering of elements and their relations on a plane? Or are diagrams performative processes in which discourses animate compositions or arrangements, and through which poetics or worldings articulate actual and potential relations? If the answer is the former, then speculation concerning audio diagrams is doomed from the start. If the answer is ‘not just the former’, then a path unfolds that might lead to diagrammatic practices with sonic if not musical ends. Whether sonic compositions are diagrams or merely productive of ‘diagrammatic’ processes may be a relevant query here, but it is quickly superseded by another question relevant to a discussion of audio diagrams: what is the relation of the terms diagrammatic and diagram?

As the art historian Susanne Leeb writes:

There are currently at least two opposing ways of understanding the term ‘diagram’. Some see diagrams above all as an aid to systematisation – ‘problem solvers, because they “automatically support a large number of perceptual inferences, which are extremely easy for humans”’ – while others see them as ‘proliferators of a process of unfolding’ or ‘maps of movement’.³ If in the former case the visual diagram is regarded in terms of the potential for order and visualisation, for example in mathematics, economics, statistics or pedagogy, in the latter case it is rather the structural possibility of putting relationships in the foreground, so conceiving of the diagrammatic as something which describes the alignment of words, shapes, objects and persons [. . .] – the second concept is projective, with vectors pointing in unknown directions.

LEEB 2011: 31

Leeb is careful to distinguish between the concept of a diagram as visual aid for solving problems and a second concept presenting a diagram as a projection of structural possibility, noting semiotics and cognitive science have paid much attention to the former, whereas the latter conception is marked by ‘the power and subject theories of Michel Foucault as well as Gilles Deleuze and Félix

Guattari' (31). Importantly, the latter do not conceive of diagrams as optical schemas.⁴

Leeb's discussion of diagrams seems playful. The use of the term 'the diagrammatic' turns an adjective into a noun, and the word 'alignment' also alludes to the term diagram as noun and verb, as thing (a diagram) and process (to diagram). In Leeb's first concept of a diagram as an aid to systemization, a (diagrammatic) process produces a concrete (diagram) thing; in Leeb's second concept of diagrams as maps of movement, the (diagrammatic) process is a mobile (diagram) arrangement. Leeb does not waste time debating whether one or the other concept is correct, suggesting both visual ordering and structural projection (systematizing and openness) are inherent in diagramming. Leeb quotes Kenneth Knoespel to point to how a diagram can be a composition of lines and figures that create a stable organization of information (Knoespel 2001: 146), as well as explaining how a diagram can be a marking or crossing out, as a means of discovery, or of destabilizing relations (Leeb 2011: 31). These observations are helpful to the cause of sonic diagramming. In suggesting that a diagram can be an unfolding process, duration and temporality are presented as being as important for diagramming as the dimension of space or a plane. It is Leeb's nuanced concept of a diagram as open process that provides a starting point for an exploration of sound works as diagrams that are processual and performances.

Even so, the idea that diagrams can be heard rather than seen seems a contradiction. For the transience of sound (and therefore of audio diagrams) would seem to invoke a logic of disappearance rather than appearance, and this might reasonably be thought a perverse logic for making diagrams. Even if audio diagrams exist in recorded and repeatable form, they would still be heard as passing in time. The gambit here is if audio diagrams are unfolding projections, a shift from seeing to hearing extends diagramming beyond a plane or isomorphism (of paper, blackboard, canvas or screen). Different kinds of diagrammatic practices may then emerge, inferred by Voegelin's embodied sound mappings and a question – is there ever a sense of the ear residing 'outside' or 'beyond' a sonic composition in the way a pair of eyes, hovering above or in front of a graphic diagram engenders a view from nowhere, from outside the plane of a diagram, sovereign over all that is seen – a disembodied, God's-eye perspective?

The immaterial and embodied aspects of audio diagrams would be at odds with optical regimes that schematize and systemize through visual and graphic means. Such *opticaltechnics* can be associated with a subject – a diagrammer – that, when diagramming, speculates or reasons by discounting or forgetting material, temporal and bodily limitations (both their own and more generally). This is not in itself a bad thing as forgetting or eliding these limitations engenders an imaginary traversing of spacetimes and relations, and this gives diagramming (and the diagrammer) power and reach. Perhaps then, the technics of optical diagramming – bearing a disembodied, God's-eye perspective – are the offspring

of Enlightenment or Kantian (or post-Kantian) critique, extending customs of detached, modern subjects pursuing knowledge, marking territories and territorializing relations.

Auraltechnics do not follow the same logics as opticaltechnics. The former points to specific time-space and bodily relations and an audio diagram would differ from its conventional, graphic counterpart by permeating a place or site (even when conjuring another, different spacetime). Sound pervades and affects the body in ways that an image cannot. That is, unlike an optical diagram, an audio diagram would not be an autonomous object in a space, similar to a modernist artwork, the latter involving a *clearing* of and in space, as a plane for new inscriptions.⁵ If sound compositions do not involve a clearing of space as such, is there an equivalent process? Would silence – an audience becoming quiet before a performance – produce a kind of audio plane for sonic inscription, even if the sound of an audience breathing and trying to remain quiet fills the ears when the noise of talking, clapping or people moving dies down? The silence of an audience marks a spacetime in which to listen (similar perhaps to an audience noisily signalling their anticipation of a performance). Rather than silence or noise, it is the anticipation of sound making or listening which might be a form of clearing then, which is an idea relevant to listening to sound recordings too: an auditor presses play and anticipates the first sounds of the recording. This time of anticipation, of listening and sound making, is scored by John Cage who produced the famously silent (but of course never noiseless) composition *4'33"* (1952), in which no instrument is played. Is *4'33"* analogous to the plane of inscription of a visual diagram though? Again, differences between optical and aural compositions persist. In a graphic diagram, any assertion or inscription takes place on a plane with edges – it has a frame – but at the same time, this plane (a sheet of paper, blackboard or screen) is analogous to a continuum (or the universe) in which distance and time are of no account: that is, the plane of inscription of a visual diagram is both spatially bounded and boundless (the latter through the register of the imaginary). We can call this bounded and boundless ground of a visual diagram its *plane-of-assertion*. While this is lacking in sonic works, a sound composition can be said to have a frame of a kind which we might call its *time-of-assertion*, the duration of a composition that can also be analogous to a continuum (or the cosmos) if so imagined or felt as such. Unlike a plane-of-assertion, a time-of-assertion passes and is porous; that is, sound compositions (in performance or recording) have no boundary marking out the sound of the composition from the sound of the world the auditor inhabits.

A diagrammatic composition lacking a plane of assertion might be thought a problem or limitation. The eye can look over (and over) an image on a plane. Optical diagrams, in having a relative permanency, may engender critical reflection (as a clearing for discussion and discourse) in ways that audio diagrams would not. Auraltechnics is not conceived in opposition to opticaltechnics and

offers alternatives to the primacy of the eye and the subject that visual schemas and processes of spatial clearing engender. What kind of subject or diagrammer might be produced by audio diagrams? The term ‘distributed subject’ seems appropriate and builds on Voegelin’s conception of hearing as motility – listening as mobility. This would be a different use – or rather a mirroring that allows for a reversal – of the term ‘distributed person’ coined by Alfred Gell (1998). Gell proposes that a person is distributed when their agency is extended into the world through various objects and technologies (diagrams being one such technology). The subject or diagrammer produced by audio diagrams would give the term ‘distributed’ a different inflection. As much as an auditor would have a sense of reaching out, affecting and grasping the world through making and registering sound, an auditor would have a sense of the world reaching towards them – entering them – through their audio canals and vibrating eardrums. As Jean-Luc Nancy writes:

To listen is to enter a spatiality by which, *at the same time*, I am penetrated, for it opens up in me as well as around me, and from me as well as toward me [. . .]. To be listening is to be *at the same time* outside and inside, to be open from without and from within[. . .].

NANCY 2007: 13

This sense of distribution, of being open without and within, relates to how both physical events and perception, and embodiment and environmental and technological contingencies are agents important to sound. An audio-diagrammer would necessarily engage with the idea (the feeling) of sound passing without and within, through and across inner and outer ranges, ultimately collapsing (crossing out) the separation of internal and external realms. In relation to this, Nancy makes one more observation relevant to a discussion of audio diagramming as a time-of-assertion. The philosopher quotes Richard Wagner’s *Parsifal* (1882) and writes of listening as ‘the sharing of inside/outside, division and participation, de-connection and contagion. “Here time becomes space”’ (13). For Nancy, listening – a durational performance – produces a spatialized register of mutable relations. The implication of this is that durational sonic compositions (including audio diagrams), although having no plane-of-assertion (no isomorphic possibilities), do not necessarily lack spatial registration through which relations can be explored. For it would be through the time of listening, as a registering of temporalities that are also spatialized events (divisions and connections associated with bodies, places, territories), that the diagrammatic manifests in sound.

One further important if obvious point can be drawn from Nancy’s referencing of Wagner. Sonic compositions have affective, communal or communing functions. While visual artworks (including graphic diagrams) may bind

communities too, as Nancy suggests, 'the visual is tendentially mimetic', different to the sonorous, which is 'tendentially methexic (that is, having to do with participation, sharing or contagion)' (10). It is not that the visual (which may have its own forms of contagion) is a problem; it is that sound making offers different aesthetic, social, and even sacred possibilities for diagramming.

A Third Ear

If Leeb makes a case for diagrams as unfolding projections, and Nancy points to the time of listening as a spatialized register, there is still more work needed before an audio composition can be counted as a diagram. An obvious next step might be to reach for Gilles Deleuze's *The Logic of Sensation* and the philosopher's concept of the Diagram (Deleuze 2005), to address sonic presentations as analogous to paintings and as abstract machines through which multiplicity can be traced. Why obvious? The Diagram is said to escape opticality and transcend the material or concrete, which would seem analogous with sonic presentations. Appropriating this concept as the key to audio diagramming would elide differences between optical and aural presentations though; whatever the analogies that can be drawn, the ear is a different technology to the eye, as we shall see. More than this, if audio diagrams, in all their possible forms, exceed the concept of the Diagram – if they are more than analogous to painterly compositions – it is because diagrammatic sound works can be telegraphic (like graphic diagrams). Though diagrams are not discussed in Jean-François Lyotard's writing (the philosopher is known for addressing language and language games), his thoughts on technology are relevant here. In 'Logos or Techne, or Telegraphy', Lyotard identifies three ways in which the human body can be thought of as a technology engaged in telegraphic operations, the last of which aids the cause of audio diagrams (Lyotard 1993).

The philosopher writes of three sorts of 'memory-effects' – *breaching*, *scanning* and *passing* – relating to various kinds of inscriptions (48). The first of these, *breaching* (which might be understood as connecting), relates to habitual recall facilitated by the neuronal and motor-sensory operations of the body, which enable repetition of behaviour with limited expenditure of energy in familiar environments (48–9). This operation involves an unthinking processing of sense data, such as colours and tones. Lyotard notes this process is exploited by capitalist and cybernetic machines, which can store sense data as information, 'realizable at spatial and temporal distance'; that is, the data is 'telegraphable' (50). And, indeed, many technological processes which telegraph information involve breaching (or habitual recall), including diagramming.

Lyotard's second memory-effect is *scanning*, occurring through categorization and cartography, and defined as remembering – a 'reactualization' of the past in

the 'present (of consciousness)' (51). For Lyotard, it is the inscription of language or code that facilitates this re-actualization at spatial and temporal distance. Here, inscription of language is broadly defined and includes DNA sequences and speech acts governed by semantic rules, giving scanning biological and social scope. Specifically, the human development of scanning (as technique for remembering) is described by Lyotard as a 'technologos' that facilitates critical reflection, a facility that can even examine its own processes. If all diagrams draw upon breaching, it is through scanning that optical schemas engender a technologics of remembering (recall beyond the capacity of habit) and of telegraphy; that is, optical schemas, as an inscription of information, mediate gestures across spacetime. Equating visual schemas with scanning is not just to point to the way human eyes may literally scan or read a graphic image; it is to point to how visual diagrams are a ready-to-hand means of storing and transmitting information.

Audio diagrams would not share this technologos. Even sound recordings pass in time and cannot be scanned (and re-scanned) like an image. For audio diagrams to offer telegraphy, another memory-effect is required, for which Lyotard's third term, *passing*, provides a potential candidate. The philosopher associates passing with anamnesis (or recollection). This term is associated with fiction and narrative, but in Lyotard's essay, anamnesis is identified with psychoanalysis and the technique of working through signifiers to register sense and meaning: 'The point would be to recall what could not have been forgotten because it was not inscribed' (54). Lyotard acknowledges this sounds nonsensical but then states that it is a 'technological task' (54–5) – a telegraphy – that is not achieved through breaching and scanning (his first two memory-effects) but through:

[. . .]listening with a third ear, removing all pre-inscriptions of the other two (stopping them up), abandoning the already established synthesis, at whatever level: logical, rhetorical and linguistic, and letting work in a free-floating way what passes; the signifier, however senseless it might appear. (56)

Referencing the 'third ear' of psychoanalysis that aids recollection of what has not been inscribed – recollection of what is unconscious – may not seem so different to the operations of the Diagram articulated by Deleuze. There is a difference though. The function of passing (in psychoanalysis) is to register signifiers and locate (or inscribe) their place within a chain of signifiers that structure or give order to a patient's life. Passing is a process of fashioning an assemblage through an analytical form of listening. This observation is not intended as a comment on psychoanalytical-schizoanalytical disputes, and the aim here is not to cast audio diagrams as psychoanalytic, diagnostic operator. However, as the unconscious has been introduced as relevant to auraltechnics, it perhaps needs stating that the unconscious is not approached as a 'private

theatre' of personal or familial dramas in this chapter; rather it is approached as impersonal and productive, incessantly producing signifiers (Deleuze and Guattari 2000: 55). Why then reference the clinic of psychoanalysis? The intention is, through the example of analysis by (third) ear, to develop a concept of audio diagramming as a process of sound making and listening that registers or shapes not-yet-inscribed ensembles (rather than chains) of signifiers and signs.

In requisitioning *passing as memory-effect* to support the cause of audio diagrams, it should be noted that visual diagrams, viewed in certain ways, can also engender recollection of what has not been inscribed: any abstract shape in a diagram can become a face or world, a social relation or indeed anything and everything if so registered or imagined. Such potential relies on techniques of looking, as well as processes of abstraction (all visual diagrams are abstract machines to an extent). While an analogy between visual diagrams and sonic works can be drawn here (which may strengthen the cause of audio diagrams) there remains an important distinction between passing and scanning. To develop the concept of passing Lyotard draws on the psychoanalytic clinic that listens to speech for signifiers (indexes of actual and imaginary relations) that have not been consciously processed. In this, Lyotard's notion of a 'third ear' engenders a diagrammatic auraltechnics registering symbolic, imaginary and indexical signifiers in the field of sound, and through recollection and association. The next task is to address the relationship of sound to recollection and the indexical (and indeed, sound as memory and as index), before fully discussing listening and sound making as a diagrammatic practice.

The Sonorous and the Audible

The Order of Sounds: A Sonorous Archipelago by Francois J. Bonnet addresses sound and the sonorous as different (Bonnet 2016). The former – the audible – involves both resonating matter and motor-sensory discrimination or vibrations heard by an auditor. For sound is the sum of physical events and phenomenal perception (74–6). The latter is defined as beyond what is audible (or we could say, what is not inscribed). The sonorous, simply put, is a name for the sphere from which audible sounds are registered; a sphere of potential sound (75–6). What is heard by an auditor is only a partial registering, or in Bonnet's terms, a domestication of the sonorous – a tracing of sound where the sonorous opens onto the 'audible world' (8). Hearing is an indexical process and, moreover, sound heard by the ear is a memory of an index – a 'sound memory' – for sound has already passed when heard (27).

Sound is a particular kind of index then. Charles Sanders Peirce identifies indexes as signs that have a physical relation to an absent referent, the index as sign being a trace of that referent (Peirce 1998a: 9). There is, of course, a

difference between a knock at a door and indexes such as fingerprints and photographs, which is alluded to by Bonnet when referring to sonic indexes as imprints that quickly disappear. Furthermore, Bonnet suggests an audible imprint is an ‘infra-thin’, a term associated with Marcel Duchamp’s poetic semiotics. Bonnet quotes the artist: ‘velvet trousers –/ their whistling sound is an / infra-thin separation signalled / by sound. (it is *not*? an infra-thin sound)’ (Bonnet 2016: 25). Perhaps the most common infra-thin is breath, of which Duchamp said, ‘[. . .]each breath is a work which is inscribed nowhere, which is neither visual nor cerebral, it’s a sort of constant euphoria’ (Duchamp quoted in Cabanne 1971: 72). How then to mark what is neither visual nor cerebral? Bonnet points to how a sonic infra-thin is given substance through grasping sound as indexical, imaginary and as memory:

The substantialization of sound as breath; sound as the avatar of the spirit of gods or of the dead; the bestowing upon it of a sacred, magical character; the superimposition of reverberative clouds; of phenomenal haloes in so many reflecting mirrors reaffirming the existence of that which they reflect while rendering it ungraspable; reminisces and memorializations; these are just some of the different ways in which sound is traced.

BONNET 2016: 24

It is through these tracing processes – reverberation, repetition (reflection), reminiscing and memorialization – that sound, as an effect of the field of the sonorous, can be marked. Another way of putting this is to state that sound as index ‘inscribed nowhere’, when registered as imprint, is a trace of a desire to produce and connect. And if recording technologies transform the registering of sound, they do so by transforming and extending the potential of the ear’s and mind’s processes and desires, engendering diagrammatic possibilities in the process.

Forever Lost, Forever Living

Bonnet’s notion of sound as imprint – as index and memory – is added to the chapter’s collection of concepts, and aids speculation on what an audio performance or recording might diagram. Again, it is helpful to think about the sound of breath, and how that sound points to a milieu of a breathing body. In this way, following Bonnet, the identification of a sound engenders a ‘glimpse’ of a certain place or of many territories (39–40). Bonnet, somewhat ambivalently, notes that Raymond Murray Schafer names audio traces as ‘soundmarks’ and as signatures of a ‘soundscape’; the latter term being Schafer’s alternative phrase for a territory and acoustic environment that brings forth ‘values, beliefs

and conceptions' (42–3). These two terms – soundscape and soundmark – suggest sound assemblages (and potentially audio diagrams too) are not just empty indexes; they engender the marking of figure and ground relationships as well as narrative and conceptual association. For there are sound traces that might be registered as wet, dry, bright, dull, hard, soft, metallic, brittle, dreamy or explosive, pointing to material qualities and sights, smells, taste and touch. And there are sounds that belong to a place and time, that are domestic, urban or rural, that seem comforting or threatening, or that are human, non-human, mechanical or elemental.

Still, the term 'soundmark' might seem a contradiction, and Bonnet comments on this, pointing again to how sound is impermanent – a memory-trace that does not leave a physical mark. Bonnet suggests this conception points to sound as history – stories – that he also thinks of 'as genealogy and as *fiction*' (44). This proposition implies that a sonic memory-trace cannot be heard as an isolated sound, and the writer is critical of the theorists of *musique concrète* and of electroacoustic and acousmatic listening who propose the idea of a Sound Object as raw audio material free of sonic origins (85). This critique is relevant to this discussion of audio diagramming and worth addressing more fully. The Sound Object was first proposed by a pioneer of *musique concrète* Pierre Schaeffer, who famously recorded and isolated (sampled) sounds, an example being recordings of whistles, steam engines and the turning wheels of trains, all of which can be heard throughout Schaeffer's composition *Étude Aux Chemins De Fer* (1948). For Bonnet, the production of a Sound Object – produced by recording processes – would be a reification and rationalization of sound, pursuing an 'objectal logic' which he abhors as the (impossible) idea of reduced listening (86). He is suspicious too of the attempt to locate sound 'within a network of values and signs, within determinate space', as he believes this would bring about an authoritarian closure of the world of sound that is also a denial of the heterogeneity of the sonorous (102). In short, for Bonnet, Schaeffer's objectal logic promotes the idea that it is the auditor as sound-maker (an 'I') that is the author of sound (or Sound Objects), and not the world. Furthermore, theorists of the Sound Object elide the ways in which listening to sound is 'schizological', which is a term Bonnet uses when discussing the stand-off between phenomenology and physics which privilege either perception or physical events. Bonnet argues this is a debate that has no resolution, as sound is an 'unsynthesizable multiplicity' (71–3). Bonnet's rejection of Sound Objects and affirmation of the unsynthesizable aspect of the sonic are theorizations important, if in some ways challenging, for a discussion of audio diagrams, pointing to why a 'schizological' approach – which works towards complexity rather than reduction, and always towards heterogeneity – would be a path for audio diagramming that would, following Leeb, engender the diagrammatic unfolding of 'vectors pointing in unknown directions' rather than systemization (Leeb 2011: 31).

A question remains. Do sonic recordings domesticate or elide the unsynthesizable aspects of sound – do they bring an objectal logic to sonic presentations, allowing sounds ‘ceaselessly to live again’ despite being ‘forever lost’ (Bonnet 2016: 34)? Bonnet claims, phonography and radiophony give a sound recording a power related to the absence of the event that produces it; a power that audio reproduction and transmission doubles through creating a simulacrum of presence and through broadcasting across time and space, far from any original sound event and many times over (analogous to the distribution of a graphic diagram, reprinted many times). A logic of extraction and transportation of sound may be at work in the recording of sound compositions which, as Bonnet argues, introduces new forms of hearing, in that a recorded sound work has no background-sound to be filtered out (36). It is true that, when attending to a recording, the site of listening and the auditor’s body can produce ‘unwanted’ sound, and the effects of different technologies and architectures can be audible too; but conventionally, it is thought that the author of a recording has decided or settled on what the auditor should or can hear, and fidelity of the recording is taken for granted. But to make sound the living dead is not envisaged as the objective of audio diagramming that may use recording techniques (nor would the isolation of sound as raw material be a goal).

Returning to the work of El-Dabh, the musician’s approach to recording points to another possibility. When the musician was working with tape loops in the late 1950s, as Denise Seachrist writes, ‘El-Dabh begun experimenting with the idea of sounds and noise and how music could be carved out from noise’ and ‘he begun to think that perhaps he could chisel the sound out rather than building it in’ (Seachrist 2003: n.p.). This analogy of a sound composition with sculpture suggests sonic figures might be formed from the sonorous, just as figures might be carved in such a way as to leave or emphasize qualities of the material used to make the sculpture. Audio diagrams as (sculptural) assemblages of manipulated and edited sound might retain traces of the sonorous, its heterogeneity. When all is said and done though, it may be that reductive, objectal logics and open, schizological approaches are just different forms of listening and sound making important to audio diagramming. To approach this binary from a new perspective, it is helpful then to attend to the deep listening practices and diagrammatic scores of Pauline Oliveros before finally making a case for specific audio works as audio diagrams.

Diagramming Listening and Listening as Diagramming

Diagrams as graphic notation for sonic performances differ from conventional musical scores, in that they can include not just symbols, but icons and indexes

and they can take the form of geometric or spatial arrangements of figures. The pages of conventional Western musical scores might be diagrammatic in part; even so, conventional musical notation systems are different to diagrams as scores; the latter invite the tracing of vectors of unknown or multiple directions, which the former guard against. Conventional musical notation is a technology of remembering (of scanning) to give fidelity to repeated performances of a composition or sequences of sounds. If diagrammatic scores also operate through scanning, they are often, at least in terms discussed above, aids for recollecting what has not been inscribed, inviting performances exploring spontaneity and attending to contingencies, which all requires techniques of listening and responding that are different to reading musical notation.

Exemplary diagrams for sonic performance are found in *Anthology of Text Scores* by Pauline Oliveros (2013), a musician, composer and exponent and teacher of Deep Listening practices. The anthology presents many diagrams. One score, *Wind House Mandela*, merits particular attention as, to quote Oliveros, 'a kind of map for organising and creating performance', guiding a sonic improvisation that navigates a series of opposing terms – including 'Differ', 'Match', 'Louder', 'Softer' – placed in a circle surrounding the central protocol 'Listen' (92–4). Scanning the score provides direction for listening and responding sonically to an environment, which is a process of tracing what has not been inscribed, and which can be thought of as a form of passing.

'Listen' – the key directive for performing the Mandela – is indicative of the artist's auraltechnics and Oliveros has stated that the ears hear whereas the brain listens (as a third ear?): 'Focal attention, like a lens, produces clear detail limited to the object of attention. Global attention is diffuse and continually expanding to take in the whole of space/time continuum of sound' (Oliveros 2005: 13). In this way, Oliveros conceives of a practice of focused (reduced) and global (open) listening, registering or thinking of sound traces in spacetime, or of differentiating (or sounding) figures from a sonic environment, or even as a continuous practice of creating audio figures from or alongside a sonorous or sonic continuum. An important question is does *Wind House Mandela* engender compositions of intelligible relations (diagrams rather than a series of indexes)? An answer becomes apparent when attending to the scope of terms inscribed on the circumference of the Mandela which include 'Inner', 'Outer', 'Story', 'Metaphor'.

To explore this further, it is worth reflecting on Schaeffer's *Étude Aux Chemins De Fer* from the perspective of a Deep Listening practice. Schaeffer's work seems the inverse of works produced by Oliveros, for Schaeffer's compositions seem analogous to visual schema, whereas Deep Listening has affinity with Leeb's diagram tribe of the moving map. A process of Deep Listening to *Étude Aux Chemins De Fer*, using the *Wind Horse Mandela*, makes this relation complex. For Schaeffer's audio work presents sounds that are recorded outside

a train, next to the engine and from inside a moving train – ‘outer’ and ‘inner’ acoustics are audibly different, and they mark a train standing still or moving on tracks through a landscape. There is the sound of heat (energy put to work) too, released through a whistle. Schaeffer’s *Railway Study* presents the sound (a story) of the first and second laws of thermodynamics, and a rhythm of (and metaphor for) modernity and industrial progress (or from a contemporary perspective, for unregulated fossil fuel carbon emission). Reduced listening is reversible then? Or at least, it might be said, whether an auditor identifies what they hear as isolated Sound Objects or traces of milieus, or whether the auditor takes up reductive or open practices of listening is, to an extent, a choice – a practice – and not fully dictated by sonic material or compositions. What becomes clear and undeniable though is that audio diagramming would involve not just sound making but diverse ways of listening too, just as visual diagramming would involve not just drawing but specific modes of looking or seeing. And such a practice might combine and shift between focused and global, and reduced or open modes of listening.

Refrains of Listening

Experimenting with the *Wind Horse Mandela* raises a question: is it necessary to make a sound work to make an audio diagram if listening is a form of composing? This may again come down to definitions, but if audio diagrams are intended as a form of telegraphy, then the answer would be just listening, remembering and imagining is not enough. (Then again, if telegraphy is not a goal, perhaps just listening, remembering and imagining is sufficient?) What then is the role of listening, remembering and imagining in telegraphic audio diagramming? The answer is implied in Lyotard’s concept of a Third Ear: it is to make and explore a sonic assemblage and to imprint or draw out an assemblage’s refrains. In the clinic the analyst repeats or draws attention to signifiers; in audio diagramming, sound is made or presented to an auditor.

A new term – the Refrain – is introduced above. If earlier in the chapter it is suggested that Deleuze’s idea of the Diagram might limit a discussion of audio diagrams, the concept of the Refrain that the philosopher developed with Guattari, aids nuanced exploration of diagrammatic sound making and listening (Deleuze and Guattari 1987: 310–50). Deleuze and Guattari’s first example of the Refrain is a song that a frightened child sings under their breath when walking in the dark, to create a ‘center in the heart of chaos’ (311) and to ‘seek, mark and assemble a territory’ (327) that is familiar. This territorial assemblage is the first of four kinds of refrain identified by Deleuze and Guattari. A second kind assumes a function within a territory (the example of a lullaby is given), a third marks out

new territories (by means of deterritorialization and reterritorialization), and a fourth and most radical refrain serves to ‘gather forces’ and engender a departure from a territory, to say ‘Goodbye’ and embrace the cosmos (327).

With the idea of sounding out and (deep) listening to different kinds of refrains, it is possible to advance an auraltechnics that embraces heterogeneity through a continuous process of registering, assembling and reassembling the traces of audible effects and relations in sonic fields. This would be a sonic diagramming of mutable, transient and fugitive refrains. In adding concepts borrowed from Oliveros and Deleuze and Guattari to ideas gathered in support of the cause of audio diagrams, we finally arrive at the point in the chapter where audio diagrams may emerge.

Conclusion: Sitting in a Room, Listening for Audio Diagrams

Where to find audio diagrams? The four candidates discussed already – the work of Schaeffer, Lucier, El-Dabh and Oliveros – suggest the search should span various kinds of compositions including sonic works made up of discrete parts or repetitions and compositions that are analogue or continuous. Starting with an approach privileging number, pattern and symmetry, Marcus Du Sautoy suggests the music of Oliver Messiaen is a candidate for consideration as an audio diagram.⁶ The mathematician points to how prime numbers structure Messiaen’s *Quartet for the End of Time* (1941), in which two different musical sequences are played together 17 and 29 times respectively before being repeated, ‘to create the sense of timeless[ness] in the piece’ (Du Sautoy 2012: n.p.). Du Sautoy is interested in how Messiaen’s use of the two prime numbers creates a series of musical permutations analogous to a multi-dimensional form, which cannot be drawn or modelled in two or three dimensions but that can be perceived through the fourth dimension of time. Is *Quartet for the End of Time* an audio diagram then? The answer may hinge on whether a multi-dimensional figure manifests through scanning Messiaen’s score alone. Du Sautoy is clearly appreciative of the aesthetic or affective qualities of Messiaen’s use of prime numbers. It may be though that counting rather than listening (as this chapter has defined it) realizes Messiaen’s composition as a diagram, albeit as a refrain of a ‘center in the heart of chaos’, analogous to Leeb’s systemizing visual aids.

If formal sonic approaches privileging counting and number do not produce the strongest case for audio diagrams, will attending to analogue practices be more productive? There are practices that present what can be called zones of sound, in which the continuous, sonic idiosyncrasies and harmonics of spaces are made apparent – in which forces are gathered as refrains to register the

cosmos. The works of La Monte Young and, in particular, the installation *Dream House* (1993) made with Marian Zazeela, exemplify this approach. *Dream House* consists of a recording of a cyclical repetition of sine waves, played within a room with magenta lighting. Movement of an auditor's body (movement of the ears) engenders exploration of the relationships of various frequencies. Here, something similar to the Diagram of Deleuze might be claimed, in which multiplicity – the cosmos – registers in Young's and Zazeela's space or composition. To continue this exploration of sound and space, other practices developed a similar approach towards more architectural ends. Brian Eno (a musician influenced by Young) is interested in how sound can demarcate and transform space. He is reported to have suggested that, one day, music will be used diagrammatically (Toop 2018: 11–12); that is, music will create calming atmospheres for specific spaces (as refrains put to use in a territory) – Eno's recording *Ambient 1: Music for Airports* (1978) being something of a manifesto for this idea. Towards more critical and diagrammatic ends, Steve Goodman and Toby Heys, a.k.a. Audint, developed an installation titled *Dead Record Office* (2010) consisting of zones of sounds produced through ultrasonic, directional speakers. An auditor moved through Audint's installation, relating sounds to an archive of cards pinned to a gallery wall, which looked like record sleeves and presented images of figures and events. *Dead Record Office* engendered exploration of the ways frequencies have psychological and physiological effects, themes that Goodman (2012) and Audint (2019) have also explored through researching how sound can function as a weapon, aid control, conjure the past and serve as a continuum between the living and the dead (as a refrain with specific social functions).

If a diagram emerges in Audint's installation (perhaps the work of most interest here), it is through combining sound, architecture and images, which is not to dismiss *Dead Record Office* as an audio diagram but point to the work's hybrid character. And this is true of the *Dream House* by Young and Zazeela, and Eno's idea of sonic zoning, in which sound serves architectural ends. Related analogue approaches that are less architectural in terms of presentation are worth attending to here. Éline Radigue conceived the work *Occam Hexa I* (2013) for brass, string and woodwind as a wandering through the Ile de la Cité in Paris; a composition that is performed by a tracing of the island facilitated by a drawing made by Radigue. Similarly, Susan Stenger's sound piece *Sound Strata of Coastal Northumberland* (2015) is a sonic tracing of a geological and geographic mapping of a coastline. Stenger's work consists of the exhibition of an artefact, a scroll depicting a cross-section of the coast, accompanied by a sonic composition that draws on historical and local musical traditions and environmental data. In both Radigue's and Stenger's compositions, continuous sound conjures places and times. However, the annotated images seem important to the emergence of any diagram; which is to say, in these works,

visual components supplement audio compositions and vice versa. Does there exist an audio diagram without supplementary images or architectural components – is there an audio diagram discernible through listening alone?

Turning to forms of music engineered through sound effects, one candidate is Dub, or rather Edward George's theorizations of the *Strangeness of Dub* produced as a radio series for Morley College in London (George 2019–20). George explores Dub as a sonic genre engineered through echo, delay and reverb effects that can signal refusal, create silences or erasures and address colonial and post-colonial legacies. For George, the erasures of instruments and voices in Dub through sonic effects mark an absence of presence – a metaphysics of Dub similar to Jacques Derrida's use of the concept *sous rature*, which describes a word that is crossed out but remains legible, indicating a phrase that falls short of expressing something about existence but, nether-the-less, is still needed to articulate something that cannot be fully expressed. There is a danger here that the sounds of King Tubby, Lee 'Scratch' Perry and others are being requisitioned by this chapter for an academic cause, and that without referencing Edward George's inventiveness and deep knowledge, an audio diagram would remain elusive. Dub's erasures are audible though and can be said to have diagrammatic affects, an example being *I and I Survive (Slavery Days)* (1976), a Dub version of Burning Spear's *Slavery Days* (1975) in which the musician sings 'Do You Remember the Days of Slavery?'. In the Dub version, Burning Spear's words are absent but return as an auditor remembers the original. For George, placing words and melody under erasure through delay and reverb effects or instrumental adaptation points to traumas past and present, as well as the promise of paradise in the future for the descendants of abducted people, through a return to Africa. It would seem Leeb's description of a diagram as a crossing out that is both exploratory and destabilizing is relevant to Dub and its deterritorializing-reterritorializing refrains. Perhaps discursive description does similar work to listening to the sonic elements of a composition when casting Dub tunes as diagrams? Whatever the case, with Dub we move closer to registering audio works as diagrams through attending just to compositions (it is the case that discourse is a supplement or agent in this case, but this is true of all diagrams).

As the chapter moves towards its goal, to take stock so far, two kinds of compositions are relevant to audio diagramming: the first are sonic presentations in which sound is registered as an assemblage, as with De Sautoy's approach to Messiaen; the second are compositions in which time or duration can be registered as actualizing temporal and spatial dimensions, as with the sonic presentations of Young, Eno, Audint, Radigue and Stenger and George's Dub. The combination of the functions of these two kinds of compositions can be found in the later work of Steve Reich, and in particular Reich's *Different Trains* (1988) and his interest in analogue recordings and repetition and difference

producing sonic assemblages in which audio events have both temporal and spatial dimensions or resonance. *Different Trains* is a composition for string quartet and tape samples, and the work revisits Reich's interest in tape pieces explored early on in his career. The composer has explained how *Different Trains* developed from reflecting on his childhood, when he travelled across America on trains with his governess. As the child of Jewish parents, if he had been in Germany or other parts of Europe when young, he would have been travelling on very different trains with deadly destinations. In the first movement, recordings of phrases uttered by Reich's governess and a retired Pullman Porter are looped with the sound of trains. The second movement presents the words of Rachel, Paul and Rachella who give testimony about Nazi antisemitism. Samples from both movements are reprised in the third movement, which points to the relocation of Holocaust survivors to America after 1945. Throughout the work though, through difference produced by repetition, some refrains are fugitive, unsynthesizable, escaping identification with a place or person. When listening to the *Different Trains*, recollection assembles signifiers and refrains that point to stories and histories while, at the same time, traces of the heterogeneity of the sonic are registered too.

Reich thought *Different Trains* was a new form of musical documentary, and the cinematic quality of the composition cannot be denied. Importantly, the three movements of the piece are titled 'America-Before the War', 'Europe-During the War' and 'After the War', which creates a discursive-diagrammatic structure for the work. More expansive than Schaeffer's *Railway Study*, *Different Trains* makes a relation between American and Holocaust transportation systems through deterritorializing and reterritorializing refrains, with train whistles becoming war-time sirens, and the instruments of the quartet sounding out the samples of moving trains and the rhythms and tones of the speech of different witnesses. While lacking perhaps the openness of the work of Young et al., and the metaphysics of George's *Dub*, *Different Trains* stands as a sonic diagram of Reich's reflection on time and place, on modernity, and on what it means to survive and remember the Holocaust. If such a thing as an audio diagram is possible, *Different Trains* – a sonic composition analogous but also far richer and more open than any graphic timeline or map – is its progenitor.

Notes

- 1 El-Dabh's experiments are contemporary with the development of *musique concrète*.
- 2 The term time is used throughout the chapter to refer firstly to the human experience or registration of duration, and secondly to the processual and to events. The term time is not used to refer to any measurable dimension or given any scientific or objective value in this chapter – indeed, many physicists would argue that time is an

illusion, produced by human motor-sensory processes and a failure to understand entropy.

- 3 In the first instance, Leeb is quoting John Ó Maoilearca (formerly Mullarkey) (2006: 162). In the second instance Leeb is quoting Ben van Berkel and Caroline Bos (1998: 22).
- 4 It is worth noting that Deleuze was greatly influenced by Foucault's thinking on the capturing, tracing or registering of forces that would escape discourse:

What can we call such a new informal dimension? On one occasion Foucault gives it its most precise name: it is a 'diagram', that is to say a 'functioning, abstracted from any obstacle [. . .] or friction [and which] must be detached from any specific use'. [. . .] It is an abstract machine. [. . .] It is a machine that is almost blind and mute, even though it makes others see and hear. (2006: 34)

- 5 The term clearing is initially derived from Peter Sloterdijk who writes:

[. . .]the history of the Clearing cannot be developed only as a tale of man moving into the houses of language. For as soon as speaking men gather into larger groups and connect themselves not only to linguistic houses but also build physical houses, they enter the arena of domestication. (2009: 22)
- 6 Du Sautoy made this claim during the Royal College of Art symposium DIAGRAM, 24 February 2021.

CONCLUSION: ALLUSIVE DEVICES

Discussion between the authors that took place on 31 March 2023.

Three Kinds of Analogy

David Burrows: The first thing to discuss, I guess, is a definition of analogy, in relation to the title *Drawing Analogies*. I will start by suggesting an analogy affirms a correlation through asserting a resemblance or correspondence between things, or it's a finding of equivalence or connection when comparing the structures, functions, and relations of things. I think this is picked up in Dean's text, and Mary's texts, and maybe in my texts and John's, that there might be two kinds of analogy. There is analogy asserted as a similarity between things through appearance or resemblance, and another kind, which is analogy asserted as a similarity between the relations of things, which is very important to diagramming. A diagram draws analogy through the relations of that diagram having similarity with the relations of what is being diagrammed. But there's another analogy, a third kind of analogy that's addressed in Dean's text on intensive diagrams, which is, I'm going to say, analogy as becoming-like. So Dean, you suggest this third kind of analogy is made through the diagram of Gilles Deleuze. Making something new, I would say, by becoming-like, by becoming like a beetle in Kafka's story. The protagonist doesn't actually become a beetle but something new. Another example is when Virginia Woolf becomes a shoal of fish. I have some problems with the idea of becoming but I think this idea is important in relation to a third analogy and diagramming.

Dean Kenning: Although I think Deleuze would reject the word 'like'; for him, becoming is not mimesis. It's more a sense that something completely new has been created through a connection. I agree there probably are three types of analogy or three ways in which I'm thinking of the term. One is simply the

Peircean sense of an icon operating through resemblance – whether that's an image or a diagram or a metaphor. The second type is when something resembles something structurally. And the third kind of analogy is what Deleuze names 'aesthetic analogy', which he defines as 'resemblance by non-resembling means' and which operates on the nervous system.

I know in John's chapters there is a concern about the influence Aristotle has had on all sorts of classification type thinking and logic systems. This relates to when we try to identify something in terms of similarities, and in terms of differences. In *Difference and Repetition* (1994) Deleuze is really focusing on Aristotle's notion of analogy across genera, which is the point where things can't be identified in terms of a common concept that they fit into. So, you cross the branches of this classificatory tree, and the only way you can do that is by forming a likeness between two different sets of relations: fins are to fish as wings are to birds or whatever. So, this is a structural likeness between different things, rather than minor differences between likenesses within a common species, which would be a more perceptual mode of analogy. When Deleuze gets to his book on Francis Bacon, he introduces this new notion of analogy, aesthetic analogy, as a way to talk about how a painting or artwork can acquire an intensity which produces a sensual or nervous, rather than iconic, resemblance to the world. He uses the parallels of analogic language, which is non-symbolic, kinesic and vocal communication about relations, and analogue synthesizers which modulate sound physically, in a continuously variable way, rather than through translation in code. And I think for Deleuze, what he's always trying to do is make connections without creating gaps in the way things relate. That's the difference between the arboreal and the rhizomatic diagram, everything at any possible point is able to be connected potentially to any other point, due to the univocal field of forces from which everything emerges. So, there's an actual physical relation in Bacon's work between the intensive processes that are going on in the plasticity and tonal intensity of actual painting, and the embodied facts or sensations that Bacon is trying to get down in paint, which are the intensities of life, brought on by forces hitting the body, and the body being this sort of agitated meat.

I always think Deleuze uses a lot of analogies. He's not using them in the Aristotelian sense, creating relations between two things which remain distinct, so that we can understand one fixed thing in relation to something else. Deleuze is using analogies almost like examples of the ways univocity functions at these different levels of reality. That's where I'm trying to get to. To a new notion of resemblance through aesthetic analogy, which is much more physical, and about hidden, intensive processes rather than about something laid out in extension before your eyes, as in a classificatory diagram. So, we're not jumping between points with Deleuze, we're plugging into different, connected moments across a univocal plane of being.

David Burrows: Can I cut in.

Dean Kenning: Yeah, go for it.

David Burrows: This leads me to another aspect of analogy and diagramming that I've been thinking about, and that we've discussed. It's analogic thinking, which we've discussed before when thinking about anthropology. Actually, it's a question of ontology. Maybe that's not the right word, it's a question of an ontological orientation, which Philippe Descola calls analogism in *Beyond Nature and Culture* (2013). We've talked about this in relation to the Great Chain of Being, an idea prevailing in medieval Europe. But you also find analogism in Africa in societies that draw similarity between social events and the climate. Or in China and elsewhere, when similarities between microcosms and macrocosms are drawn. Descola says that analogism and analogies are elusive and that they offer dizzying prospects because, I guess, they make connections and create order, through finding similarity in a world of many things that seem not to be ordered. And Descola says, what happens is, in Europe, this way of thinking gives humans a special focus: humans are able to create meaning and order, which gives rise to what he calls naturalism, or we can call it the sciences and Enlightenment. And this interested me a lot, because it seems that diagramming, not always, but quite often, is associated with a kind of scientific presentation of knowledge, or a development of knowledge that might be mathematically presented, or allow for deduction, whereas analogy is inductive. This is what Peirce says as well: analogy is inductive, and therefore it creates uncertainty. So, it seems that in diagramming you might have something like two ontologies at work, analogism and naturalism, or some processes that are analogical and perhaps some that are scientific. And I thought this is something that all of us seem to be dealing with, to a greater or lesser degree. Which might point to different kinds of diagrams, like the diagram that fixes information, concerned with systems and defining and communicating things precisely, or diagrams that are exploratory, that open up relations and that, in the sense that Dean is talking about diagrams, produce something new. I would suggest we've never and don't now see these different diagrams in a hierarchy – that one's better, and that one's worse than the other. And we might say that all diagrams might partake of those aspects, which suggests to me that diagrams are a little schizo.

Mysticism and Science and Diagrams

John Cussans: I'm trying to draw some threads together here. I think we can work from what Dean said back to what David just said. This is a question for

Dean that relates to Mary's chapters, particularly the af Klint chapter, but also that relates to both of David's chapters. And it's something to do with a general assumption that diagrams are scientific, that they have become closely associated with Western techno-rationalism. And popularly, they still seem to be associated with that. But it's very clear from our research, that in fact diagrammatics are rooted in mystical, occult, quasi-scientific modes of representation. So, things like the Great Chain of Being, which just came up, is crucial for Aristotle. In fact, the legacy of Aristotle is linked to, or built on, in some ways, a model of a Great Chain of Being, which is not a scientific diagram at all, but its hierarchical implications tend to be perpetuated. And the diagrams of people like Robert Fludd (the 17th-century physician who made magical, alchemical and astrological diagrams) and a lot of the diagrams that Hilma af Klint is referring to and drawing on – theosophical, spiritualist, mystical, hermetic diagrams – are not scientific in a modern sense, and yet they make analogies between macrocosms and microcosms, which can be understood as relating to scientific ideas. There's this sense, I think, with all our work, that we recognize that diagrams lean very much into the mystical, the spiritual, and that which is understood now as unscientific. And this is an argument about whether or not diagrams can ever really lose a link to metaphysics, theology and a fundamental question, which as David points out, concerns the separation of order and chaos – which is there in Fludd's diagrams of microcosms and macrocosms – and the question of how you distinguish between those things. And just to bring it full circle, when I was reading Dean's chapter on intensive diagrams, I was struck by the quasi-mystical aspect of the concept of intensive diagrams, and the use of the cruciform, this analogy of the crucifixion which immediately, to me, raises the question, what is the crucifix doing in the centre of Deleuze's diagram? And as I read your chapter Dean, I kept feeling, there's a mysticism in Deleuze that I'm wondering about. Anyway, it's a returning question. Thinking about Mary's chapter on Hilma af Klint too, is there a residual mysticism, even of a material kind, in Deleuze's philosophy?

Dean Kenning: Well, I've got lots to say, there's so much there. I might want to come back to this idea of the relation between science and art in terms of allusion. But Mary . . .

Mary Yacoob: What at first interested me in af Klint's diagrams are the analogies she was drawing between the visible world and the invisible world. So, she was using biological and botanical imagery to visualize her ideas about spirituality. She had contributed scientific illustrations for a handbook on horse surgery for a veterinary institute and created watercolours of plants early on in her career. Later she was drawing correspondences between what you can see, what you can observe in the phenomenological world, and what you can't see in the spirit

world. Also, some art historians have drawn correspondences between new technologies which were allowing people to see what had been the invisible properties of matter, such as X-rays, developments in microscopes, or the idea that the world is permeated with electromagnetic waves, with ideas about uncovering the spiritual world. So, Theosophists or Anthroposophists were saying that maybe you could have a spiritual scientist, or a kind of science of spirituality, where you might be able to see invisible spiritual realms through, say, meditation, or learning about religion. And so then, diagrams became a space in which you might manifest these ideas and communicate them to others.

Dean Kenning: Yes, I think that the traffic goes two ways, in terms of the mystical drawing analogies from science and the other way around. This is true if you just look at the way that chemistry came out of alchemy, for example. But actually Mary, what you were saying about this invisible ground, the fact that there is this invisible realm relates to John's question about Deleuze's mysticism. I think Deleuze is a very materialistic philosopher, but there is an ideal realm, he calls it the Ideal plane, whereby being is one, and difference is being. Being is one in the sense that all difference *is* in the *same* way. And so, there is this sort of underlying or continuous ground or field of intensive relations that we need to get to. And that's why we need abstraction, the abstraction of the diagram. But the abstraction of structural diagrams for Deleuze is never abstract enough, because you're still dealing in this sort of Aristotelian representational logic of difference and similarity and the structural and hierarchical gaps between things. Whereas Deleuze, he's trying to get to the underlying shared ground of absolute connection.

But I just wanted to say one thing, maybe we're in danger of setting up a false dichotomy between science and artistic diagrams which are supposedly more tuned into the body. Here I think of Gilles Châtelet, who is important for us, who describes what scientists and mathematicians do in terms of an irrationalism, a romantic irrationalism, and from which certain things can be fixed in terms of how we understand the relation between one part of reality and another (2000). But Châtelet talks about how, for him, diagrams are embodied devices, always in a constant dialectic with thought experiments on the one hand and laboratory experiments using physical apparatus on the other. And there's a constant motion between these things, so he will talk about thought experiments as allusive devices. An allusive device is a means by which you can propel your own body, through imagination, into a certain space, and in the process, you create or discover the space itself. And using a scientific instrument is an allusive device, in the sense that it allows your hands to think through gestures, just as diagrams do. So, we're in danger of a sort of Aristotelian categorical division or Cartesian dualism if we draw this difference between the sciences and art too strongly, even in terms of analogies, even in terms of how mysticism draws on scientific

systems in order to come up with an alternative version of reality – that still seems to separate things out too much.

Plane of Assertion and the Phemic Sheet

Mary Yacoob: Dean, you talked about a univocal field of forces that Deleuze wants to get to, a plane of being, which is an abstract machine or diagram. Deleuze is interested in how relations can come into play, and then get disintegrated and reassembled again in different ways. And I thought that this might link to what we keep coming back to, which is Peirce's idea of a diagram as a plane of assertion, a plane on which lots of different kinds of things can come into relation. So, I was just wondering if we could talk about the possible connections between these two concepts from Deleuze and Peirce, and how the diagram comes into play here.

John Cussans: David's written quite eloquently about this, I think.

David Burrows: Yes, maybe there is a relation. My understanding is that on the side of Deleuze, he's a 100% Spinozist and he believes in univocity, which I personally don't believe in. I think it's a questionable idea about the world. From reading anthropology, I would see univocity as one ontology among others. If you believe in univocity though, you believe that everything is one substance, as a kind of virtual reality, and actualization produces difference in extension. We got the idea of a diagram as a plane of assertion from Peirce who describes making a diagram by cutting up a sheet of paper. Making what Peirce refers to as a Phemic sheet, which is a term meaning a sheet of inscriptions, a sheet of lots of different forms of languages and representations existing side by side, together. Peirce's sheet of paper has different colours on each side. He cuts out a shape and turns it around and inserts it back in the sheet. He cuts into the continuum, analogous with the sheet of paper, so it could be the sheet of paper is everything. You make the cut and you actualize something, assert something on a plane. But it seems that there are differences between Deleuze and Peirce as well. Deleuze definitely buys into univocity as, that's what reality is. I'm not sure Peirce has that idea at all.

Dean Kenning: No.

David Burrows: I just want to say one other thing. I do agree, it's a false dichotomy to have science on one side and art on the other, definitely. But there are different modes of thinking or modes of operation. There is a difference

between analogy, which seems to be more inductive, and some procedures of the sciences, which work through deduction, working away from uncertainty rather than through uncertainty. Scientists obviously use analogy all the time, and use induction. There remains different ways of operating through diagrams, but it seems to me what underpins diagramming is analogy and analogous relations, and analogic thinking at some point, which is the case even when diagrams present deductive reasoning or mathematical proofs. There is a difference between formula or an equation and diagrams. The latter work through analogy.

Dean Kenning: Yes, Peirce is quite a mystical thinker as well, you might say. But the difference between Peirce and Deleuze is there is a notion of a certain evolution in Peirce's thought which I think Deleuze doesn't believe in. Peirce's system is dynamic, because what he calls firstness is always coming into interrupt thirdness, such as the symbol when it comes along to fix something. It's interesting to relate this, actually, to what you write David about musical notation, because, although conventional musical notation is iconic, it is diagrammatic, we almost don't see it as a diagram because it has become so conventionalized that we read a conventional score like we read a book. We're not looking at musical notation as a diagram, even though it has strongly diagrammatic elements. So musical notation has ended up being symbolically fixed.

But because of firstness, and because the icon is firstness, reasoning is not simply inductive or deductive, it's also abductive. So abductive reasoning would be this point where allusion is possible, the point where we are thinking through possibilities, and that would be the point where we are constructing a new diagram, when we're not simply operating on the diagram we have, but we start thinking about forms differently.

What's interesting about what you said Mary is, I think you're right. Deleuze does draw a lot of diagrams and even draws his 'diagram' in his book on Foucault, quite neatly, in conventional diagrammatic form. But the way he's using the term diagram, which he initially takes from Foucault, is to refer to some sort of abstract level, where we're not thinking about the actual stuff we see and the stuff we read or hear, we're not thinking about visible structures or discourse. We are thinking about the invisible forces that are churning about, which we can't really pinpoint, but which determines things to emerge into visibility, or into language. Deleuze is not talking about diagrams in terms of the Phemic sheet where you get down a number of relations in the clearest way possible, in order to mentally or graphically experiment with the objects that a diagram is representing. Deleuze is demanding a different sort of flattening. If you flatten everything, then you begin to see the way that things connect that otherwise appear to be completely separate, autonomous entities. You flatten it all down and that's where the diagram operates. The diagram is operating when actualities

get flattened down to this virtual level, so we can make connections that never occurred to us, because it doesn't appear to be the way things actually exist.

Making Diagrams

John Cussans: Can I step in here? I just wanted to draw a chain from what David was saying about the Phemic sheet and our discussion of the plane of assertion, which we've talked a lot about, and to take it back to this question of art making, or artistic practice, which is core to what we all do. Obviously, we're very interested in the Phemic sheet, and what's nice about this example from Peirce is that he actually cut into the paper to make a diagram. It's a sculptural work, and we know that Peirce made lots of diagrams, and Deleuze is very interested in the line in Odilon Redon's art, and the work of Bacon. And there's something about the drawing, making and production which obviously draws us to these thinkers addressing practicality. On the other hand, part of the trajectory of making art is towards the construction of objects which often end up sitting in galleries as finished artefacts. Precisely because of their finished aesthetic nature, they don't carry with them that practical or pragmatic function and tone of diagrams. I'm not sure where I'm going with this but I just wanted to ask if anyone wanted to speak specifically to that question of aesthetic artefacts and the function-serving nature of diagrams.

Mary Yacooob: I think you see this in af Klint's works, where she is observing and making drawings of plants, and then trying to schematize what she sees as their spiritual properties. I was wondering if that is what you're talking about John, artworks that emphasize their function as thinking devices, as tools for thought, which is maybe more emphasized in, say, conceptual or process art: artworks that really emphasize, through their manifestation, the process of their production, and how they are used as tools for thinking? Maybe they convey that sense of the activity of diagramming, which is something that David also talks about.

There is the noun 'diagram', as a kind of finished artefact, with which, like Peirce, we reason and make inferences. There are diagrams as aesthetic things, diagrams where we don't fully understand the intelligible relations they are conveying, but we respond to them aesthetically. And diagramming as a verb, emphasizing the activity of diagramming, which is what David discusses in his chapters on sound and cosmological diagrams.

Dean Kenning: I thought maybe, Mary, this relates to Joy Division's *Unknown Pleasures* cover, and the way you discuss what Peter Saville did to that image, using it as a graphic piece of design which has an allusive feel of an index of

some kind. We're not told what the index is. There's something about this image that feels like some technical apparatus has captured a physical rhythm or vibration, or communicated something outside of human language, whilst also giving us an icon of a sort of mountain range. So that there is a relation here between the romantic landscape and the inhuman cosmic landscape, presented in this paired-down, abstract, scientific way. What you were saying was that Harold D. Craft, who originally made the diagram I think, for a PhD project, he tried out arrangements. You know, he's already being quite creative, putting these pulsar graphs together in various ways. But his focus is on putting them together in order to communicate information about the pulsar, and so he didn't want something too suggestive, in terms of depth and the idea of passing by a mountain range. He wanted to keep it objective, to take out the embodied aspect of maybe walking past the mountain range. So, I don't know if you'd like to elaborate on that in terms of this question of the difference or non-difference between what artists do and what scientists might do in terms of the diagrammatic.

Mary Yacoob: Craft says at first he was playing with aesthetics when he displaced each line by a certain number of data points, so that the stack of lines in the diagram would slant diagonally across the page. He thought that looked aesthetically pleasing and interesting, and he enjoyed manipulating his materials, which in this case was the data; like, I think, a sculptor or artist would manipulate clay or stone or paint. But in the end, he decided to have the diagram appear as a vertical stack of lines because the purpose of the diagram was to compare the shape of the pulses, to identify patterns in the data, and it was more difficult to do that if they were appearing on a slant. In the end, the practicality of what he was doing took precedence. Whereas I could imagine an artist like Sol LeWitt doing a whole grid of stacks of modulating lines on different diagonal slants, and that for him would be an investigation into the formal and geometric properties of these lines, and an investigation into spatial perception. Martin Kemp says that if you look at people's processes rather than the intentional ends or the absolute end results of what they manifest to the public, there's probably quite a lot in common between what scientists do and what artists do.

Dean Kenning: Yeah, that's certainly Gilles Châtelet's point, that diagrams are gestures. I guess this might relate to the difference between the analogue and the digital as well. The idea that we use our hands, we use our bodies. And it reminds me of something that Deleuze says, which is that through the digital, we lose our hands, and we replace them with a finger, and the finger is the thing that presses the button. He's writing this before mobile phones. You become a finger or a digit that chooses from binary options. So, we lose a certain capacity to manipulate stuff. It's quite interesting Mary that you talk about data as being sculptural material that you have to act on. It's not a passive thing that you simply

receive, which is normally how we receive it in infographic diagrams, and in all this quantitative data that we're fed through our screens.

David Burrows: In Châtelet's writing there's also very disparaging remarks about set theory which he sees as just the poverty of counting things, which might be digital in approach, and he insists on this. He's interested in perspective, in creating horizon points and proximities and distance. This is perhaps what links him to Deleuze. Châtelet is also interested in scientists that use diagrams to explore the potential of forms or of mass.

Dean Kenning: Yeah, he says, you recognize them in these moments when being is caught smiling, before they curl up and die and end up as schematics in student textbooks. Well, this is what happens, but you look at the original diagrams – even though Châtelet doesn't talk about biology, if you look at that famous Darwin sketch of the 'Tree of Life', which is quite rhizomatic in fact, it's this sort of explosion. You can sense the moment of realization and invention. So, suddenly something is bursting out in an iconic form that can't be expressed symbolically in writing – writing is too slow, writing is too ponderous or vague. And it just appears as this image.

Mary Yacooob: Darwin writes 'I think' at the top of that diagram, it literally says that.

The Interpretant

David Burrows: It's an observation, which is really a question as well, which takes us back to analogy. A key term for us is one I struggle to understand but hopefully I understand it enough. It comes from Peirce, which is 'the interpretant', which we've discussed before. It seems to me Peirce is saying that a sign is something which gets its meaning, not just from its relation to an object, but from the interpretant? And that's the case with diagrams. Now the interpretant can be thought of as the effect a sign has on a mind, and there's not just one mind, and that really does complicate things. Because how a diagram has sense or meaning relates very strongly to the interpretant, which also introduces the fact that although all diagrams might be abstract, in some sense, they are also produced in discursive contexts. If abstraction tends to open things up, then discursive contexts, even if it's the context of art – even if it is art and diagrams, or art as the diagram – this tends to narrow or limit things. It seems to me that, if diagrams rely on the interpretant, so do analogies. That's another kind of, I wouldn't say elusive point, let's say variable that Peirce introduces, which is very important.

Dean Kenning: That's why Peirce is so interesting and for me offers a real challenge to Deleuze's system. Deleuze and Guattari describe Peirce's system as being involved in signifier and signified relations, but I think that's not so simple, because Peirce's sign is a trinity – not only the object and representamen, but also the interpretant. So, this opens up the whole question of context, the whole question of needs, desires, expectations, misinterpretation and deception. And so, this is not really about signifier-signified relations, which seem very symbolic and human. It's about how some particular sentient thing takes something else for a sign which triggers a response. This is why he calls it a 'quasi-mind', because it's not limited to humans or to symbolic language or to rational thought. Something either feels something, acts in a certain way or thinks something in response to a sign, and that response is the interpretant and at the same time the creation of a new sign. Because any of those living responses can be a sign to someone or something else. And this is why Eduardo Kohn, in his book *How Forests Think* (2013), can construct a whole ecology around Peirce's semiotic system, involving humans, plants and creatures of all kinds. And I think it does relate to what John writes about Alfred Korzybski. I have doubts about whether Korzybski fully achieves a move beyond Aristotle, because his approach seems classificatory, but I know he wants to go beyond Aristotle's binary thinking. Cybernetics and Jakob von Uexküll and Korzybski have this similar idea, that meaning is always a function of what the particular context demands. And this extends, in Gregory Bateson's terms, to the evolution of organisms. In his Korzybski Memorial Lecture, he defines the 'evolutionary unit' or the 'unit of survival' not as an individual or as a species, but as an organism in its environments, because all life forms are so connected in dependency to their environment that it's just daft to separate those things, as if organisms exist autonomously in a neutral space. So, it seems to be that the emphasis on context is an acknowledgment of connection. And what Peirce does through the idea of the interpretant is connect everything in an infinite universe of possible connections across all the various levels of life.

David Burrows: Do you think some diagrams for us are not diagrams for others, if the interpretant is variable?

Dean Kenning: Well, yes, exactly. A diagram is like any sign, a sign is taken in terms of expectations, which might be determined according to the conventions of a society or culture or discipline. So, in a way, we'll read a diagram as a diagram because we recognize it as a certain type of thing. But I guess, for humans at least, a question might be, what would a non-human diagram look like?

Mary Yacoob: We might read diagrams as images and approach them as aesthetic experiences, but we also might read something that isn't a diagram

diagrammatically. So, Michael Marrinan and Frederik Stjernfelt both say that you might see a painting, and read it diagrammatically, if you're starting to examine the skeleton points of connections in the painting, or making measurements in your mind, like comparing the width of something with its height, perhaps you're starting to read it diagrammatically?

Dean Kenning: What about the famous waggle dance of the of the honey bee? This is an icon for bees in the hive representing the distance, direction and quality of pollen. Tell me if I'm wrong, this is a diagram. It's a sign which is interpreted by the other bees, a gestural analogy of the relations of the thing that the bees want, which is good quality pollen, which isn't too far away. And this information is presented in iconic form, an icon of relations.

Mary Yacoob: The dance is a physical moving diagram?

Dean Kenning: Yes, a drawing in space, communicating the position of the pollen.

David Burrows: The only thing is, does the bee see what we do, a bird's eye view of the figure of eight? What the bee might see is a certain kind of dance.

Dean Kenning: But that relates to what you say David, when asking if sound or music can be a diagram. Because you don't get that overview in something that is presented to us temporarily. So, we don't get time to see the synoptic whole.

David Burrows: Yes.

Dean Kenning: It will be a diagram because we still create the form as a parallel pattern.

David Burrows: Yes, but I'm just suggesting that we are not the bee and what the bee sees is different. The bee doesn't see what we see, there's a dance so maybe there's a diagram, but there's some sort of difference there. What I wanted to say was that a dog doesn't see a diagram there, which means that a diagram is reliant on an interpretant. Without an interpretant, there is no diagram.

Dean Kenning: Without an interpretant, there is no sign.

David Burrows: Yeah. And a lot of writing on diagrams tends not to take this idea on board enough maybe.

John Cussans: I agree that all diagrams are cultural diagrams to the extent that there has to be a repertoire of significations for them to have meaning and to operate. And I also agree that you can recognize diagrammaticity or diagram-like things within a culture, if it is part of your cultural repertoire to have a sense of what diagrams look like. So I think because we're in a culture that uses diagrams, we can recognize diagram-like things. We understand that they signify intelligible relationships. But we might not understand precisely what intelligible relations they signify. I agree with all that. And I think that David's right, that maybe the cultural specifics of the potential for diagrammatic signification and interpretants is perhaps not always looked at as much. But I want to go back to this question of analogy.

David Burrows: Can I just say one thing? That John, what you made me think of is something Viveiros de Castro wrote, following the metaphysics of Amerindians. That the jaguar likes beer but the beer is blood. Maybe the bee draws diagrams, but the diagram is a dance?

John Cussans: Yeah, thanks for throwing that curve ball.

David Burrows: Sorry.

John Cussans: No, it's fine. It's interesting, because I'm thinking our entire conversation is like a massively complex process of diagramming. I know we're all sitting here writing down and drawing diagrams, I have got stuff all over the place, trying to find the structure to hold the thoughts together, so I can continue a coherent stream of sentences. Mary's got a finger pointed up, and we're like this plane of rhizomic, entangled, diagrammatic consistency. And people are trying to draw insightful visions of how it all works. That's very, very nice.

But if I can try and throw the curve ball back in, and I'll just try to throw it back as a ball, literally, because in Korzybski's Structural Differential (which has two balls as part of the assemblage), the second ball is a Fido ball. That's why it was called the anthropometer because it was explicitly designed to show that Fido can recognize the ball, chase the ball, bring it back, smell the ball, but Fido can't read the anthropometer. A dog couldn't possibly understand Korzybski's Structural Differential. It can't understand the intelligible relations represented by it. I also get, David, that you're resisting a certain anthropomorphism which for me is kind of what the anthropometer demonstrates: the inevitability of the anthropomorphism of diagrammatics, because of the ways in which humans construct symbolic links, coded systems in order to communicate knowledge, and to transmit knowledge over time, develop higher cognitive structures, etc. But that isn't the point I'm trying to make. The point I'm trying to get to is that Douglas Hofstadter and Emmanuel Sander in *Surfaces and Essences* (2013) talk

about analogies as the core of cognition. There's something almost pre-semiotic about analogy for them, that is, to do with recognizing resemblances and making inferences from resemblances that aren't necessarily conventional. I'll just give the example that came to mind when reading *Surfaces and Essences*. I was shooing flies out of the window to try and get them out of the kitchen, and it reminded me of being a teacher and trying to get students to not resist doing the work but to understand that by doing the work, and doing well, maybe they'll be able to fly out of the university window and be free. Now that just came to mind. And what Hofstadter and Sander say is that we're constantly doing that. We're constantly drawing analogies. But the ones that stick are the ones that contain an idea, a cognition that has shared value for understanding something. So, analogy drawing is what we're constantly doing on a certain plane of cognition or pre-cognition, and the analogies that have meaning, or seem to do something, or offer an insight in that moment, they're the ones that we find useful. So, the analogy I drew might be ridiculous and just fall by the wayside. Most analogies, they say, are just wasted. The point I'm trying to make about that is to bring us out of semiotics. I don't think that's different to what we've been discussing, but what it does seem to do is take us out of the problematic of semiotics, which I think Deleuze, Peirce, Korzybski and Lacan, who we haven't talked about yet, are certainly all entangled in. All of structuralism is entangled in semiotics. And maybe there's another way. I'm just putting this out. There is another way of thinking about analogy outside this debate about the signifier, the signified, the interpretant, structure, the code.

Paranoid Critical Method and the Semiotic Square: *Idios Kosmos* and Idiotic Simplicity

Mary Yacoob: John, just to follow on from what you're saying, I was thinking about what you wrote about Salvador Dali and analogies and diagrams. Sometimes diagrams enable you to make analogies between different entities, and some of these analogies might conform to conventional notions of reality. But some of them might resist conventional notions of reality, and this is what Dali was interested in. So, how was he doing that? What was he bringing into play to instigate these kinds of resistances, was it dreams or chance operations?

John Cussans: Yeah, it was serendipitous chance operations and coincidences like the analogy of the snail shell. He's eating snails at a restaurant and talking about Freud. He sees an image of Freud in a newspaper being read by someone

at a nearby table and draws the correlation between a snail shell and Freud's cranium, and then decides that the structure of Freud's thought is like a spiral, like a snail. But I suppose the important thing is that this is very close to Hofstadter and Sander's concept of analogy: that sense that this inventive creativity is something that is constantly happening. But some analogies are credible and work better than others. People will say that's useful for thinking about X, Y and Z. And another person will say, well, that's absolutely ridiculous, it is completely obvious that there is no relationship between snails and Freud's way of thinking. So, it's about perspective in that sense. But obviously for Dali, a crucial thing is that he's trying to undermine any bourgeois, rationalist, scientific, normative model of understanding the universe, which to an extent is a provocation. What he's suggesting is that reality is what he sees it to be, and what he induces other people to see through his art. And it's an assault. I mean, primarily it's an attempt to undermine and dislodge normative, conventional, sensible and dominant ways of thinking about creativity and the world. Whether or not he believed in his analogies, I couldn't say with certainty.

David Burrows: Are we back here to the dichotomy of analogy and analogism and rationalism and the scientific?

Dean Kenning: The thing is, the bee couldn't make a literary analogy in that sense, because that sort of metaphorical analogy, is what Peirce would describe as a thirdness of iconicity. For exactly that reason, I don't think the bee would do a dance to describe the quality, direction and distance of something other than pollen. That would be a metaphorical leap, which is exactly what Dali does. But I have got a question I've really been dying to ask you, John. I made this connection in your essay, probably because I'm very interested in the idiot, and I've written about idiocy. You talk about Rosalind Krauss talking about the stupidity . . .

John Cussans: The idiotic simplicity.

Dean Kenning: . . . the idiotic simplicity of the semiotic square, which nevertheless is so generative, and able to reveal so much in terms of the complexity of how rules are set for certain things to unfold either artistically or socially, politically, and so on. So, there's an almost universal objective schema underlying all our supposedly individual ways of thinking. On the other hand, you talk about paranoid critical theory or paranoia in general as an *idios kosmos*, as a private universe. I was wondering – I thought it's such a rich seam – what is the relation between the idiotic simplicity of the objective schema and the *idios kosmos*, the thing that Dali does. It's Dali who makes that analogy in his own idiosyncratic way, and discovers that Freud's brain is a snail.

John Cussans: Yeah. The Krauss quote is idiotic simplicity and extravagant cunning, that's the second part of it. It's a really strong statement isn't it, but I don't know if I can really answer this question, because you know my chapter starts with idiotic simplicity and moves towards the paranoid critical and puts Jacques Lacan right in the centre of that, because there's a strange dis-temporality to the whole thing. Extravagant cunning is the interesting bit for me, because it suggests another agency, a Big Other. It suggests to me that the Big Other has already got your number, and it's already ahead of the game. And again, it goes right back to Aristotle. So, maybe Aristotle is the beginning of this idiotic simplicity and extravagant cunning that has continued shaping thought for however many years.

Dean Kenning: It's certainly there in the way that structuralism picked up on Marxist ideas about underlying economic structures or on the Freudian unconscious. I'm not sure there is anything different in what you said about Hofstadter. Isn't he talking about an innate, pre-linguistic capacity that is similarly built into any sort of personal creativity we might have?

John Cussans: It's not *a priori*, just to say (I mean the kind of analogies we can draw, or do draw). Hofstadter does say there's a primary necessity to differentiate, related to this thing that keeps coming up as well, which is the figure-ground relation. At a cognitive, psychological level, the ability to differentiate and identify are two basic things you need to be able to do. Again, that would be the same, even for Lacan. The mirror phase is a way of thinking through this notion of identification and differentiation, which will later, through language, lead to symbolic identifications – I'm different from mummy, daddy's different from mummy, they have different names. But prior to that, there has to be this differentiation of a visual field that in some way separates, that makes an object. So, it's probably something to do with Peircean firstness, but I'm not well versed in that.

Dean Kenning: Do you think Dali escapes the other of the other, because the private other just replaces the social other?

John Cussans: Yes, exactly, and that's the paranoid critical position, and Philip K. Dick is where I get the *idios kosmos* idea. Who's he getting it from? Heraclitus, I think. The *koinos kosmos* is contrasted with the *idios kosmos*. The former is about feeling part of a group and a unity, living in consensus reality. If we all agree on a reality, it's much easier for all of us. But if one of us goes 'actually, I don't see reality like that: I think this so-called reality is constructed by a super intelligent alien being that has used this idiotically simple, extravagantly cunning diagram to convince us of things that aren't true', then we're going to feel massively alienated

and isolated, and we're going to be trapped in our *idios kosmos*, which is of course, what Phil Dick felt himself. But he'd also been constructing the alternative version all his life. So, in this way his science fiction was constantly building an *idios kosmos* and a *koinos kosmos*, because his audiences and his readers love the literature. We're constantly doing that. But I think if I understand the paranoid critical perspective of Dali correctly, and what my chapter on 'Invisible Machines' is suggesting, is that paranoia is a systematic delusion. This is what Dali likes about Lacan's theory of paranoia, a perspective that emerged through Emil Kraepelin and others, that it's a highly logical, totally thought-out systematic delusion, which is as tight and deterministic in its clarity, or more so, than so-called reality which we're all told is the real one, the real reality. So, it's affirming the radical alterity of your own paranoid universe as the Other of the Big Other. As you say.

Mary Yacoob: Philip K. Dick sees this as a creative force, as a kind of world building, as a kind of critique of social reality?

John Cussans: Yeah. But constantly engaged with existential difficulty.

Science, Art and Cosmic Connectedness

Dean Kenning: I was wondering maybe to bring you in on this, David, because you seem to be suggesting, not that there is something superior about diagrams that can occur outside graphic form, but that they reach another level, or have more capacity to reach another level, for us to tune into. You're very interested in this idea of cosmic connectedness. And we can achieve this through demonstrating with a line (representing linear time, as Carlo Rovelli does) how we live in a sort of bubble of time, and how that's an illusion. And so, we can connect to stars through constellations that allow us to identify certain things. But then there seems to be, with music or with installation art, or other forms, a point where we go beyond that, into some deeper, more affective realm. I might be misinterpreting.

David Burrows: I feel this is what Mary's getting at as well, in a way. I'd say for me, having opportunities to talk to anthropologists, and our friends Martin Holbraad in UCL Anthropology and Hermione Spriggs, has been important for me. I am slowly grasping what the ontological turn means for anthropology, which made me then reflect on different kinds of ontologies – I guess they would call this ethnographic work but I'm not equipped to do ethnography. I was quite affected by reading Yuk Hui's book *Cosmotechnics* (2016) too, which suggests

that there is an idea that comes from Martin Heidegger, and which others explore too, concerning technology. As I understand it, for Heidegger, ideas about technology stem from the Greeks and the idea of *technē* or *technai* uncovering or revealing nature, which for Heidegger becomes something that masters and dominates nature in the modern era. And in line with some anthropological thinking about ontology, Yuk Hui suggests that there are other instances of technology being developed that don't have Promethean or naturalist, scientific techno-modernist notions or functions. And Yuk Hui basically says that cosmotechnics is a relationship made between the cosmos and moral orders – which I take to be how you live in relation to the cosmos – through technical activity. Whereas the scientific technical modernist approach would be, 1. to separate nature and culture and, 2. create a relationship to the cosmos through mathematics. So I wanted to explore this. Perhaps because artists come out of a tradition in which the relationship of the cosmos and life is considered – even the romantic sublime is something like that. I found when some artists were influenced by the developments of scientific techno-modernist thought, Einstein, whatever, even biology, this influence is explored within an aesthetic approach that's not exactly cosmotechnics, perhaps, as Yuk Hui lays it out, but it's something similar. There's something similar to cosmotechnics in the work of John Latham, Yayoi Kusama, af Klint and other examples I've looked at, Black Quantum Futurism, etc.

There is this bringing of a different kind of diagramming as well by these artists influenced by the sciences, to explore a relation between life (how to live) and the cosmos, which scientists sort of bracket out, for obvious reasons. I think it's the case that artists tend to make things that are accessed through the senses – we have talked about, as artists, how through our training, you think a lot about mediation, materials, and it matters whether you use charcoal or pencil, or you print using ink, it's different to make a digital image than it is to draw quickly in front of people. We also think about embodiment and how this brings bodies into diagrams, and our senses and minds. So there's a difference between a God's-eye view from outside – which I think is important, and I wouldn't dismiss that – and when we enter diagrams through embodied knowledge, or when there's something in the diagram that reflects upon moral orders.

Dean Kenning: How do you then square that with the way Châtelet writes about the sciences? For example, the creation or discovery of an 'electrogeometric space', which is all about these scientific figures of the nineteenth century hurling themselves with diagrammatic gestures into a space which is no longer the extended and deterministic Newtonian or Cartesian backdrop for objects to exist within, but an intensive, pulsating space. Almost as if in drawing the lines of a diagram, you'd at the same time be creating the paper they're drawn on – so there's no distinction between the Phemic sheet and the diagram. Through

making these simple, modest diagrammatic gestures, you are actually, to use the way that Mary was talking earlier, sculpting this space, or modulating it; you're bringing this space into existence. Which is the electromagnetic and Einsteinian space-time rather than a passive container space within which other objects move, according to gravitational pull, and so on.

David Burrows: I think there are examples where scientists are thinking about embodied approaches. With Châtelet's writing on physics, I think there is a sense of embodied knowledge. It's very interesting to me that he talks about perspective, and he really stands out for me because he suggests that's a way of thinking about Albert Einstein sitting on a beam of light, crossing horizon lines, which is very much about embodied knowledge. So, I take the point that science doesn't always bracket out embodied knowledge.

Dean Kenning: Is it more the way it's presented to us?

David Burrows: In the end, I think it's more to do with when embodied knowledge is not necessarily seen as producing knowledge of reality.

BIBLIOGRAPHY

- Aristotle (1941), 'Topics', in R. McKeon (ed.), *The Basic Works of Aristotle*, New York: The Modern Library.
- Adams, David (2020), *The Esoteric Botany of Hilma af Klint* [Lecture], Lightforms, Hudson, New York, 8 March.
- Af Klint, Gustaf (2005), 'Hilma af Klint: A Short Memoir', in John Hutchinson with assistance from Sheena Malone (eds), *Hilma af Klint*, 6–9, Dublin: Douglas Hyde Gallery.
- Af Klint, Johan and Hedvig Ersman (2018), 'Inspiration and Influence: The Spiritual Journey of Artist Hilma af Klint', *Guggenheim*, 11 October. Available online: <https://www.guggenheim.org/blogs/checklist/inspiration-and-influence-the-spiritual-journey-of-artist-hilma-af-klint> (accessed 7 Sep. 22).
- Agamben, Giorgio (2009), *What is an Apparatus? and Other Essays*, Stanford: Stanford University Press.
- Althusser, Louis (2020), *On Ideology*, Verso: London.
- Almqvist, Kurt (2023), 'The Significance of Anna Cassel to the Art of Hilma af Klint', in Kurt Almqvist and Daniel Birnbaum (eds), *Anna Cassel: The Saga of the Rose*, 163–73, Bokförlaget Stolpe, Stockholm, Sweden.
- Ambrosio, Chiara (2014), 'Iconic Representations and Representative Practices', *International Studies in the Philosophy of Science*, 28 (3): 255–75. <http://dx.doi.org/10.1080/02698595.2014.959831>
- Anton, Corey and Lance Strate, eds (2012), *Korzybski and . . .*, New York: Institute of General Semantics.
- Arnheim, Rudolph (1969), 'Gestalt and Art' in J. Hogg (ed.), *Psychology and the Visual Arts*, 257–62, 1969, Harmondsworth: Penguin.
- Arnheim, Rudolph (1969), 'The Gestalt Theory of Expression', in J. Hogg (ed.), *Psychology and the Visual Arts*, 263–87, Harmondsworth: Penguin.
- Ashley Montagu, M. F. (1944), 'Two Articles on 'Race''. *ETC: A Review of General Semantics*, 2 (1).
- Audint (2019), *Unsound: Undead*, ed. S. Goodman, T. Heys and E. Ikoniadou, Falmouth: Urbanomic.
- Ballard, James G. ([1969] 2014), *The Atrocity Exhibition*, London: Fourth Estate.
- Bateson, Gregory (1970), 'Form, Substance and Difference – Alfred Korzybski Memorial Lecture', *ETC: A Review of General Semantics*, 72 (1) (January 2015), 90–104.
- Bateson, Gregory (2000), 'Problems in Cetacean and Other Mammalian Communication', in *Steps to an Ecology of Mind*, 364–78, Chicago, London: University of Chicago Press.
- Bell, Shannon and Gad Horowitz, eds (2016), *The Book of Radical General Semantics*, New Delhi: Pencraft International.

- Bellos, Alex. (2013), 'George Widener: The Incredible Life of the Man Who Makes Art for Robots', *The Guardian*, 17 June. (accessed 7 September 2021).
- Besant, Annie and C. W. Leadbeater (1905), *Thought-forms*, London and Benares: The Theosophical Publishing Society.
- Besant, Annie and C. W. Leadbeater (2020), *Occult Chemistry*, Brooklyn, NY: Sacred Bones Books.
- Bois, Yve-Alain and Rosalind Krauss (1997), *Formless: A User's Guide*, New York: Zone.
- Bonnet, Francois J. (2016), *The Order of Sounds: A Sonorous Archipelagos*, trans. R. McKay, Falmouth: Urbanomic.
- Borges, Jorge Luis (2000), *Labyrinths*, Harmondsworth: Penguin Classics.
- Bos, Caroline and Ben van Berkel (1998), 'Diagrams: Interactive Instruments in Operation', *ANY*, 23: 19–23.
- Buonomano, Dean (2017), *Your Brain is a Time Machine: The Neuroscience and Physics of Time*, New York: W. W. Norton & Company.
- Burgin, Christine, ed. (2018), *Hilma af Klint: Notes and Methods*, Chicago, London: The University of Chicago Press.
- Burroughs, William S. and Brion Gysin (1978), *The Third Mind*, New York: Viking Press.
- Burrows, David (2020), 'Science Fictioning Singularities: The Diagrammatic Imaginaries of Physics', in J. Golding, M. Reinhart and M. Paganelli (eds), *Data Loam: Sometimes Hard, Usually Soft: the Future of Knowledge Systems*, 38–64, Berlin: De Gruyter.
- Burrows, David and Simon O'Sullivan (2019), *Fictioning: The Myth Functions of Contemporary Art and Philosophy*, Edinburgh: Edinburgh University Press.
- Cabanne, Pierre (1971), *Dialogues with Marcel Duchamp*, trans. R. Padgett, London: Da Capo Press.
- Caillois, Roger (1935/1984), 'Mimicry and Legendary Psychasthenia', trans. John Shepley, *October*, 31: 16–32.
- Campbell, Colin (2016), 'What is Radical General Semantics?', *Berfrois*, 27 Oct. Available online: <https://www.berfrois.com/2016/10/colin-campbell-radical-general-semantics/> (accessed 8 Nov. 2022).
- Cardinal, Roger (2005), 'The Calendars of George Widener', *Raw Vision*, 51: 42–47.
- Châtelet, Gilles (2000), *Figuring Space: Philosophy, Mathematics, Physics*, trans. R. Shore and M. Zagha, Dordrecht: Kluwer Academic Publishers.
- Châtelet, Gilles (2014), *To Live and Think Like Pigs: The Incitement to Envy and Boredom in Market Economies*, trans. R. MacKay, Falmouth: Urbanomic.
- Christiansen, Jen (2015), 'Pop Culture Pulsar: Origin Story of Joy Division's Unknown Pleasures Album Cover', *Scientific American*, 1 September. Available online: <https://www.scientificamerican.com/blog/sa-visual/pop-culture-pulsar-origin-story-of-joy-division-s-unknown-pleasures-album-cover-video/> (accessed Oct. 2022).
- Dahb, Halim El (2005), *Quote on Sound*, sound work made from an interview with Fari Bradley, Pastronix. Available online: <https://soundcloud.com/parstronix/halim-el-dabh-quote-on-sound> (accessed 14 May 2022).
- Dali, Salvador (1935), *Conquest of the Irrational*, New York: Julien Levy.
- Dali, Salvador ([1942]1993), *The Secret Life of Salvador Dali*, London: Alkin Books.
- Danby-Smith, Michael J. (1969), 'The Scholastic Doctrine of Analogy', MA thesis., McMaster University. Available online: <https://macsphere.mcmaster.ca/handle/11375/10702>
- Darby, Mary and Gallagher, Cormac (1994), 'The Historical Development and Clinical Implications of Jacques Lacan's Optical Schema', *The Letter*, 02: 87–111.
- Decharme, Bruno (2007), *George Widener* [Film], ABCD. Available online: <https://abcd-artbrut.net/en/films-en/widener-george/> (accessed 19 Oct. 2022).

- Deleuze, Gilles ([1986] 2006), *Foucault*, trans. S. Hand, London: Continuum.
- Deleuze, Gilles ([1981] 2005), *Francis Bacon: The Logic of Sensation*, trans. D. W. Smith, London: Continuum.
- Deleuze, Gilles ([1968] 1994), *Difference and Repetition*. trans. P. Patton, London: Athlone.
- Deleuze, Gilles and Félix Guattari (2000), *Anti-Oedipus: Capitalism and Schizophrenia*, trans. R. Hurley, M. Seem, H. R. Lane, Minneapolis: University of Minnesota Press.
- Deleuze, Gilles and Félix Guattari ([1980] 1987), *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. B. Massumi, Minneapolis: University of Minnesota Press.
- Descola, Philippe (2013), *Beyond Nature and Culture*, trans. J. Lloyd, Chicago: University of Chicago.
- Diagram Research Group (2020), Delta Research Placement at Flat Time House <http://flattimeho.org.uk/events/diagram-research-group/> (accessed 13 Oct. 2023)
- Dick, Philip K. (1988), *The Dark Haired Girl*, Willimantic, CT: Mark V. Zieging.
- Dick, Philip K. ([1981] 2001), *Valis*, London: Orion Publishing Group.
- Dick, Philip K. (2010), *The World Jones Made*, London: Gollancz.
- Dólar, Maden (2006), *A Voice and Nothing More*, Massachusetts: MIT Press.
- Du Sautoy, Marcus and Quentin Cooper (2012), 'Talking Primes', online interview for Open Learn, The Open University. Available online: <https://www.open.edu/openlearn/science-maths-technology/mathematics-and-statistics/mathematics/talking-primes> (accessed 22 July 2022).
- Edwards, Rebecca (2019), 'Ami Clarke interviewed by arebyte Gallery Curator Rebecca Edwards', *arebyte Gallery*. Available online: <https://www.arebyte.com/ami-clarke-interview-with-rebecca-edwards> (accessed 30 Oct. 2022).
- Ehrenzweig, Anton (1969), 'A New Psychoanalytic Approach to Aesthetics', in J. Hogg (ed.), *Psychology and the Visual Arts*, 109–28, Harmondsworth: Penguin.
- Ettinger, Bracha L. (2005), *The Matrixial Borderspace*. Minnesota: University of Minnesota Press.
- Everaert-Desmedt, Nicole (2006), 'Peirce's Esthetics', *Signo*. Available online: <http://www.signosemio.com/peirce/esthetics.asp> (accessed 16 Sep. 2022).
- Fant, Åka (1986), 'The Case of the Artist Hilma af Klint', in Maurice Tuchman with Judi Freeman (eds), *The Spiritual in Art: Abstract Painting 1890–1985*, 155–64, New York: Abbeville Press.
- Fant, Åka (2021), *Hilma af Klint: Occult Painter and Abstract Pioneer*, trans. Ruth Urbom, Stockholm, Sweden: Bokförlaget Stolpe.
- Feynman, Richard and Charles Weiner (1968), interview, Niels Bohr Library and Archives, Melville: American Institute of Physics. Available Online: www.aip.org/history-programs/niels-bohr-library/oral-histories/5020-3 (accessed 16 Dec. 2022).
- Finkelstein, Haim (1975), 'Dali's Paranoia-Criticism or the Exercise of Freedom', *Twentieth Century Literature*, 21 (1) Essays on Surrealism: 59–71.
- Flieger, Jerry A. (1997), 'Postmodern Perspective: The Paranoid Eye', *New Literary History*, 28 (1), Cultural Studies: China and the West: 87–109.
- Foucault, Michel ([1975] 1991), *Discipline and Punish: The Birth of the Prison*, trans. A. Sheridan, London: Penguin Books.
- Foucault, Michel ([1966] 1989), *The Order of Things: An Archaeology of the Human Sciences*, London, New York: Routledge.
- Freud, Sigmund (1923), *The Ego and the Id*, London: Hogarth Press.
- Freud, Sigmund (1923), 'Some Neurotic Mechanisms in Jealousy, Paranoia and Homosexuality', *International Journal of Psychoanalysis*, 4: 1–10.
- Freud, Sigmund (1933), *New Introductory Lectures on Psycho-Analysis*, New York: Carlton House.

- Freud, Sigmund (1959), *An Outline of Psycho-Analysis*, London: Hogarth Press.
- Freud, Sigmund (1959), *Beyond the Pleasure Principle*, New York: Bantam Books.
- Freud, Sigmund ([1925]1961), 'A Note Upon the "Mystic Writing Pad"', in *The Ego and the Id and Other Works*, London: Hogarth Press.
- Fried, Yehuda and Agassi Joseph (1976), *Paranoia: A Study in Diagnosis*, Dordrecht: D. Reidel Publishing.
- Gansterer, Nikolaus (2011), *Drawing a Hypothesis: Figures of Thought*. New York: Springer.
- Gardner, Martin (1958), *Logic Machines and Diagrams*. New York: McGraw-Hill.
- Gaskin, Nettice R. (2021) 'Semantic Symbology: the Evolution and Amolification of Comograms', in *Journal of Visual Practice*, 20 (3): 259–74.
- Gee, Grant (2007), *Joy Division*, [Film], Hudson Productions Ltd.
- Gell, Alfred (1998), 'The Distributed Person', in *Art and Agency: An Anthropological Theory*, 96–154, Oxford: Oxford University Press.
- Gelmis, Joseph (1970), 'Stanley Kubrick', in *The Film Director as Superstar*, 381–411, England: Penguin Books Ltd.
- George, Edward (2019), 'Strangeness of Dub: Institutions of the Trace (Archive Fever II)', [radio programme], Morley College London. Available online: <https://morleyradio.co.uk/programmes/the-strangeness-of-dub-ep8/> (accessed 22 July 2022).
- Gere, Charlie (2006), 'Introduction', in *Art, Time and Technology*, Oxford: Berg, Bloomsbury Design Library. <http://dx.doi.org/10.5040/9781474293617.0003>.
- Goethe, Johann Wolfgang von (1970), *Theory of Colours*, trans. Charles Lock Eastlake, Cambridge, Mass.: MIT Press.
- Goodman, Steve (2012), *Sonic Warfare: Sound, Affect and Ecology of Fear*, Massachusetts: MIT Press.
- Gordon, Lewis. R. and Jane Anna Gordon (2006), *Not Only the Master's Tools: African American Studies in Theory and Practice*, Paradigm: Boulder/London.
- Greeley, Robin A. (2001), 'Dalí's Fascism; Lacan's Paranoia', *Art History*, 24 (4): 465–92.
- Greimas, A. J. and François Rastier (1968), 'The Interaction of Semiotic Constraints', *Yale French Studies*, 41, Game, Play, Literature: 86–105.
- Guattari, Félix (2011), *The Machinic Unconscious: Essays in Schizoanalysis*, Los Angeles: Semiotext(e).
- Halder, G., P. Callaerts and W. J. Gehring (1995), 'Induction of Ectopic Eyes by Targeted Expression of the Eyeless Gene in Drosophila', *Science*, 267 (5205): 1788–92. <https://doi.org/10.1126/science.7892602>
- Hansen, Miriam (1987), 'Benjamin, Cinema and Experience: "The Blue Flower in the Land of Technology"', *New German Critique*, special Issue on Weimar Film Theory: 40: 179–224.
- Haraway, Donna J. (2016), 'A Cyborg Manifesto: Science, Technology, and Socialist-Feminism in the 1980s', in *Manifestly Haraway*, 3–90, Minneapolis/London: University of Minnesota Press.
- Hasegawa, Yuko (2006), 'The Spell to Re-integrate the Self: Yayoi Kusama in the New Era', trans. P. Miki, *Afterall Journal*, 13, Spring/Summer, London: UAL, 46–53.
- Hayles, Katherine N. (2012), *How we Think: Digital Media Contemporary Technogenesis*, Chicago/London: University of Chicago Press.
- Hayles, Katherine N. (2017), *Unthought: The Power of the Cognitive Nonconscious*, Chicago/London: The University of Chicago Press.
- Hébert, Louis (n.d.), 'The Semiotic Square'. Available online: <http://www.signosemio.com/greimas/semiotic-square.asp> (accessed 1 June 2022).

- Henderson, Linda Dalrymple (2019), 'Hilma af Klint and the Invisible in Her Occult and Scientific Context', in Kurt Almqvist and Louise Belfrage (eds), *Hilma af Klint: Visionary*, 71–92, Stockholm: Stolpe.
- Henry Boxer Gallery (2009), *The Art of George Widener*, Henry Boxer Gallery.
- Hjelmslev, Louis (1963), *Prolegomena to a Theory of Language*, trans. F. J. Whitfield, Wisconsin: University of Wisconsin Press.
- Hofstadter, Douglas and Emmanuel Sander (2015), *Surfaces and Essences: Analogy as the Fuel and Fire of Thinking*, New York: Basic Books.
- Holmes, Thom (2012), *Electronic and Experimental Music: Technology, Music and Culture*, New York: Routledge.
- Hui, Yuk (2016), *The Question Concerning Technology in China: An Essay on Cosmotechnics*, Falmouth: Urbanomic.
- Hui, Yuk (2020), 'Cosmotechnics', foreword, *Angelaki, Journal of the Theoretical Humanities*, 25 (4), 1–2, eds. Y. Hui and P. Lemmens, London: Taylor and Francis.
- Hui, Yuk (2021), *Art and Cosmotechnics*, Minneapolis: University of Minnesota Press.
- Jameson, Fredric (1977), 'Imaginary and Symbolic in Lacan: Marxism, Psychoanalytic Criticism, and the Problem of the Subject', *Yale French Studies*, No. 55/56, Literature and Psychoanalysis. The Question of Reading: Otherwise: 338–95.
- Jameson, Fredric (1987), 'Foreword', *On Meaning: Selected Writings. Algirdas Julien Greimas*, Minneapolis: University of Minnesota Press.
- Jameson, Fredric (1997), *Postmodernism or, the Cultural logic of Late Capitalism*, Durham NC: Duke University Press.
- Jameson, Fredric (2002), *The Political Unconscious: Narrative as a Socially Symbolic Act*, London: Routledge Classics.
- Kaiser, David (2005), 'Physics and Feynman's Diagrams', *American Scientist Online*, The Scientific Research Society, 701: 156–65. Available online: <https://web.mit.edu/dikaiser/www/FdsAmSci.pdf> (accessed 16 Dec. 2022).
- Kenning, Dean (2015), 'Thinking Through Art: The Social Body Mind Map' in N. Addison and L. Burgess (eds), *Learning to Teach Art and Design in the Secondary School (Third Edition)*, London/New York: Routledge.
- Kenning, Dean (2021), 'Exploratory Diagramming and Diagram Theory: Greimas, Peirce and Châtelet', *Journal of Visual Art Practice*, 20 (3): 177–95.
- Kenning, Dean (2022), 'Transcend Logical Forms', interview with Marco Cali in *Contemporary British Drawing*. Available online: <http://www.contemporarybritishdrawing.com/dean-kenning.html> (accessed 2 May 2023).
- Kemp, Martin (2000), *Visualizations: The Nature Book of Art and Science*, California: The University of California Press.
- Klotz, Eric and Volkert Besseling (2012), *Data Visualization Reinterpreted: The Story of Joy Division's 'Unknown Pleasures' Album Design*, Visualized. Available online: <https://www.youtube.com/watch?v=reEQye0EOAw> (accessed 12 Jan. 2023).
- Kluckhohn, Clyde (1956), 'General Semantics and Primitive Languages', *General Semantics Bulletin*. Available online: <https://www.generalsemantics.org/resources/documents/gsb-20-21-kluckhohn.pdf>
- Knoespel, Kenneth (2001), 'Diagrams as Plotting Device in the Work of Gilles Deleuze', *Littérature, Théorie, Enseignement*, 19: 145–65.
- Kohn, Eduardo (2013), *How Do Forests Think: Towards an Anthropology Beyond the Human*, Berkeley: University of California Press.
- Korzybski, Alfred (1924), *Time-Binding: The General Theory*, New York: E. P. Dutton & Company.

- Korzybski, Alfred (1964), *General Semantics Seminar 1937*, New Jersey: Institute of General Semantics.
- Korzybski, Alfred (2000), *Science and Sanity: An Introduction to Non-Aristotelian Systems and General Semantics*, Brooklyn: Institute of General Semantics.
- Korzybski, Alfred (2008), *Manhood of Humanity: The Science and Art of Human Engineering*, New York, E. P. Dutton & Company, Project Gutenberg EBook 25457.
- Kraepelin, Emil (1899/1915), *Clinical Psychiatry: A Textbook for Students and Physicians*, New York, NY: Macmillan.
- Krämer, Sybille and Christina Ljungberg (2016), 'Thinking and Diagrams – An introduction', in Sybille Krämer and Christina Ljungberg (eds), *Thinking with Diagrams: The Semiotic Basis of Human Cognition*, 1–20, Boston/Berlin: Walter de Gruyter.
- Krämer, Sybille and Christina Ljungberg, eds (2016), *Thinking with Diagrams: The Semiotic Basis of Human Cognition*, De Gruyter: Berlin.
- Krauss, Rosalind E. (1986), *The Originality of the Avant-Garde and Other Modernist Myths*, Cambridge/London: MIT Press.
- Krauss, Rosalind E. (1994), *The Optical Unconscious*, Cambridge/London: MIT Press.
- Krauss, Rosalind E. (1977), 'Notes on the Index: Seventies Art in America. Part 2', *October*, 4: 58–67.
- Kusama, Yayoi (1978), *Manhattan Suicide Addict*, Tokyo: Kosakusha.
- Kusama, Yayoi (1998), *Sumire Kyohaku (Violet Obsession)*, Tokyo: Saakuhinsha.
- Kusama, Yayoi (2013), *Infinity Net*, London: Tate Publishing.
- Lacan, Jacques (1931), "'Écrits' inspirés": Schizographie' ["Inspired" writings: Schizography], *Annales Médico-Psychologiques*, 2: 508–22.
- Lacan, Jacques (1975), *De la Psychose Paranoïaque dans ses Rapports avec la Personnalité*, Paris: Seuil.
- Lacan, Jacques (1976–77), *Seminar XXIII, 1975–76*, ed. J.A. Miller, *Ornicar?*, 6–11.
- Lacan, Jacques (1977), *Écrits: A Selection*, trans. A. Sheridan, London: Tavistock Publications.
- Lacan, Jacques (1986), *The Four Fundamentals of Psycho-Analysis*, London: Penguin Books.
- Lacan, Jacques ([1981/1993]), *The Psychoses: The Seminar of Jacques Lacan, Book III, 1955–1956*, New York, NY: Norton.
- Lacan, Jacques (1991), *The Seminar. Book I. Freud's Papers on Technique*, New York/London: Norton.
- Lacan, Jacques (1991), *The Seminar. Book II. The Ego in Freud's Theory and in the Technique of Psychoanalysis, 1954–55*, New York/London: Norton.
- Land, Nick (2011), *Fanged Noumena: Collected Writing 1987–2007*, Falmouth/New York: Urbanomic/Sequence Press.
- Latham, John (1993), 'Consideration of One Least Event Universe', document and essay in John Latham Archive, London: Flat Time House, n.p.
- Latham, John (n.d.), 'From the Point of Convergence Between Art and the Sciences, 1954. . .', document and essay in Latham Archive, London: Flat Time House, n.p.
- Leeb, Susanne (2011), 'A Line With Variable Direction, Which Traces No Contour, and Delimits No Form', in Nikolaus Gansterer (ed.), *Drawing a Hypothesis: Figures of Thought*, 29–42, Vienna/New York: Springer.
- Lepoutre, Thomas, Manoel. L. Madeira and Nicolas Guerin (2017), 'The Lacanian Concept of Paranoia: An Historical Perspective', *Frontiers in Psychology*, 8: 1564. Available online: doi: 10.3389/fpsyg.2017.01564.

- Lévi-Strauss, Claude (1962), *The Savage Mind*, London: Weidenfield and Nicolson.
- Linden, Gurli (2005), 'Excerpts from Notes by Hilma af Klint', in John Hutchinson with assistance from Sheena Malone (eds), *Hilma af Klint*, 6–9, Dublin: Douglas Hyde Gallery.
- Lipez, Zachary (2019), 'How Joy Division's "Unknown Pleasures" Image Went from Underground Album Cover to a Piece of Cultural Ubiquity', *The Washington Post*, 14 June.
- Lippard, Lucy R (1997), *Six Years: The Dematerialization of the Art Object From 1966 to 1972*, Berkeley: University of California Press.
- Lomas, David (2013), 'The Botanical Roots of Hilma af Klint's Abstraction', in Iris Müller-Westermann with Jo Widoff (eds), *Hilma af Klint – A Pioneer of Abstraction*, 223–39, Stockholm: Moderna Museet.
- Lovecraft, Howard P. and Edgar Hoffman Price (2014), *Through the Gates of the Silver Key*, New Jersey: Start Publishing LCC.
- Liotard, Jean-François (1983), 'Logos or Techne, or Telegraphy', in *The Inhuman*, trans. G. Bennington and R. Bowlby, Cambridge: Polity Press.
- Malabou, Catherine (2022), *Plasticity: The Promise of Explosion*, Edinburgh: Edinburgh University Press.
- Malloy, Vanja V. (2012), 'Rethinking Alexander Calder's Universes and Mobiles: The Influence of Einsteinian Physics and Modern Astronomy', *Immediations*, 3 (1): 1–18, London: Courtauld Institute of Art.
- Margulis, Lynn (1998), *Symbiotic Planet: A New Look at Evolution*, New York: Basic Books.
- Marrinan, Michael (2016), 'On the "Thingness" of Diagrams', in Sybille Krämer and Christina Ljungberg (eds), *Thinking with Diagrams: The Semiotic Basis of Human Cognition*, 21–56, Berlin/Boston: De Gruyter Mouton.
- Martin, Hedvig (2023), 'Who Created The Paintings for the Temple', in Kurt Almqvist and Daniel Birnbaum (eds), *Anna Cassel: The Saga of the Rose*, 157–161, Bokförlaget Stolpe, Stockholm, Sweden.
- McRobbie, Angela (2015), *Be Creative : Making a Living in the New Culture Industries*, Cambridge: Polity Press.
- Mitton, Simon, ed (1977), *The Cambridge Encyclopaedia of Astronomy*, London: Jonathan Cape.
- Morgan, Douglas N. (1955), 'Icon, Index, and Symbol in the Visual Arts', *Philosophical Studies: An International Journal for Philosophy in the Analytic Tradition*, 6 (4): 49–54. Available online: <https://www.jstor.org/stable/4318224> (accessed 4 Feb. 2023).
- Müller-Westermann, Iris (2013), 'Paintings for the Future: Hilma af Klint – A Pioneer of Abstraction in Seclusion', in Iris Müller-Westermann with Jo Widoff (eds), *Hilma af Klint – A Pioneer of Abstraction*, 33–51, Stockholm: Moderna Museet.
- Müller-Westermann, Iris (2018), 'Introduction and Commentary', in Christine Burgin (ed.), *Hilma af Klint: Notes and Methods*, 7–246, Chicago/London: The University of Chicago Press.
- Müller-Westermann, Iris and Helmet Zander (2013), 'There is No Religion Higher Than Truth: A Conversation Between Helmut Zander and Iris Müller-Westermann on Spiritualism, Theosophy and Anthroposophy', in Iris Müller-Westermann with Jo Widoff (eds), *Hilma af Klint – A Pioneer of Abstraction*, 113–28, Stockholm: Moderna Museet.
- Nancy, Jean-Luc (2007), *Listening*, trans. C. Mandell, New York: Fordham University Press.

- Netz, Laura (2019), 'Insight: Into Ami Clarke's exhibition "The Underlying"', *Clot Magazine*. Available online: <https://www.clotmag.com/interviews/insight-ami-clarkes-exhibition-the-underlying> (accessed 28 Oct. 2022).
- Newkirk, Toy (2011), 'Ingenious Minds', [film], Screaming Flea Productions.
- Oliveros, Pauline (2013), *Anthology of Text Scores*, ed. S. Golter and L. Hall, New York: Deep Listening Publications.
- Oliveros, Pauline (2005), *Deep Listening: A Composer's Sound Practice*, New York: Deep Listening Publications.
- Ó Maoilearca (formerly Mullarkey), John (2006), *Post-Continental Philosophy. An Outline*, New York, Continuum.
- Owens, Joseph (1978), *The Doctrine of Being in the Aristotelian 'Metaphysics'. A Study in the Greek Background of Mediaeval Thought*, 3rd edn, Toronto: Pontifical Institute of Mediaeval Studies.
- Peirce, Charles Sanders (1893), 'Evolutionary Love', *The Monist*, 3: 176–200.
- Peirce, Charles Sanders (1976), '18 (PAP) (293): Prolegomena for an Apology to Pragmatism', in Carolyn Eisele (ed.), *New Elements of Mathematics: Volume 4*, 313–30, The Hague: Mouton and Atlantic Highlands, NJ: Humanities Press <https://doi.org/10.1515/9783110805888.313>.
- Peirce, Charles Sanders (1906), 'Prolegomena to an Apology for Pragmatism', *The Monist*, 16 (4): 492–546.
- Peirce, Charles Sanders (1992), 'On the Algebra of Logic: A Contribution to the Philosophy of Notation (1885)', in Nathan Houser, Christian Kloesel (eds), *The Essential Peirce: Selected Philosophical Writings Volume 1: 1867–1893*, 225–28, Bloomington, Ind.: Indiana University Press.
- Peirce, Charles Sanders (1998a), 'What Is a Sign? (1894)', in Andre De Tienne, Jonathan R. Eller, Albert C. Lewis, Cathy L. Clark, and D. Bront Davis (eds), *The Essential Peirce: Selected Philosophical Writings Volume 2: 1893–1913*, 4–10, Bloomington, Ind.: Indiana University Press.
- Peirce, Charles Sanders (1998b), 'Sundry Logical Conceptions', in Andre De Tienne, Jonathan R. Eller, Albert C. Lewis, Cathy L. Clark, and D. Bront Davis (eds), *The Essential Peirce: Selected Philosophical Writings Volume 2: 1893–1913*, 267–88, Bloomington, Ind.: Indiana University Press.
- Peirce, Charles Sanders (1998c), 'Immortality in the Light of Synechism (1893)', in Andre De Tienne, Jonathan R. Eller, Albert C. Lewis, Cathy L. Clark and D. Bront Davis (eds), *The Essential Peirce: Selected Philosophical Writings Volume 2: 1893–1913*, 1–3, Bloomington, Ind.: Indiana University Press.
- Peirce, Charles Sanders (1998d) 'The First Rule of Logic', in Andre De Tienne, Jonathan R. Eller, Albert C. Lewis, Cathy L. Clark and D. Bront Davis (eds), *The Essential Peirce: Selected Philosophical Writings Volume 2: 1893–1913*, 42–56, Bloomington, Ind.: Indiana University Press.
- Peirce, Charles Sanders (1998e) 'Seven Systems of Metaphysics', in Andre De Tienne, Jonathan R. Eller, Albert C. Lewis, Cathy L. Clark and D. Bront Davis (eds), *The Essential Peirce: Selected Philosophical Writings Volume 2: 1893–1913*, 179–95, Bloomington, Ind.: Indiana University Press.
- Perrier, Edmond (2009), *The Philosophy of Zoology Before Darwin: A Translated and Annotated Version of the Original French Text*, trans. A. McBirney, Dordrecht: Springer.
- Pula, Robert P. (1996), 'Alfred Korzybski, 1879–1950: A Bio-Methodological Sketch', *Polish American Studies*, 53 (2): 57–105.

- Quammen, David (2018), *The Tangled Tree: A Radical New History of Life*, London: William Collins.
- Radio X (2020), 'What Does the Cover of Joy Division's Unknown Pleasures Mean?', *Radio X*, 24 April. Available online: <https://www.radiox.co.uk/artists/joy-division/cover-joy-division-unknown-pleasures-meaning/> (accessed 15 Oct. 2022).
- Ricco/Maresca (2021), 'George Widener: Mindscapes', *Ricco/Maresca*. Available online: <https://www.riccomaresca.com/viewing-room/52-george-widener-mindscapes-online-exclusive-new-work/> (accessed 25 Oct. 2022).
- Ricco/Maresca (2022), 'George Widener: Count Down', *Ricco/Maresca*. Available online: <https://riccomaresca.viewingrooms.com/viewing-room/65-george-widener-count-down-in-person-and-online/> (accessed 8 Mar 2022).
- Ringbom, Sixten (1966), 'Art in "The Epoch of the Great Spiritual": Occult Elements in the Early Theory of Abstract Painting', *Journal of the Warburg and Courtauld Institutes*, 29: 386–418.
- Ritchie, Matthew (2017), *The Temptation of the Diagram*, Los Angeles: Getty Research Institute.
- Roazen, Paul (1973), *Brother Animal: The Story of Freud and Tausk*, London: Penguin.
- Roberts, John (2020), *Red Days: Popular Music & the English Counterculture 1965–1975*, Colchester: Minor Compositions.
- Robertson, Matthew (2006), *Factory Records: The Complete Graphic Album*, United Kingdom: Thames and Hudson.
- Rosamond, Emily (2022), 'Reputation Regimes', *Art Monthly*, 461, November.
- Rovelli, Carlo (2016), *Seven Brief Lessons of Physics*, trans. E. Segre and S. Carnell, London: Penguin.
- Rovelli, Carlo (2019a), *The Order of Time*, trans. A. Lane, London: Penguin.
- Rovelli, Carlo (2019b), 'The Illusion of Time', lecture at YPO Edge Conference, Cape Town. Available online: <https://www.youtube.com/watch?v=AumrYDQluEc> (accessed 16 Dec. 2022).
- Sandqvist, Gertrud (2020), 'The Great Affirmation', in Kurt Almqvist and Louise Belfrange (eds), *Hilma af Klint: The Art of Seeing the Invisible*, 229–42, Stolpe Publishing.
- Savage, Jon (2014), 'Introduction', in Deborah Curtis and Jon Savage (eds), *So This is Permanence: Joy Division Lyrics and Notebooks*, xiii–xxviii, Faber and Faber, London.
- Schuchardt Read, Charlotte (1955), 'Mira Edgerly Korzysbska: A Biographical Sketch', *Bulletin of the Institute of General Semantics*, 16/17.
- Seachrist, Denise A. (2003), *The Musical World of Halim El-Dabh*, Ohio: Kent State University Press.
- Sharon-Zisser, Shirley (2018), 'Art as Subjective Solution: A Lacanian Theory of Art Therapy', *International Journal of Art Therapy*, 23 (1): 2–13. <https://doi.org/10.1080/17454832.2017.1324884>
- Simondon, Gilbert (2020), *Individuation in Light of Notions of Form and Information*, Minnesota: University of Minnesota Press.
- Simondon, Gilbert (1980 [1958]), *On The Mode of Technical Objects*, trans. N. Mellamphy, Ontario: University of Western Ontario.
- Sirató, Charles (1936), *Dimensionist Manifesto*, Des 2 Artisans: Paris.
- Sloterdijk, Peter (2009), 'The Elmauer Rede: Rules for the Human Zoo. A Response to the Letter on Humanism', *Environment and Planning D Society and Space*, 27 (1): 12–28.
- Smolin, Lee (2013), *Time Reborn: From the Crisis in Physics to the Future of the Universe*, London: Penguin.

- Somers-Hall, Henry (2013), *Deleuze's Difference and Repetition: An Edinburgh Philosophical Guide*, Edinburgh Philosophical Guides Series, Edinburgh: EUP.
- Stjernfelt, Frederik (2017), 'Schematic Aspects of an Aesthetics of Diagrams', in Matthew Ritchie (ed.), *The Temptation of the Diagram*, 130–39, Getty Research Institute.
- Stjernfelt, Frederik (2000), 'Diagrams as Centerpiece of a Peircean Epistemology', *Transactions of the Charles S. Peirce Society*, 36 (3): 357–84. Available online: <https://www.jstor.org/stable/40320800>
- Stockburger, Axel (2011), '3 Elements', in Nikolaus Gansterer (ed.), *Drawing a Hypothesis: Figures of Thought*, New York: Springer.
- Strait, Joel. 'What all Those Knobs on Your Synthesizer Do' https://www.joelstrait.com/what_all_those_knobs_on_your_synthesizer_do/ (accessed 11 May 2023).
- Sumner, Bernard (2014), *Chapter and Verse: New Order, Joy Division and Me*, London: Transworld Publishers.
- Svensson, Anna Maria (2005), 'The Greatness of Things: The Art of Hilma af Klint' in John Hutchinson with assistance from Sheena Malone (eds), *Hilma af Klint*, 13–30, Ireland: Dublin Douglas Hyde Gallery.
- Sylvester, David (2016), *Interviews with Francis Bacon: The Brutality of Fact*, third enlarged edition, London: Thames & Hudson.
- Tausk, Victor (1933), 'On the Origin of the "Influencing Machine" in Schizophrenia', *Psychoanalytic Quarterly*, 2: 519–56.
- The Cell, The Chemistry of Life* (2011), [TV programme] BBC4, 6 May. <https://learningonscreen.ac.uk/ondemand/index.php/prog/010ECEFC?bcast=63997122> (accessed 14 Apr. 2023).
- Thorne, Kip (1994), *Black Holes and Time Warps: Einstein's Outrageous Legacy*, New York: W. W. Norton.
- Toop, David (2018), *Ocean of Sound: Ambient Sound and Radical Listening in the Age of Communication*, London: Serpent's Tail.
- Tversky, Barbara (2014), 'The Cognitive Design of Tools of Thought', *Review of Philosophy and Psychology*, 6: 99–116. <https://doi.org/10.1007/s13164-014-0214-3>
- Tversky, Barbara (2017), 'Diagrams: Cognitive Foundations for Design', in Alison Black, Paul Luna, Ole Lund, Sue Walker (eds), *Information Design: Research and Practice*, 349–60, London: Routledge. Available online: 10.4324/9781315585680 (accessed 2 Sep. 2022).
- Van Campen, Crétien (1997), 'Abstract Art and Experimental Gestalt Psychology', *Leonardo*, 30 (2): 133–36.
- Voegelin, Salomé (2010), *Listening to Noise and Silence: Towards a Philosophy of Sound Art*, London: Bloomsbury Press.
- Voss, Julia (2019), 'Five Things to Know About Hilma Af Klint', in Kurt Almqvist and Louise Belfrage (eds), *Hilma af Klint: Visionary*, 21–40, Stockholm: Stolpe.
- Voss, Julia (2022), *Hilma af Klint: A Biography*, trans. Anne Posten, Chicago/London: The University of Chicago Press.
- Walsh, Louise (n.d.), 'Journeys of Discovery', *Cambridge University*. Available online: <https://www.cam.ac.uk/stories/journeysofdiscovery-pulsars#:~:text=Professor%20Dame%20Jocelyn%20Bell%20Burnell,Cavendish%20Laboratory%20with%20Antony%20Hewish> (accessed 15 Oct. 2022).
- Wheeler, John (1978), 'Beyond the Black Hole', in H. Woolf (ed.), *Some Strangeness in Proportion: A Centennial Symposium to Celebrate the Achievements of Albert Einstein*, 341–75, Reading, MA: Addison-Wesley Publishing Co.
- Wheeler, John (2000), *Geons, Black Holes and Quantum Foam: A Life in Physics*, New York: W. W. Norton and Company.

- Wheeler, John and Kenneth Ford (1994), interview, Niels Bohr Library and Archives, Melville: American Institute of Physics. Available online: www.aip.org/history-programs/niels-bohr-library/oral-histories/5020-3 (accessed 16 Dec. 2022).
- Widener, George (2017), 'Post-Dubuffet: Self-Taught Art in the Twenty-First Century: Speech at the American Folk Art Museum'. Available online: <https://www.riccomaresca.com/blog/36-post-dubuffet-self-taught-art-in-the-twenty-first-century-speech-by-george-widener/> (accessed 22 Oct. 2022).
- Wilden, Anthony (1987), *The Rules are No Game: The Strategy of Communication*, New York: Routledge & Kegan Paul.
- Williams, James (2003), *Gilles Deleuze's Difference and Repetition: A Critical Introduction and Guide*, Edinburgh: University Press.
- Willmore, Katherine E. (2012), 'The Body Plan Concept and Its Centrality in Evo-Devo', *Evolution: Education and Outreach*, 5 (2): 219–30.
- Wilson, Christopher (2003), 'Interview with Peter Saville', in Emily King (ed.), *Designed by Peter Saville*, 23–50, New York: Princeton Architectural Press.
- Wright, Michele M. (2015), *Physics of Blackness: Beyond the Middle Passage Epistemology*, Minneapolis: University of Minnesota Press.
- Wynter, Sylvia (2003), 'Unsettling the Coloniality of Being/Power/Truth/Freedom: Towards The Human, After Man, Its Overrepresentation – An Argument' *CR: The New Centennial Review*, 3 (3): 257–337.
- Zdebik, Jakub (2012), *Deleuze and the Diagram: Aesthetic Threads in Visual Organisation*, London: Continuum.

INDEX OF NAMES

- Af Klint, Hilma, 14–6, 25–7, 61–84, 222, 226, 236
De Fem, 63–4
Evolution, The, 62, 65
Flowers, Mosses and Lichen, 66, 79, 81
Letters and Words Pertaining to Works by Hilma af Klint, 71, 74
Paintings for the Temple, 63, 72, 83
Primordial Chaos, 68, 72–7, 82, 83
Tree of Knowledge, 77–8
Ten Largest, The, 64, 65
Violet Blossoms with Guidelines, 66, 79–80
- Af Klint, Gustaf, 63–4
- Af Klint, Johan and Hedvig Ersman, 75
- Almqvist, Kurt, 75, 82
- Althusser, Louis, 49, 59
- Ambrosio, Chiara, 67, 84
- Anton, Corey, 194
Korzybski and. . ., 194
- Aquinas, Saint Thomas, 18, 115, 119, 129
- Aristotle, 18, 21, 28, 36, 112–16, 118–19, 129, 136, 138, 176–7, 220, 222, 229, 234
- 'Topics', 112, 114–15
- Artaud, Antonin, 15, 152
- Ashley Montagu, M. F., 195
- Audint, 30, 214–5
Dead Record Office, 214–5
- Ayewa, Camae and Rasheedah Phillips, 104–5, 195
- Bacon, Francis, 20, 25, 28–9, 109, 133, 135–52, 220, 226
Figure at a Washbasin, 29, 149–52
Study after Velasquez, 141–2
- Ballard, J.G., 46, 57, 160, 174
- Bardini, Theierry, 194–5
- Bataille, Georges, 57,
- Bateson, Gregory, 25, 139–41, 193, 196, 229
- Baudrillard, Jean, 195
- Bell Burnell, Jocelyn, 154
- Bénard, Robert, 24
- Bentham, Jeremy, 109
- Besant Annie and C.W. Leadbeater, 32, 66, 83
- Black Quantum Futurism, 25, 27, 85, 104–6, 236
The Black Grandmother Paradox, 105–6
Black Woman Temporal Portal, 106
Community Futures Lab, 105
Temporal Deprogramming, 105
Quantum Event Maps, 104–6
- Blavatsky, Helena, 63
- Bell, Shannon, 192
The Book of Radical General Semantics, 192
- Benjamin, Walter, 45–6, 49, 60, 191
'A Short History of Photography', 45
'The Work of Art in the Age of Mechanical Reproduction', 46, 191
- Beuys, Joseph, 2, 3, 5, 13, 15
- Bohr, Niels, 94
- Bonnet François J., 30, 200, 207–10
- Buffon [Comte de], Georges-Louis Leclerc, 124
- Buonomano, Dean, 90
- Borges, Jorge Luis
Three Versions of Judas, 1
- Burgin, Christine, 71, 74

- Burning Spear, 215
I and I Survive (Slavery Days), 215
Slavery Days, 215
- Burroughs, William S., 31, 46, 57,
 194–5
- Burroughs, William S. and Brion Gysin
The Third Mind, 31
- Burrows, David, 8, 9, 13, 19
 'Science Fictioning Singularities: The
 Diagrammatic Imaginary of
 Physics', 8
- Burrows, David and Simon O'Sullivan
*Fictioning: The Myth Functions of
 Contemporary Art and
 Philosophy*, 8
- Cage, John, 203
 4'33", 203
- Calder, Alexander, 27, 91–3, 96, 98, 100
Triumphant Red, 93
- Campbell, Colin, 193, 197
- Cardinal, Roger, 164
- Cezanne, Paul, 142, 144, 146–7, 152
- Châtelet's, Gilles, 1, 3, 7–9, 23, 223,
 227–8, 236–7
*Figuring Space: Philosophy,
 Mathematics and Physics*, 1, 7
- Christiansen, Jen, 156–7
- Clarke, Ami, 13, 29, 31, 153, 167–74
The Underlying, 167–74
- Conio, Andy, 13
- Craft Jr., Harold D., 154–7, 173, 227
- Cussans, John, 5–6, 8, 10, 13, 19, 32
*Undead Uprising: Haiti, Horror and the
 Zombie Complex*, 32
- Cussans, John and Roberto N. Peyre
Veve Kunigundis, 5–6, 10, 32
- Cuvier, Georges, 124, 130
- d'Alembert, Jean le Rond, 24
- Dali, Salvador, 25, 53–4, 57–9, 232–5
 paranoid critical method, 53–4, 57–9,
 232–5
Conquest of the Irrational, 54
The Secret Life of Salvador Dalí, 53–4
- Danby-Smith, Michael J, 18, 129
- Darwin, Charles, 65, 119, 124, 228
Tree of Life diagram, 228
- Decharme, Bruno, 163–4
- Deleuze, Gilles, 7, 15, 18, 20, 25, 28–9,
 108–30, 133–52, 195, 205–7,
 212–4, 217, 219–20, 222–9, 232
Difference & Repetition, 28, 108–12,
 115–18, 123–130, 133–34, 136,
 138, 141, 145, 151, 220
Foucault, 129, 134, 151–2, 217
*Francis Bacon: The Logic of
 Sensation*, 29, 205, 133, 135–152,
 205,
- Deleuze, Gilles and Félix Guattari, 7, 18,
 23, 28, 47, 52, 109, 118–22,
 134–5, 195, 201–2, 207, 212–3,
 229
A Thousand Plateaus, 18, 23, 28, 47,
 109, 118–122, 134, 135, 212
- Deller, Jeremy, 14–15
- Dennis, Nolan Oswald, 15, 31
*No compensation is possible (working
 diagram)*, 15
- Derrida, Jacques, 36, 55, 215
- du Prel, Carl, 65, 72
- du Sautoy, Marcus, 30, 213, 215, 217
- Descartes, René, 50
- Descola, Philippe, 20–21, 23, 221
- Dewey, John, 183
- Diagram Research Group (DRG), 13, 20,
 23, 32
- Diagram Research Use and Generation
 Group (DRUGG), 13
- Dick, Philip K., 46, 50, 57, 166–7, 194–5,
 234–5
- Diderot, Denis, 24
- Duchamp, Marcel, 3, 15, 91, 93, 208
Large Glass, 3
- Duns Scotus, John, 115
- Dürer, Albrecht, 16
- Dyson, Freeman, 95
- Edwards, Rebecca, 172
- Ehrenzweig, Anton, 39
- Einstein, Albert, 13, 91–93, 105, 178,
 236–7
- El-Dabh, Halim, 25, 199, 200, 210, 213,
 216
Expressions of Zaarl, 199, 200
- Eno, Brian, 30, 214, 215
Ambient 1: Music for Airports, 214
- Ettinger, Bracha L., 56

- Everaert-Desmedt, Nicole, 68, 83
 Everett, Hugh, 105
- Fant, Åka, 63, 65, 74, 77
 Feynman, Richard, 27, 94–6, 98
 Flieger, Jerry A., 55
 Ford, Kenneth, 100, 101
 Foucault, Michel, 21, 49, 109, 129, 134,
 151, 194, 201, 217, 225
Discipline and Punish, 109
The Order of Things, 21, 194
 Freud, Sigmund, 27, 43–60, 232–4
Beyond the Pleasure Principle, 47–9
The Ego and the Id, 48
*New Introductory Lectures on
 Psychoanalysis*, 48
 ‘A Note Upon the ‘Mystic Writing
 Pad’’, 47–8
Project for a Scientific Psychology, 49
 ‘Some Neurotic Mechanisms in
 Jealousy, Paranoia and
 Homosexuality’, 54
- Gansterer, Nikolaus, 5, 31
 Gardner, Martin, 2
 Gee, Grant, 159
 Gehring, Walter Jakob, 25, 126
 Gelmis, Joseph, 160
 Gell, Alfred, 204
 Geoffroy Saint-Hilaire, Etienne , 25,
 123–4, 127, 130
 George, Edward, 30, 215
Strangeness of Dub, 30, 215
 Gere, Charlie, 168, 173
 Gibson, William, 194–5
 Goethe, Johann Wolfgang von, 16, 75
 Goodman, Steve, 214
 Gordon, Jane Anna, 197
 Gordon, Lewis. R., 197
 Goya, Francisco, 109
 Greeley, Robin A., 54–5
 Greenberg, Clement, 36, 39, 40, 42, 70
 Greimas, A.J., 9, 36–8
 Guattari, Félix, 7, 28, 109, 134, 195, 212
 Gysin, Brion, 31, 195
- Haacke, Hans, 15
 Haraway, Donna J., 170, 172
 Hasegawa, Yuko, 98
- Hayles, N. Katherine, 170–2
 Heidegger, Martin, 25
 Henderson, Linda Dalrymple, 65, 72, 77
 Heraclitus, 234
 Heys, Toby, 214
 Hjelmslev, Louis, 28, 129, 134–5, 149
 Hofstadter, Douglas, 234
 Hofstadter, Douglas and Emmanuel
 Sander, 17–18, 57, 231–3
*Surfaces and Essences: Analogy as
 The Fuel and Fire of Thinking*,
 17–18
 Holbraad, Martin, 235
 Horowitz, Gad, 192
 Hui, Yuk, 25–8, 86, 100, 103, 106,
 235–36
- Jameson, Fredric, 36, 38, 47, 49, 52, 59
The Political Unconscious, 36, 38, 52,
 Joyce, James, 59
 Joy Division, 29, 32, 153, 157–61, 174,
 226
Atrocity Exhibition, 160
Transmission, 157
Unknown Pleasures, 29, 153–4,
 157–61, 226
 Jung, Carl, 119, 160
- Kaiser, David, 94–6
 Kandinsky, Wassily, 16, 40, 70, 91
 Kemp, Martin, 75, 173–4, 227
 Kenning, Dean, 7–11, 13, 19, 32, 76–7
 diagrammatic artworks, 9–11, 19
 ‘Exploratory Diagramming and
 Diagram Theory: Greimas, Peirce
 and Chatelet’, 7–9, 76–7
 Keyser, Cassius J., 180
 Klee, Paul, 40
 Klotz, Eric and Volkert Besseling, 159,
 161
 Kluckhohn, Clyde, 195
 Knoespel, Kenneth, 7, 202
 ‘Diagrammatic Writing and the
 Figuring of Space’, 7
 Köhler, Wolfgang, 51
 Korzybski, Alfred, 7, 29, 40, 175–97, 229,
 231–2
Time-Binding: The General Theory,
 183

- Science and Sanity: An Introduction to Non-Aristotelian Systems and General Semantics*, 175, 177, 180, 195
- Manhood of Humanity: The Science and Art of Human Engineering*, 178, 180–3, 195
- Kraepelin, Emile, 54, 235
- Krämer, Sybille and Christina Ljungberg, 13, 70
- Kohn, Eduardo, 229
- Krauss, Rosalind E., 27, 35–60, 233–4
 ‘Grids’, 35, 41
 ‘Notes on the Index: Seventies Art in America. Part 2’, 152
The Optical Unconscious, 36, 38, 39, 41, 42, 45–6, 60
The Originality of the Avant Garde and Other Modernist Myths, 36, 41, 43, 53
 ‘Sculpture in the Expanded Field’, 41
- Kubrick, Stanley, 160
- Kusama, Yayoi, 25, 27, 97–100, 107
Infinity Net, 97–8
Manhattan Suicide Addict, 97
No. F, 97 Imaginary, Symbolic and Real
Sumire Kyohaku (Violet Obsession), 98
- Lacan, Jacques, 25, 27, 36, 38, 40, 42–7, 49–60, 234–5
 ‘Aggressivity in Psychoanalysis’, 54
 ‘The Ego in Freud’s Theory and the Technique of Psychoanalysis’, 43–4, 49, 50,
The Four Fundamentals of Psychoanalysis, 56
 Graph of Desire, 57–8
 Inverted Bouquet diagram, 44–5
 Schema L, 43–5
- Lamarck, Jean-Baptiste, 124
- Land, Nick, 195
- Latham, John, 13, 27, 100, 101–4, 107, 236
 ‘Consideration of One Least Event Universe’, 101
Time Base Spectrum, 101–2, 107
- Time Base Roller with Graphic Score*, 102–3
- Lawrence, D.H., 152
- Le Bot, Marc, 150
- Leeb Susanne, 1, 2, 7, 25, 153, 160–1, 169, 201–2, 205, 209, 211, 213, 215, 217
- Lévi-Strauss, Claude, 51, 119–20
- LeWitt, Sol, 81, 227
- Linden, Gurli, 69
- Linnaeus, Carl, 119, 124
- Lomas, David, 63, 72, 77, 79
- Lucier, Alvin, 198–200, 213
I am Sitting in a Room, 198–200
- Lytotard, Jean-Francois, 55, 152, 195, 205
 ‘Logos or Techne, or Telegraphy’, 205
- Magritte, Rene, 190
- Malabou, Catherine, 130
- Malloy, Vanja V., 92–3
- Margulis, Lynn, 130
- Marrinan, Michael, 32, 230
- McKenna, Terence, 195
- McRobbie, Angela, 4
- Mehretu, Julie, 5, 31
- Mers, Adelheid, 5, 31
The Artist as Ceiling Fan, 13–4
- Messiaen, Olivier, 215
Quartet for the End of Time, 30, 213
- Miss, Mary, 41–42
- Mondrian, Piet, 39–41, 48, 70, 137, 139–40
- Morgan, Douglas, 71, 74, 76
- Morley, Paul, 159
- Müller-Westermann, Iris, 65, 71–2, 74, 79
- Nancy, Jean-Luc, 198, 204–5
- Netz, Laura, 170–171, 173
- Newkirk, Toy, 164
- Newton, Isaac, 16, 91, 105, 180, 236
- Nietzsche, Friedrich, 118
- Oliveros, Pauline, 25, 30, 210, 211, 213
Anthology of Text Scores, 211
Wind House Mandela, 211
- Osbaldeston, David, 13, 31
- Owens, Joseph, 114

- Perrier, Edmond, 124, 127
 Perry, Lee 'Scratch', 215
 Peirce, Charles Sanders, 1, 7–9, 18–9,
 23–5, 27, 32, 61, 66–9, 71–2,
 74–7, 82–4, 109, 110, 112, 129,
 138, 141, 156, 175, 178, 207,
 220–1, 224–6, 228–9, 232–4
 'The First Rule of Logic', 23
 'Immortality in the Light of Synechism',
 83
 'On the Algebra of Logic: A
 Contribution to the Philosophy of
 Notation', 1, 69, 129
 'Prolegomena to an Apology for
 Pragmatism', 8, 76, 84, 110
 'Seven Systems of Metaphysics',
 23–4
 'Sundry Logical Conceptions', 67, 110
 'What Is a Sign?', 19, 67, 71, 110,
 112, 207
 Picabia, Francis, 15, 91
 Plastique Fantastique, 8
 Pollock, Jackson, 137, 139
 Porphyry, 112, 118
 Pula, Robert P., 178–80

 Quammen, David, 130

 Radigue, Éliane, 30, 214–5
Occam Hexa I, 214
 Redon, Odilon, 108–10, 129, 134, 136,
 226
 Reich Steve, 30, 215–6
Different Trains, 30, 215–6
 Riegl, Alois, 145
 Ringbom, Sixten, 70
 Ritchie, Mathew, 1
 Roberts, John, 4
 Robertson, Matthew, 160–1
 Rogers, Kenneth, 16
 Rosamond, Emily, 170
 Rovelli, Carlo, 27, 89–90, 95, 103, 106,
 235
The Order of Time, 89, 90
 runagrupa, 5,
 Ruskin, John, 39

 Sandqvist, Gertrud, 81
 Saussure, Ferdinand de, 134

 Savage, Jon, 174
 Saville, Peter, 153, 157–61, 174,
 226–7
 Schaeffer, Pierre, 209, 211–3, 216
Etude Aux Chemins De Fer, 209,
 211–2, 216
 Schafer, Raymond Murray, 208
 Schuchardt Read, Charlotte, 180
 Schwinger, Julian, 94
 Seachrist, Denise, 210
 Sharon-Zisser, Shirley, 54, 59–60
 Sirató, Charles, 15, 91
 Simondon, Gilbert, 25–6, 152
 Social Morphologies Research Unit
 (SMRU), 13, 32
Morphologies of Invisible Agents, 13
 Somers-Hall, 114, 118, 123
 Spriggs, Hermione, 235
 Steiner, Rudolf, 63, 65, 79, 83
 Stenger, Susan, 30, 214–5
*Sound Strata of Coastal
 Northumberland*, 214
 Stjernfelt, Frederik, 7, 67–9, 76, 83,
 230
 Strait, Joel, 152
 Strate, Lance
Korzybski and . . ., 194
 Sumner, Bernard, 159–60, 174
 Svensson, Anna Maria, 63–4, 72, 75
 Sylvester, David, 133, 137

 Tausk, Victor, 47
 Thorne, Kip, 100
 Treister, Suzanne, 14, 31
 Tubby, King, 215
 Tversky, Barbara, 154, 156, 163, 165,
 171–3

 Valades, Didacus, 22
 Van Gogh, Vincent, 144, 151
 Van Vogt, A. E., 194
 Viveiros de Castro, Eduardo, 231
 Voegelin, Salomé, 200, 202, 204
 Voigt, Jorinde, 5, 31
 von Uexküll, Jakob, 229
 Voss, Julia, 62, 75, 83

 Walsh, Louise, 154
 Watson, John B., 183

- Wheeler, John, 27, 99–102
 ‘Beyond the Black Hole’, 99
 Geons, Black Holes and Quantum Foam, 99
- Whitehead, Alfred North, 175, 178
- Widener, George, 25, 29, 31, 153, 162–7, 173
 Blauer Montag, 162–3
 Blue Monday (Reversal), 163
 Sunday’s Crash, 162
 V.A.L.I.S., 165–6
- Wilden, Anthony, 193–95
- Williams, James, 129
- Wilson, Christopher, 160
- Wilson, Tony, 161
- Woolf, Virginia, 219
- Wright, Michele M., 104–5
- Wynter, Sylvia, 196
- Yacoob, Mary, 10–13, 19
- Young, La Monte, 30, 214–6
- Young, La Monte and Marian Zazeela, 214
- Zander, Helmut, 74, 79, 83
- Zdebik, Jakub, 109

INDEX OF WORKS, CONCEPTS AND TOPICS

- abductive analogy, 48
abductive reason, 225
abstract expressionism, 40
abstract line, 108–10, 129, 134, 136
abstract machine, 15, 50, 118, 121–2,
135, 205, 207, 217, 224
abstraction, 7, 15, 18, 27, 36, 39–41, 61,
68–70, 81–2, 104, 109–10, 121–2,
135, 137, 140, 176, 178, 184–90,
192, 197, 207, 223, 228
abstracting process, 30, 122, 183, 185,
189, 197
accelerationism, 194–5
accident (in painting), 134, 138–9, 143,
149
actual, 20, 122–3, 129, 137, 147, 201,
207, 220, 225–6
actualization, 8, 28, 32, 109–10, 121–4,
126–8, 134–5, 143, 149, 152,
205–6, 215, 224
aesthetic, 3–6, 8, 13–7, 25, 36, 38, 48,
58, 68–70, 76–7, 82, 85–6, 90,
106, 144, 149, 156–7, 164, 173,
205, 213, 226, 227, 229, 236
aesthetic analogy, 20, 136, 142, 144,
220
aesthetic artefact, 226
afrodiasporic, 106
afrofuturism, 106
alchemy, 16, 222–3
algorithm, 16, 140, 170
allusive device, 218, 223, 226
analogical, 53, 56, 61, 114–5, 118, 123,
129, 140–4, 146, 221, 225
analogic communication, 29, 140–2, 220
analogical diagram, 18–9, 23–4, 28, 61,
114–5, 142, 144, 146–9,
analogism, 20–1, 23, 221, 233
analogue, 19–20, 147, 157, 199, 213–15,
227
analogical filter, 147
analogue photography, 142, 191
analogue synthesizer, 29, 147–9, 220
analogy, 8, 17–21, 23–4, 27–9, 31, 41,
48, 55, 56–60, 89, 96, 105,
110–12, 114–6, 118–9, 120–3,
129, 133, 136–7, 139, 142–44,
167, 173, 200, 207, 219–23, 228,
232–4,
analogy-making, 17, 57
analogy of proportion, 18, 119
analogy of proportionality, 18, 119–20
anamnesis, 57, 206
annotations, 61, 63, 66, 68–71, 77
anthropology, 6, 8, 13, 20, 24, 31, 119,
162, 221, 224, 235
anthroposophy, 15, 63, 65, 83,
apparatus, 46–50, 58, 60, 184, 223,
227
Aristotelian, 119, 122, 124, 136, 152,
197, 220, 223
arrows, 79, 105, 165
art education and training, 3, 177
art history, 3, 16, 36, 169, 186, 188, 192
assignifying traits, 139
association, 30, 54, 159, 207, 209
Atis-Rezistans-Ghetto Biennale, 5, 32
atom, 89, 93, 97–9, 128, 184, 187
audio diagrams, 7, 30, 200–7, 209–13,
215
aura of artwork, 191
auraltechnics, 7, 30, 200, 203, 206–7,
211, 213,
autodidactic, 3–5, 9, 13, 31, 179
automatic drawing, 63, 83
autonomy, 36, 137, 139, 148, 170

- avant-garde, 3, 15, 38, 41, 43, 46, 52–3, 56, 70, 169
- Bauhaus, 15
- becoming, 28, 118, 120–2, 146, 152, 219
- becoming-animal, 120
- being-in-common, 117
- Betelgeuse, 85, 87–89
- Big Other, 44, 51, 56, 234–5
- biotechnology, 170
- bisphenol A, 167–8, 170–2
- Black Atlantic musical subcultures, 6
- blackness, 104–5
- body, 93, 96, 98, 113–6, 124–8, 136–47, 150–2, 167, 170, 200, 203, 205, 208, 210, 214, 220, 223
- Borromean knot, 59
- branching, 28, 112–3, 115, 118
- breaching, 205–6
- brushstrokes, 76–77, 82, 144
- bubble of now, 90–1, 98, 103–4
- Buddhism, 71, 77
- calendar, 26, 162–3, 165–6, 173
- capture or trap [a fact], 136–8, 143–4
- categorical, 36, 111, 114–6, 122–3, 128, 223
- catastrophe, 122, 139, 147–9
- chaos 99, 110, 139, 148, 212–3, 222
- chemistry, 223,
- Christianity, 21, 66, 77, 83
- classes of life, 182–3, 193–4
- classification, 2, 28, 66, 119, 121–22, 126, 220
- clearing, 203–4, 217
- code, 2, 41, 47, 56, 126, 137, 140, 142–3, 147, 159–60, 174, 189, 193, 197, 206, 220, 231–2
- cogito, 40, 50, 111
- coloniality, 6, 192, 215
- colonization, 86–7
- colour, 3, 7, 16, 23, 29, 63, 70, 75, 77, 79, 135–6, 139–40, 146–9, 151, 174, 189,
- conceptualism, 16, 26, 36, 178, 186, 197
- concrete, 52–4, 109, 121–3, 135, 146, 202, 205
- concrete assemblages, 135
- Connaissance*, 44, 51, 56
- connection, 11, 17, 19–20, 23, 56, 105, 109–10, 115, 117–8, 121–5, 128–9, 134, 137–8, 146–7, 149, 152–3, 162, 170, 172, 204, 219–21, 223, 226, 229–30
- consciousness, 23, 38, 41, 46, 51, 54, 56–7, 65, 69, 72, 75, 82–3, 91, 110, 161, 206
- consensus reality, 55, 234
- Constructivism, 15
- continuous plane of being, 21, 28, 117, 122, 128, 134, 149, 220, 223
- continuously variable mould, 134
- contemporary art, 3–6, 14, 16, 26, 28, 47, 52, 86, 104, 186–8, 192, 197,
- contemporary art world, 4–6,
- contour, 145–6, 148–9, 151
- contraction and expansion, 29, 145, 148, 151
- correspondence ‘without resemblance’, 123, 125, 134, 136, 141
- coronavirus, 85
- cosmo-diagramming, 25, 86, 88, 90
- cosmos, 23, 28, 72, 85–6, 93, 98–102, 104, 159, 203, 213–4, 236
- cosmology, 13, 26–7, 87, 92
- cosmotronics, 25, 28, 86, 103, 106, 235–6, 243
- creativity, 4, 59, 70, 83, 87, 233, 234
- crisis of historicity, 47
- critical race theory, 196
- critical theory, 4, 8, 15–6, 26–7, 36, 47, 55, 58–9
- cruciform, 112, 222
- Cubism, 15
- cybernetics, 4, 8, 16, 49, 178, 196, 205, 229
- cyborg, 59, 170
- Dada, 15, 26
- data, 4–6, 10, 14, 23, 29, 67, 147, 153, 157–8, 165, 167–8, 170–4, 205, 214, 227–8
- Darwinian, 119, 124
- deduction, 23, 221, 225
- Deep Listening, 210–1, 213
- definition, 71, 175–6, 178, 180, 189, 196
- deformation, 127, 138, 143–6, 148, 152

- De Stijl, 15
determination, 52, 108–9, 112, 115–8,
123–4
diagram, 2–10, 13–20, 23–32, 36, 38,
41–50, 52, 57–59, 61–4, 66–77,
81–84, 86–90, 93, 95–6, 99–101,
103–10, 112, 114–5, 118–9,
121–3, 127–9, 133–40, 142–4,
146–49, 151, 153–4, 156–65, 167,
169, 171, 173, 175–78, 183–5,
188, 193–7, 199–217, 219–36
diagrammatic, 26, 29, 36, 41, 43, 50, 58,
61–5, 67–70, 72, 74, 77, 79, 81–2,
85, 87, 90–1, 95–8, 100, 103–4,
106–7, 112, 117, 137–8, 141,
143–4, 146, 156, 162, 164–6, 171,
199–205, 207–12, 214–6, 222,
225–7, 230–1, 236–7
diagramming, 21, 23–28, 57, 60, 62, 76,
79, 81, 86–88, 90, 95, 100, 103,
135, 202, 204, 206, 209, 212,
215, 219, 221, 225, 231, 236
difference, 18, 28, 83, 108–12, 114–24,
128–30, 136, 147, 149, 186–7,
189, 200, 215–6, 220, 223–4, 227,
230
difference in itself, 114, 116
differentiation, 109, 111–2, 115, 117–8,
121, 127–9, 234
digital, 41, 126, 140–2, 146–7, 152, 157,
161, 172, 187, 191, 199, 227–8
digital synthesizers, 147, 152
dimensionality, 182, 190
discursive, 5, 19, 42, 49, 70, 197, 215–6,
228
distributed person, 204
documenta fifteen, 5, 10, 32
double articulation, 134
drawing, 2–4, 6–11, 15, 17–9, 29, 61–64,
75, 77, 79, 83, 94–5, 100, 149,
153, 157, 162–7, 173, 190, 212,
214, 231, 236
drawing analogies, 6, 18–9, 31, 38, 46,
57, 149, 223, 232
dream, 47, 51, 69, 77, 82–3, 119, 159,
164
dream machine, 49
dispositive, 49
Dub, 30, 215–6
Earth, 21, 87–9, 97, 112
Écriture, 47
ego, 40, 43–5, 48, 50, 52, 56
electromagnetic waves, 65, 94, 223, 237
embodiment, 7, 8, 19, 28, 46, 92–3, 96,
99–100, 104, 141, 193, 202, 204,
220, 223, 227, 236, 237
emergence, 28–9, 72, 74, 90, 101,
103–4, 106, 109–10, 115, 117–8,
121–3, 133–5, 137, 139, 143–4,
146, 148–9, 194, 202, 214, 220,
225
encyclopaedia, 24
energy, 49, 50, 76, 82, 94, 193, 206, 212
energy-binding, 182
Enlightenment, 20–1, 23–5, 203, 221
equivocity, 114, 118, 129
esoteric, 4, 6, 14, 24, 32, 62–3, 65–6, 70,
72, 79, 83
event, 18, 29, 49, 51, 55, 100–7, 112,
153, 162, 168, 176, 184–5, 204,
207, 209–10, 214, 316, 221
evolution, 62, 65, 72, 74–5, 83, 90, 119,
121, 126–7, 160, 173, 195, 225,
229
eye, 39, 45, 65, 69, 71, 74, 79, 96, 99,
100, 115, 126–7, 130, 140, 145,
167, 171–2, 187, 191, 202–6, 230,
236
eyeless (ey), 126
extension, 101, 176–8, 195, 224
extensional device, 196
extensity, 28, 128, 133, 144
extensive, 28, 47, 122, 128, 146
fact, 23, 54, 66, 136–40, 142–3, 162,
220,
Factory Records, 161
feminism, 16, 38, 170
fiction, 8, 52, 59, 106, 173, 195, 206,
209
field, 39, 41–3, 45, 60
field of diagrammatology, 4, 7
field of vision, 45, 51, 60
figurative givens, 137–8, 146, 152
figure, 7–8, 17, 24, 29, 39, 41, 94–6,
98–100, 108–10, 112, 133–4,
136–39, 142–46, 149–52, 202,
210–14, 236

- figure-ground relation, 28, 40, 97–8, 128, 134, 209, 234
- figure of eight, 230
- fine art, 3, 161, 181
- Flat Time House, 13, 100–1, 103,
- forces, 28, 49, 54, 66, 75, 79, 94, 122, 127, 138, 143–4, 152, 213, 217, 220, 224–5
- French theory, 195, 197,
- future, 29, 52, 75, 83, 89, 90, 104–6, 153, 162–3, 166, 168, 171–4, 180, 183, 187, 195, 215,
- general semantics, 176–78, 192, 194, 196–7
- genes, 119, 125–8, 130, 134
- genesis, 117, 124
- genetic, 109–10, 117, 119, 122–3, 125–8, 133, 136, 145
- genetics, 28, 125
- genus, 112–7, 119, 136
- geometry, 16, 24, 27, 45, 62, 93, 140, 146
- gestalt, 39, 40, 45, 48, 51, 58, 165, 172
- gestalt psychology, 39, 40, 51
- God's-eye view, 202, 236
- grandfather paradox, 106
- grandmother paradox, 106
- graph, 23, 29, 36, 38–9, 58, 70, 74, 91, 138, 154, 156, 227
- graphic, 2, 36, 38, 58, 94, 103, 109, 112, 134, 149, 154, 178, 201–6, 210, 216, 225, 235
- graphic design, 8, 29, 153, 161, 201, 226
- graviton, 103, 107
- gravity, 85, 89, 103, 107
- great chain of being, 18, 21, 23, 221–2
- grid, 41–3, 149, 227
- habit, 4, 71, 76, 87, 103, 176–7, 193, 197, 200, 205–6
- haptic, 145
- heterogeneity, 209–10, 213, 216
- high-frequency trading, 170, 174
- Hinduism, 63, 77
- homeobox gene, 125–6, 128
- honey bee, 230
- hormone, 170
- human, 15–6, 21, 23–6, 28, 30, 36, 38, 47–51, 65, 69, 71, 83, 86–90, 93, 97–8, 100–1, 103–4, 110, 113–5, 119–20, 124, 126, 129, 134, 140, 146, 160, 164–5, 167, 170, 177–8, 180–5, 187, 189, 191, 194–7, 199, 201, 205, 208–9, 216–7, 221, 227, 229, 231,
- human engineering, 178
- humanism, 15, 52, 194
- hyper reading, 171
- hysteria, 56, 142
- icon, 7, 19, 57, 61, 66–8, 72, 74, 83, 110, 122, 141–2, 171, 175–6, 210, 220, 225, 227, 230
- Iconic, 3, 6, 7, 67, 70, 74, 82, 112, 121–2, 129, 138, 141, 143–4, 178, 190, 220, 225, 228, 230, 233
- iconic diagram, 29, 149
- iconic sign, 18–9
- id, 48
- idea, 17, 30, 186, 192–4
- ideal connections, 123–4, 125
- ideal structure, 123
- identity, 16, 30, 105, 109, 111–2, 114–5, 119, 121, 123, 128, 136, 138, 176, 185, 186, 192–3
- identity politics, 36, 196
- ideological and state apparatuses, 49
- idios kosmos*, 55, 232–5
- idiotic simplicity, 36, 232–4
- image, 7, 17, 19, 20, 27, 29, 30, 39, 46–7, 50–1, 57, 63, 67, 70–2, 77, 98–100, 110, 112, 129, 136–9, 141, 143–5, 148–50, 152–3, 156–62, 164, 171, 173–4, 176, 178, 185, 188–91, 193, 200, 203, 206, 214–5, 220, 226–9, 232, 236
- botanical 63, 82, 222
- figurative 138
- imagination, 11, 18–9, 23, 51, 77, 87, 100, 111, 119–20, 160, 223
- imaginary, 8, 20, 27, 38–41, 43–5, 47, 49–52, 56–61, 69, 99–100, 106, 119–20, 122, 136, 163–4, 200, 202–3, 207–8
- Imaginary, Symbolic and Real, 27, 50, 59

- index, 19, 20, 27, 30, 61, 66, 67–8, 72–7, 82, 110, 112, 129, 137, 139, 141–4, 156, 207–11, 226–7
- individuality, 185, 193
- induction, 23, 65, 225
- influencing machine, 46
- infographics, 3–5, 10
- infra-thin, 208
- inorganic, 181–2, 193–4
- intensity, 28, 122, 127–8, 130, 135–7, 139, 143, 145–6, 151–2, 220
- intensive quantities, 122
- intensive relations, 18, 20, 28, 122–3, 126, 128, 133, 137, 142, 146, 223
- interpretant, 7, 18, 66, 83, 228–32
- interpretation, 7, 8, 18–9, 58, 61, 66–8, 74, 76, 82, 84, 154, 159, 161, 172, 174, 229
- irrational marks, 138–9
- isomorphism, 18, 28, 30, 39, 48, 115, 120, 122–3, 134, 136, 143, 198, 202, 204
- jouissance*, 52
- judgement, 3, 6, 115, 117
- Jupiter, 87
- Kabbalistic, 66
- Klein Group, 36
- language, 6, 10, 19, 23, 26, 28, 30, 36, 43, 47, 49–51, 57, 59, 63, 70–1, 82, 118, 134–5, 140–1, 147, 149, 152, 156–7, 176, 179–80, 184–5, 187, 189, 192–4, 196–7, 205–6, 217, 220, 224–5, 227, 229
- least event, 101, 107
- linguistics, 38, 51, 178
- Linnaean classifications, 122
- listening, 30, 199–200, 203–7, 209–13, 215–6
- lockdown, 13, 85, 87, 90
- logic, 2–4, 28, 36, 38, 41–3, 45, 48, 50–2, 57–9, 66, 68, 76, 81, 118, 136, 138, 164, 178, 192, 194, 197, 202–3, 205, 209–10, 220, 223
- machine, 2, 15, 25, 27, 29, 45–6, 49, 50, 56–7, 90, 109, 121–2, 126–7, 135, 148–9, 153, 161, 163, 166, 170, 173, 205, 207, 217, 224, 235
- macroscopic, 85, 87
- macrocosms and microcosms, 87, 221–2
- magic square, 162
- Manchester, 159
- manual, 137–40, 148–9
- map-territory relation, 177, 190
- Mars, 87
- mathematics, 7, 16, 23–4, 29, 30, 38, 45, 50, 56, 63, 66, 68, 92, 94, 96, 99–101, 162, 164, 175, 179–81, 200–1, 213, 221, 223, 226
- matter, 27, 30, 61, 65, 67, 70, 72, 74–5, 79, 117, 122, 134–5, 137, 149, 151–2, 181–2, 187, 193, 207, 223, 236
- mediation, 111–2, 137, 173, 236
- medium, 36, 49, 70, 76, 91, 104, 137, 166, 168, 171, 187–8
- mediumship, 63–4, 79
- memory, 47, 51, 111, 164, 166–7, 178, 205–7
- Mercury, 87
- metaphor, 2, 19, 20, 23, 29, 41, 47, 49, 50, 58–9, 71, 83, 89, 110, 112, 118, 135, 141, 145, 156–7, 173–4, 195, 211–2, 220, 233
- metanarratives, 55
- microscopic, 85, 87, 172, 183
- mimesis, 121, 219
- mind, 8, 9, 17–20, 30–1, 41, 46–9, 51, 54, 57, 66, 76, 85, 104, 110, 114, 129, 136, 138, 145, 147, 159, 161, 164, 167, 170, 176, 178, 181–2, 185, 190, 194, 197, 208, 228–30, 232, 236,
- minimalism, 36
- mirror stage, 40, 43–4, 50–2, 56
- mobiles, 91–3, 96
- mobile arrangement, 98, 202
- mobile phone, 227
- modern art, 3, 15–6, 36, 41, 45, 68, 70, 81, 86, 91, 169,
- modernism, 26, 28, 36, 39–43, 68, 86, 96, 100, 104, 137, 186, 192, 203, 236
- modernist artwork, 203
- modernity, 55, 57, 196, 212, 216

- modulate, 142, 144, 148, 220
 molecular model, 167
 moon, 97
 morphogenesis, 126
 morphological, 54, 124, 126
 multiplicity, 21, 98, 121, 127, 134, 197,
 205, 209, 214
 multiverse, 105
 music, 4, 6, 10, 30, 105, 143, 152,
 159–61, 172–3, 199–201, 210–1,
 213–6, 225, 230, 235
musique concrete, 30, 209, 216
 mystic writing pad, 48
- naturalism, 20–1, 23, 221
 nervous, 9, 29, 76, 94, 137–8, 141–44,
 151–2, 220
 nervous analogy, 20, 28–9, 137–40, 146
 nervous resemblance, 149
 nervous system, 30, 137, 139, 146, 147,
 183–4, 189, 195
 neurodivergence, 164
 Newton's optics, 16
 nomadic, 117
 non-Aristotelian thought, 177–8, 188, 194
 non-Euclidean, 91
 non-instrumental studio practice, 3
 non-sculpture, 41, 57
 notebook, 15, 63
 now, 89, 90, 98, 104–5
- objectal logic, 209–10
 occult, 63, 66, 70, 83, 138, 222
 ontology, 20, 149, 221, 224, 236
 open perspective, 2
 opposition, 28, 36, 38, 41, 42, 48, 52,
 111–2, 114–5, 118, 123, 137–8,
 203
 optical, 16, 36, 39–42, 44–6, 51, 53, 60,
 137, 139, 143, 148, 200, 202–3,
 205–6
 opticaltechnics, 202–3
 optical unconscious, 36, 39, 46, 60
 orders of complexity, 193–4
 organic, 111, 118–9, 122–3, 128, 146,
 181–2, 193–4
 organism-as-a-whole-in-an-environment,
 177
 Orion, 157
- palindromic, 165
 pandemic, 85, 97, 101
 panopticon, 109
 paranoia, 27, 50, 52, 54–6, 59, 233, 235
 paranoiaccritical method, 53–5
 paranoid critical theory, 27, 50, 56, 233
 paranoid knowledge, 27, 43
 particle, 65, 79, 87, 93–7, 99, 103, 105,
 121–2, 136
 passing, 30, 205–7, 211
 past, 52, 75, 89, 90, 97, 105–6, 162,
 165–6, 171, 205, 214–5, 227
 pattern, 6, 11, 17, 39, 40, 48, 68, 105,
 118, 123, 135, 147, 156–7, 160,
 162, 197, 213, 227
- PAX6, 126
 pedagogic device, 2
 Peircean, 32, 76, 110, 141, 178, 220,
 234
 perception, 30, 39, 40–1, 67, 81, 89,
 111, 177–8, 186, 188–9, 193,
 196–7, 204, 207, 209
 perceptual resemblance, 17–8, 20, 116,
 118, 120
 performance, 2, 5, 6, 8, 9, 16, 36, 98,
 188, 202–4, 208, 210–1
petit objet a, 57
 Phemic Sheet, 224–6, 236
 phenomenological registers, 104
 phenomenology, 4, 186, 209
 phonography, 210
 photography, 43, 45–6, 137, 142–3, 191
 psychology, 15, 38–40, 42, 48–9, 51–2,
 178
 physics, 7, 8, 15, 27, 31, 85–6, 89–93,
 98–101, 104–5, 156, 179–80, 186,
 209, 237
 physicist, 27, 86–7, 89, 91, 94–6, 99,
 100, 103, 105–7, 154, 156, 216
 photon, 94–5
 plane of assertion, 203–4, 224, 226
 plane of being, 28, 117, 128, 134, 220,
 224
 plane of consistency, 121, 134, 231
 plan of composition, 124
 planets, 93, 99
 plants, 21, 65–6, 79, 81, 99, 118, 167,
 182–3, 222, 226, 229
 plasticity, 109, 118, 130, 170, 220

- plasticity of paint, 137
 Pocono conference, 94, 96
 Polaris, 87
 polka dot, 97–9
 pollution, 168
 Porphyry's Tree, 112, 118
 posthuman, 170, 172, 174
 post-colonial, 36, 215
 post-human, 172, 174
 Post-Impressionism, 146
 postmodernism, 27, 43, 45–7, 49, 52,
 54–7, 59, 192
 postmodern cultural theory, 49, 58, 192,
 post-Newtonian, 91
 post-structuralist, 47, 56, 193, 197
 practice, 2–10, 13, 15–7, 19, 26, 29–32,
 36, 38, 47, 52–3, 62–3, 66, 71–2,
 79, 85, 87, 90–1, 96–8, 100,
 103–4, 106–7, 160–2, 165, 176–8,
 187–8, 192, 195, 197, 200–2, 207,
 210–14, 226
 prediction, 29, 153, 162–3
 present, 52, 88–90, 102, 104, 106–7
 process art, 16, 26
 Promethean myth, 25, 86
 proto-universe, 101
 psychosis, 43, 54–5
 psychoanalysis, 2, 4, 8, 15–6, 24, 27, 31,
 39, 43, 47–50, 52, 54, 56–8, 119,
 206–7
 pulsar, 153–6, 158–60, 173, 227
 pure psychic automatism, 54
 purport, 129, 134–5

 quantum, 85, 87, 89, 94, 96, 99–101,
 186,
 foam, 99–101
 loop gravity theory, 103
 mechanics, 95, 101
 electrodynamics, 94, 96
 quasar, 160
 quasi-mind, 18, 229
 quilting point, 42–3

 radio astronomy, 157, 160
 radio telescopes, 154, 174
 radiophony, 210
 real, 52, 59, 60
 real-time, 2, 168

 realized, 117, 134
 reason, 24, 51, 56, 102, 107, 110–12,
 115, 117–8, 120, 123, 127, 129,
 185, 193, 225,
 reciprocal determination, 123–5
 reciprocal relations, 124–5, 126–7
 refrain, 30, 212–6
 relations, 2, 6–8, 11, 16–21, 23, 25,
 27–30, 41, 44–5, 48–9, 51, 55, 57,
 61, 66–7, 69–71, 74–6, 82, 87, 91,
 93, 96, 99, 110, 112, 115,
 117–29, 133–4, 136–7, 139–43,
 145–9, 151–4, 156, 160, 164–6,
 168, 170–1, 173–6, 178, 193, 197,
 199–204, 207, 209, 211, 213–4,
 219–21, 223–6, 229–31, 233, 236
 relativity, 15, 85–6, 91, 103, 178
 representation, 4, 7, 8, 15, 20, 29, 32,
 39, 52, 57, 59, 61, 69, 70, 77, 82,
 108–11, 117, 123, 129, 134, 136,
 139, 143, 145, 147, 152, 154,
 159, 174, 176, 178, 222, 224
 resemblance, 18, 20–1, 27–9, 59, 67,
 110–12, 114–6, 118–29, 134,
 136–9, 141–4, 148–9, 156, 219,
 220, 232
 resemblance by non-resembling means,
 136, 141–3, 220
 retinal art, 3, 15, 39
 rhizomatic, 23, 220, 228
 rhizome, 121

 sacred, 27, 61, 84, 200, 205, 208
 scanning, 172, 205–7, 211, 213
 Saturn, 87
savoir, 51, 56
 schizoanalysis, 56, 195,
 schizological, 206, 209, 210
 schizophrenia, 27, 46–7, 52–4, 56, 59
 sciences, 2, 7, 15–6, 23–5, 31, 87, 101,
 103, 157, 221, 223, 225, 236
 scientific, 7–9, 15–6, 20–1, 23–4, 56, 58,
 65, 68, 75, 79, 83, 86, 96, 100–1,
 103–6, 119, 122, 159–61, 167,
 173, 179, 180, 194–6, 216, 221–3,
 227, 233, 236
 scientific discoveries, 65, 79
 science fiction, 8, 29, 57, 153, 159, 160,
 163, 166, 170, 172–4, 194, 235

- sculpture, 9, 41, 57, 83, 91–3, 98, 136,
 172, 188, 210, 226–7
 séance, 63
 sedentary, 115, 117–8, 128
 semantic environment, 7, 177, 197
 semantic reactions, 195
 semiotic square, 38, 41, 57, 232–3
 semiotics, 27, 31, 38, 61, 66–7, 83, 160,
 178, 186, 201, 208, 232
 sensation, 110, 137–9, 141–4, 146–8,
 152, 185, 205, 220
 sensually, 142
 sentiment analysis, 167–9
 sign, 7–9, 18–21, 27, 51, 56, 58, 61,
 66–9, 71–2, 74, 78, 82–3, 110,
 127, 134–5, 139, 141, 176, 189,
 207, 209, 228–30
 signal, 9, 87, 125, 140, 142, 154, 156,
 160, 170, 208
 signification, 48, 91, 75, 79, 231
 signifier, 42, 47, 58, 60, 71, 206–7, 212,
 216
 signified-signifier relations, 42, 51, 134–5,
 156, 207, 229, 232
 similarity, 18, 20, 39, 48, 66, 114–6, 124,
 141, 172, 185, 219, 221, 223
sinthome, 59, 60
 Sirius, 87
 social mapping, 5
 Solar System, 92
 sonic mapping, 200, 202, 214
 sonorous, 205, 207–11
 sound, 19, 30, 90, 142, 149, 152, 169,
 167, 172, 189, 198–200, 202–16,
 220, 226, 230
 Sound Object, 30, 209, 212
 soundmarks, 208
 soundscapes, 30, 200
sous rature, 215
 space, 4, 11, 13, 20–1, 27, 38–9, 42, 61,
 72, 82, 87, 91–3, 95–6, 98–100,
 103–5, 117, 137, 145, 153, 157,
 159–60, 163, 166, 173, 182–3,
 187, 204, 209–11, 213–4, 223,
 229, 230, 236–7
 space-binding, 182–3, 187
 spacetime, 15, 27, 87–8, 91–3, 99, 101,
 104–6, 126, 178, 184–5, 202–3,
 206, 211
 species, 21, 51, 65, 112–6, 119–20,
 123–8, 187, 195–6, 220, 229
 spiral, 54, 66, 74–5, 84, 146, 233
 Archimedean, 83
 logarithmic, 74
 symbolism of, 74
 spirit, 27, 61, 65, 67, 70, 72, 74–5, 83,
 108, 113, 160, 222–3
 spirits, 6, 63, 71, 76, 83, 137, 200,
 208
 spirit guides, 63–4, 69, 75
 spiritual, 25, 27, 41, 62–6, 70–2, 74–5,
 79, 81–3, 222–3, 226
 spiritual growth, 75
 spiritual world, 65, 79, 223
 spiritualism, 15, 83
 stars, 21, 85, 87, 90–1, 97–9, 101, 154,
 160, 235
 state of non-extension, 101
 stock market, 168
 structural, 18–20, 28–9, 36, 38, 45, 47,
 51, 68, 76, 82, 110, 115, 117–21,
 123, 125–6, 136, 141, 145–6, 149,
 171, 201–2, 220, 223
 structural analogy, 116, 118, 121–2
 Structural Differential, 178, 183–4, 196–7,
 231
 structural-genetic, 123, 136, 145
 structuralism, 16, 27, 36, 48, 123, 186,
 232, 234
 structuralist, 20, 36, 38, 41, 43, 47, 49,
 58–9, 118, 122, 193
 structural similarity, 144
 structural likeness, 220
 structured events, 100, 103
 superego, 48
 Surrealism, 8, 26–7, 43, 53–4, 56–7
 synthesizer filters, 147
 synthesizers, 29, 147–9, 152, 220
 systematic delusion, 27, 54, 235
 systematic perspective, 2
 symbolic, 16, 23, 27, 38, 42–5, 50–2,
 55–60, 63, 66–7, 70–2, 74, 82,
 119–20, 129, 140–1, 152, 156,
 161, 189, 207, 220, 225, 228–9,
 231, 234, 243
 symbol, 16–7, 19, 23, 44, 49, 50, 66,
 70–2, 76–7, 98, 110, 112, 141,
 159, 163, 210, 225

- symbolism, 6, 32, 171, 225
 symptom, 24, 43, 47, 54, 59, 176
- taxonomy, 16, 62, 79, 119
 technical device, 57, 85–6
 technical objects, 5, 25
 technicity, 24–5, 86
 technologists, 206
 technology, 24–6, 29, 46, 86, 88, 96,
 106, 157, 160–1, 166–7, 169, 173,
 181–2, 187, 191, 199, 204–5, 211,
 236
 development, 25, 160,
 techno-scientific modernism, 96
 telegraphy, 205–6, 212
 temple, 75, 84
 temporal ecologies, 170
 teratology, 130
terra nullis, 87
 theory, 3, 4, 7, 8, 15, 26–7, 31, 55–6,
 58–9, 187, 192, 195
 Theosophy, 15, 63, 70, 74, 77,
 79, 83
 third kind of analogy, 20, 219–20
 third ear, 205–7, 211–2
 Third Mind, 31
 time, 4, 11, 13, 27, 29, 87, 88–91, 95–6,
 99–100, 103–7, 126, 140, 153–4,
 156–66, 168, 173–4, 183, 187,
 189, 201, 203–4, 209, 210, 213,
 214–6
 absolute, 88–91
 flow of, 89, 90, 103
 linear, 88–9, 105–6, 235
 multi-temporalities, 171
 sequential, 29, 153
 time-binding, 179–83, 189, 195–6
- time-of-assertion, 203–4
 time travel, 165
 timeline, 89, 105, 181, 216
 tone, 5, 7, 13, 29, 76–7, 139, 140,
 146–8, 151, 205, 216, 226
 trauma, 52, 215
Treachery of Images, 190
 tree diagram, 66, 112, 228
- uncertainties of discourse, 55
 unconscious, 39, 45–6, 48–9, 51, 53–4,
 56, 60, 63, 193, 195, 206, 234,
 universe, 8, 13, 18, 23, 25, 38, 65, 91–3,
 97–101, 103–5, 107, 160, 165–7,
 203, 229, 233, 235
 univocal, 20, 28, 114–5, 117, 121,
 123–4, 134, 136, 220, 224
 univocity, 115–8, 224
 unknowing, 57
- Venus, 87
 veves, 6, 26
 visualization, 2, 7, 10, 27, 29, 36, 65, 76,
 154, 156–9, 164–5, 167, 173–4
 virtual, 25, 28, 94–5, 105, 109, 121–3,
 126–7, 129, 133–5, 137, 151, 154,
 167, 172, 200, 224, 226
 vitalism, 72
 vodou, 6, 26
- words, 2, 17, 30, 43, 50–1, 71, 129, 135,
 156, 163, 176, 179, 183, 185,
 187, 189, 195, 199, 201, 215
- X-ray, 65, 223
- zone of indiscernibility, 146

