Warwick writing

complexness; complication; complicacy; convolution; density; difficulty; elaboration; entanglement; imbroglio; inscrutability; intricacy; involution; labyrinth; multiplicity; profundity; subtlety; tangle

Complexity

THE UNIVERSITY OF WARWICK

CONTENTS

04 Susan Bassnett: *The Books Slept*

10 Jonathan Bate: *Shakespeare's Sonnets@400*

14 Maxine Berg: *The Complex Road to Industrialisation*

18 Jim Beynon: *The Complexity of Life*

22 Shaun Breslin: *Identifying East Asia*

26 Matthew Cooke: *The Complex World of Hospital Bed Management*

30 Justin Greaves and colleagues: *Governance of Livestock Disease*

34 Jacqueline Hodgson: *The Complexity of Terrorism*

38 Andrew Hoskins: *The Diffusion of Media/Memory*

42 David Morley: *You were broken*

44 Andrew Oswald: *Heads and Reds*

48 Shirin Rai: *Gendered Ceremony and Ritual in Parliament*

52 Ian Stewart: *Complexity in Mathematics*

56 Nigel Thrift: *The Geography of Complexity Theory*

61 Robert MacKay: *Warwick's Complexity Complex*

65 *Exploring Complexity: The Warwick Prize for Writing*

Complexity

A collection of essays from the University of Warwick exploring the theme of complexity

'...complication is anterior to simplicity'

Anthony Powell (quoting Ernest Renan), *The Military Philosophers*

THE UNIVERSITY OF WARWICK

PROFESSOR SUSAN BASSNETT FRSL
DEPARTMENT OF ENGLISH & COMPARATIVE LITERARY STUDIES
s.bassnett@warwick.ac.uk

COMMENT

'We are living in the age of the world wide web, which grows and changes every day, a vast organic, seething network of information, opinions, contacts, facts and lies. It can provide knowledge, entertainment, escape from routine banality, it can take us into dark worlds of pornography and pain, it is a learning tool for students that previous generations could never have imagined being able to access. It is compulsive for some – it can take over their lives and become a substitute for reality. For those of us trained to do our research in libraries, the internet is both exciting and at the same time slightly unnerving, for it opens up all kinds of avenues that we might never have been tempted previously to explore. Our students are more at home with it than we are, scholars of my generation who have come belatedly into this brave new technologically complex world.'

Susan Bassnett FRSL is Professor of Comparative Literature in the Department of English & Comparative Literary Studies and a former Pro-Vice-Chancellor. She began her academic career in Italy, moving via the United States to the University of Warwick, where she set up and directed the postgraduate Centre for Translation and Comparative Cultural Studies. She is author of over 20 books, a Fellow of the Royal Society of Literature and a council member of the Academia Europaea.

PROFESSOR SUSAN BASSNETT FRSL
DEPARTMENT OF ENGLISH & COMPARATIVE LITERARY STUDIES
s.bassnett@warwick.ac.uk

The Books Slept

BY SUSAN BASSNETT

The great Argentinian writer, Jorge Luis Borges, takes us often in his stories and novels into great terrifying libraries of one kind and another, places where knowledge is hidden and organised in ways we cannot properly understand. For Borges, libraries and labyrinths are interconnected, places of corridors and passageways that can confuse and mislead. His short story, *The Library of Babel*, conceives of the universe metaphorically as a great Library, and he suggests that even though the human species may be extinguished, 'the Library will endure: illuminated, solitary, infinite, perfectly motionless, equipped with precious volumes, useless, incorruptible, secret.'

With his typical irony, Borges constructs an unimaginably vast structure that at first seems enticing and excites a desire to explore the hermeneutic mysteries. But as the story progresses, so we come to see that the Library is controlled somehow, somewhere, by secret, inaccessible authorities. We may think we have the power to use the Library, but it is the Library that is using us.

PROFESSOR SUSAN BASSNETT FRSL
DEPARTMENT OF ENGLISH & COMPARATIVE LITERARY STUDIES
s.bassnett@warwick.ac.uk

We are sucked into the Library, we conform to its rules, we follow its labyrinthine structures in our quest for knowledge, we obey its laws without realising we are doing so. These days, I think of Borges often when I use the internet, when whole new websites unroll before me, when I follow winding or forking paths in pursuit of some piece of knowledge or information that, however reluctantly, I find I am compelled to pursue if I want to reach my goal.

Borges would, I think, have loved the internet, for in many respects he foresaw it: he almost imagined its vastness and its complexity over half a century ago through his fantastical constructions of libraries. He would have loved it because he would have seen how it forces us to confront the fluidity of knowledge. It denies us the right that we scholars thought we had, to call ourselves experts, for there at the touch of a button are yet more sites, yet more pathways, yet more unexplored references, yet more possibilities. Every time we click on, we are reminded of all that we do not know and will never know. Yet if we step back slightly from admiring this electronic marvel, the internet can be seen as just another kind of library, a seething virtual library, with knowledge stored in the ether and the paths to that knowledge often baffling or misleading, but a library in the broadest sense nevertheless.

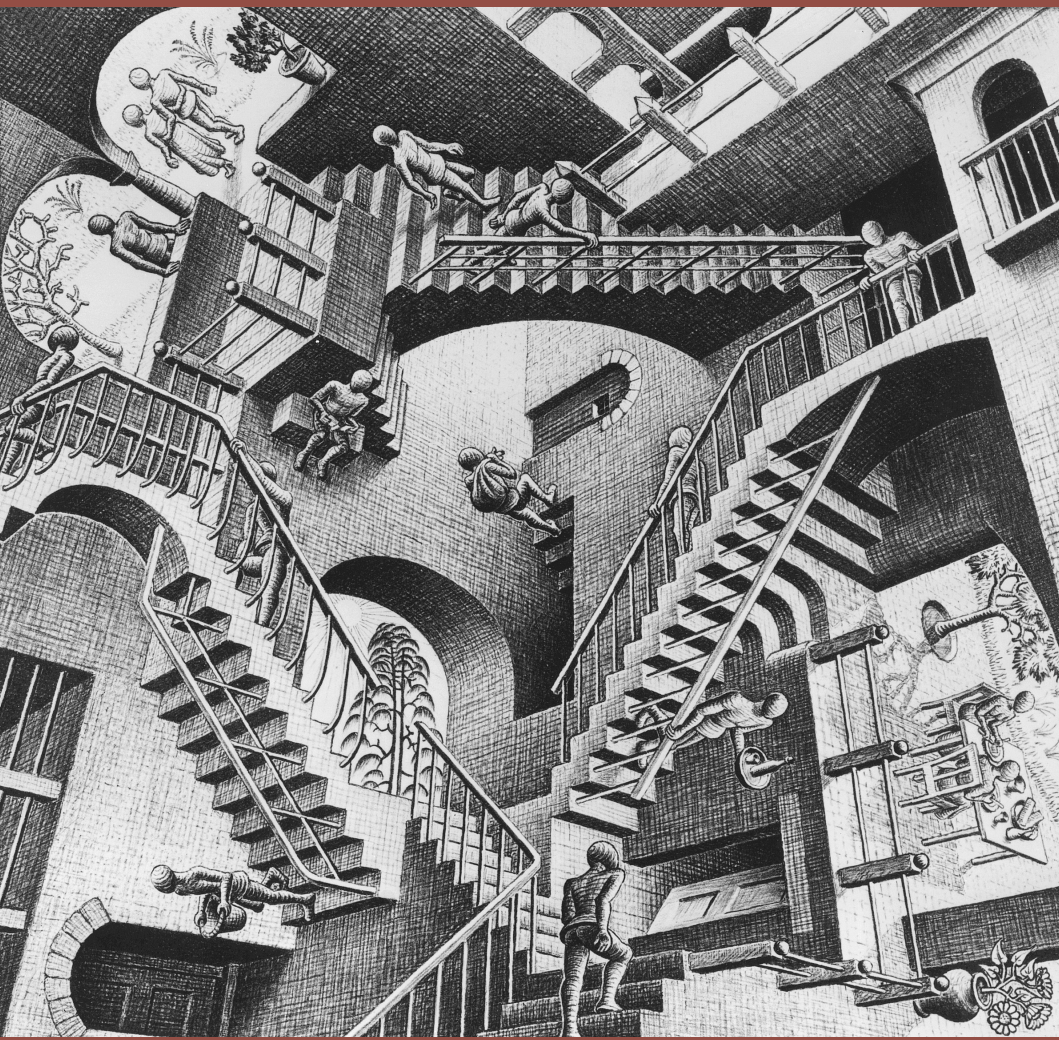
It might, at first glance, seem incongruous to connect Borges' Library of Babel, with its 'indefinite and perhaps infinite number of hexagonal galleries, with vast air shafts between' with a library created by one of the world's best-selling popular writers, Terry Pratchett, but nevertheless there is indeed a link. For both men conceive of libraries as places of great, mysterious power, sites of unknown and unknowable knowledge. One of Pratchett's stock characters is the Librarian of his Unseen University, who has been transformed into an orang-utan:

'A magical library is a dangerous place to work... he'd been a quite inoffensive human... but with the change had come the key to a whole bundle of senses and racial memories. And one of the deepest, most fundamental, most borne-in-the-bone of all of them was to do with shapes. It went back to the dawn of sapience.'

With his metamorphosis, the Librarian has acquired ancient knowledge that is built into the DNA of a different species, that conditions his behaviour and gives him new levels of insight, levels, of course, that he cannot communicate since he is now an orang-utan and has lost the faculty of speech.

Pratchett's fascination with libraries as strange, magical and frightening places recurs in his novels through his depictions of the library belonging to Death, where all human lives are stored. Death's Library consists of millions of hour glasses, referred to as 'life-timers'. In *Mort*, Death's inexperienced apprentice goes into the Library in search of a life. The Library is full of floating specks of dust, and as the apprentice listens intently he can hear 'the insect-like scritching' of the stored lives writing themselves. The shelves tower up into an infinity of darkness, and down below, in the Stacks, the

PROFESSOR SUSAN BASSNETT FRSL
DEPARTMENT OF ENGLISH & COMPARATIVE LITERARY STUDIES
s.bassnett@warwick.ac.uk



'Relativity' by M C Escher

shelves are filled with the lives of the dead encased in books:

'There were no more lives to write; the books slept. But Mort felt that they slept like cats, with one eye open. They were aware.'

The greatest difference between the internet as library and the buildings where libraries are housed is one of physicality. To access the internet we sit at a desk and gaze at a screen, but to gain access to a traditional library we have to enter a building, negotiate how to get through security, learn the ways in which books can be found, borrowed and returned. Libraries, as Borges and Pratchett in their different ways show, can be places of great anxiety, since to an outsider who does not understand the rules of a certain library, who might be using that library for the first time, the complexity of the usage system can appear daunting.

Some libraries have books on open stacks, where readers can wander at will, while others require you to file a request and wait. Free access means that you have to rely on your own initiative to find a volume, while waiting for books means that you have to put all your trust in those who can deliver the books to you. Often as a student in Italy I would wait for hours at the Biblioteca Nazionale in Rome, only to be told that the book I needed had been lost, or couldn't be found, or else the library would close for lunch and readers would be evicted into the midday heat. In the Strahov library in Prague, I found a rare seventeenth century text that I was fortunately able to photocopy; not long afterwards another scholar tried in vain to find the same text, and became so frustrated that she contacted me to check that the reference was accurate. It was indeed correct, she had not made a mistake, but the text itself had vanished, cut out of the volume, presumably by some unscrupulous trader in antiquities. My photocopy had become the last trace of its existence. So much for trust, which is, after all a modern indulgence. Visit the library in Hereford Cathedral and you will see an example of a medieval chained library, where books were deemed so valuable and readers so corruptible that each volume was secured with a heavy metal chain.

As a reader in a library, you sense that there is a vast machinery working silently around you, a machinery that you only vaguely understand but which controls your use of the books you require.

I confess to being intimidated by libraries, even by ancient, beautiful ones like the Bodleian. The sense of intimidation comes not just from the centuries of knowledge stored on the shelves, but from the very physical dynamic of the library itself, from my awareness that I have placed myself for a short time into a system that I can only dimly comprehend and which rolls on inexorably around me, just out of my grasp. Borges captures the anxiety I feel about the sense of secrecy that prevails in libraries, while Pratchett goes a step further and endows the very shelves and their contents with a life of their own. Walk down a stack in a big, well-established library late on a winter's afternoon, when the lights are dim and outside the world is in

PROFESSOR SUSAN BASSNETT FRSL
DEPARTMENT OF ENGLISH & COMPARATIVE LITERARY STUDIES
s.bassnett@warwick.ac.uk

darkness and you can almost feel the books watching you as they rest in their hermeneutic rows. You feel the urgency of silence, your footsteps resound, a dropped book or pair of glasses booms like an explosion in the stillness.

In a university library, as examinations approach, libraries are less silent, but so full of tension that they provoke a different kind of uneasiness. A library just before Finals may be full of students, but those students exude a fear that is almost palpable, a fear you can smell the moment you enter the building, the fear that comes from the possibility of failure, despite the millions of learned words towering above their desks.

The library and the internet are wonderful and frightening in different, yet not dissimilar ways. As the internet grows in power and status, the library will surely diminish, but for my lifetime and my children's at least, both will endure. Used wisely, the internet is an incomparable resource, and my grandson in his first year at school is already learning how to use it. Perhaps when he is my age, libraries will have become curiosities, places that inspire not reverence or fear but simply a mild historical interest, and all knowledge will be available at the click of a mouse on a screen.

Perhaps. Or perhaps not; perhaps the fascination that libraries exercise in the imagination as sites of infinite knowledge, as metaphors for the universe will ensure their survival. Let Borges have the last word:

'Man, the imperfect librarian, may be the product of chance or of malevolent demiurgi; the universe, with its elegant endowment of shelves, of enigmatical volumes, of inexhaustible stairways for the traveller and latrines for the seated librarian, can only be the work of a god.'ü

PROFESSOR JONATHAN BATE CBE, FBA, FRSL
DEPARTMENT OF ENGLISH & COMPARATIVE LITERARY STUDIES
j.bate@warwick.ac.uk

COMMENT

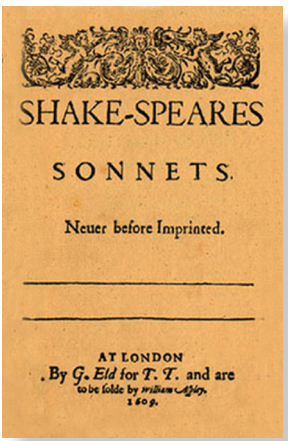
This article first appeared in a briefer version in *The Times*. It was written to celebrate the 400th anniversary of the first published edition of Shakespeare's sonnets; Jonathan Bate's Royal Shakespeare Company edition of the Sonnets was published in April 2009. The sonnets continue to pose questions: what were Shakespeare's motives in writing them; who were the 'lovely boy' and the 'dark lady'? However, as Jonathan has written in an earlier work: 'A story about where the sonnets came from is necessary for an understanding of their nature, but not sufficient for an appreciation of their complexity'.

Professor Jonathan Bate CBE, FBA, FRSL, is a well-known biographer, critic, broadcaster and Shakespeare scholar. His biography of the poet John Clare (2003) won the Hawthornden Prize for Literature and the James Tait Memorial Prize for Biography. He is on the Board of the Royal Shakespeare Company, for whom he jointly edited, with Eric Rasmussen, 'The RSC Shakespeare: Complete Works', published in 2007.

PROFESSOR JONATHAN BATE CBE, FBA, FRSL
DEPARTMENT OF ENGLISH & COMPARATIVE LITERARY STUDIES
j.bate@warwick.ac.uk

Shakespeare's Sonnets @400

BY JONATHAN BATE


SHAKE-SPEARES
SONNETS.
Neuer before Imprinted.
AT LONDON
By G. Eld for T. T. and are
to be solde by William Aspley.
1609.

On 20 MAY 1609, a publisher called Thomas Thorpe entered in the Stationers' Register his right to publish 'a booke called Shakespeares sonnettes.' A few weeks later, browsing in the bookstalls in the yard of St Paul's, you could have found the little volume and purchased it for sixpence.

Probably the greatest love poems in English literature (though John Donne runs them close), the sonnets introduced to the language such phrases as 'Shall I compare thee to a summer's day?', 'the darling buds of May,' 'remembrance of things past' and 'Farewell, thou art too dear for my possessing'. They express almost every phase and every permutation of love, from the first leap of the heart at the sight of your beloved's beauty to the last ache of sorrow and bitterness in the face of death or, worse, betrayal.

Reading the sequence through, there seems to be a story behind it—though, in sharp contrast to Shakespeare's plays, the twists of the plot and the nature of the characters are shadowy and mysterious. The poet begins by addressing a beautiful and high-ranking young man. The youth is in a position of power and the poet in one of supplication. Absence, travel,

scandal, melancholy, estrangement and reunion are variously implied. The young man appears to have an affair with the poet's mistress, thus abusing the bond of friendship. Then the poet is discomposed by a rival who wins the patronage of the fair youth with his 'well-refined pen.'

Again and again, the sequence returns to the great battle between love and time. The mood becomes autumnal ('Bare ruined choirs where late the sweet birds sang'). Time is relentless ('Like as the waves make towards the pebbled shore, / So do our minutes hasten to their end'), but the act of writing offers the hope of immortality ('So long as men can breathe or eyes can see, / So long lives this and this gives life to thee').

Then the poet turns his attention from the 'lovely boy' to the 'dark lady.' Dark-complexioned and sexually voracious, she inspires a complex mix of emotions: desire, fondness, self-abnegation, misogyny, a lingering sense of the sour taste that comes after sex ('The expense of spirit in a waste of shame / Is lust in action'). One moment the poet is bitter, the next dazzlingly playful, as he parodies conventional love poetry ('My mistress' eyes are nothing like the sun') and puns on the multiple senses of the word that is also his own name: 'Will.'

We think of love sonnets as the most personal of poems. The little book called *Shakespeare's Sonnets* is a source of endless biographical fascination because it seems to be the one work in which its author speaks in his own voice. There is, however, no intrinsic reason why a sonnet – a highly artificial literary form – should not be a dramatic performance just as a play is. It may be that for an Elizabethan poet to dash off a sequence of sonnets was a kind of exercise, a proof of artistic skill akin to the work of a composer writing a set of variations on a musical theme. If Shakespeare could imagine Hamlet and Romeo and Viola, he could also have invented the 'plot' and 'characters' of his sonnets.

We simply do not know whether the sonnets are dramatic performances written out of sheer imagination or poetic reimaginings of real figures and events. Unlike several contemporary sonneteers, Shakespeare does not name names. Because he is so guarded, the circumstances of composition have provoked centuries of speculation. The young man to whom the bulk of the poems are addressed may or may not be synonymous with the mysterious 'Mr W. H.' who is named in the collection's dedication 'to the only begetter of these ensuing sonnets'.

The traditional candidates for the role are the Earl of Pembroke and the Earl of Southampton, though neither of them was a 'Mr'. A provocative case has been made for the possibility that 'Mr W. H.' is actually a misprint for 'Mr W. S.' and that in the dedication Thomas Thorpe, the publisher, is merely acknowledging Shakespeare as the 'only begetter' of the sonnets ('begetting' was a common metaphor for authoring).

Unlike Shakespeare's narrative poem *Venus and Adonis*, the bestselling

PROFESSOR JONATHAN BATE CBE, FBA, FRSL
DEPARTMENT OF ENGLISH & COMPARATIVE LITERARY STUDIES
j.bate@warwick.ac.uk

literary work of the Elizabethan age, the Sonnets were not reprinted or frequently quoted from. The vogue for sonneteering had passed its prime by 1609. Some scholars have supposed—without any direct evidence—that they were actively suppressed because of their risky sexual orientation.

Dozens of male Elizabethan poets wrote sonnet sequences, but only Shakespeare and a certain Richard Barnfield addressed their poems explicitly to a man. Barnfield wrote in the explicitly homosexual tradition of ancient Greek pastoral poetry, whereas Shakespeare's sequence emphasizes the spiritual aspects of the poet's love for the fair youth. The only sonnets in the collection where 'Will' is actually in bed with a lover are addressed to the dark lady. Taken in their entirety, the sonnets associate heterosexual desire with consummation and disgust, homoerotic attraction with spirituality and an intensity that derives in large measure from the impossibility of consummation. Tempting as it may be to infer Shakespeare's sexuality from this duality, it might be better to read the opposition between dark lady and fair youth as a dramatic device: one is a 'character' representing desire in its sexual manifestation, the other in its idealizing and spiritual.

'The Lover', a miniature by Nicholas Hilliard (1547?–1615).

That is what I always tell my students – and myself as I sit down to reread the sonnets. Don't be drawn into the trap of supposing that they are autobiographical: that is an illusion of Shakespeare's art. But, as the hundreds of books and theories about the sonnets attest, it's very hard to stop yourself. When I worked on them for my book *The Genius of Shakespeare* back in the 1990s, I became convinced that I had identified the dark lady: she was the wife of John Florio, Italian tutor in the household of the Earl of Southampton. When I returned to them recently for my book *Soul of the Age*, I became convinced that I had identified the rival poet: he was John Davies of Hereford, the greatest calligrapher in England and a hanger-on in the circle of the Earl of Pembroke.

Each time the sonnets had worked their magic: they had made me project a story of my own into their narrative. They work like love itself by making you want to join your story to that of another. And that, of course, is why they are the greatest of all love poems and why they are still so fresh after four hundred years. When Shakespeare writes 'Let me not to the marriage of true minds / Admit impediments', the two minds that are joined are no longer his and his lover's. When I read the poem, they are mine and my lover's. When you read it, they are yours and your lover's. ü

PROFESSOR MAXINE BERG FBA, FRHS
DIRECTOR, GLOBAL HISTORY & CULTURE CENTRE
maxine.berg@warwick.ac.uk

COMMENT

'Global historical perspectives provide us with both more complex and simpler accounts of the roots of industrialisation. My work addresses the key connector that transformed the early modern world: the long-distance trade between Asia and Europe in material goods and culture. The twenty-first century has seen a new Asian ascendancy now providing the world with many of its manufactured consumer goods. My work looks back to the first global shift – one from a world provided with fine manufactured goods from Asia to a world of European industrial revolutions.'

Professor Maxine Berg FBA, FRHS, in the Department of History, is Director of the Global History and Culture Centre, and was formerly Director of the Warwick Eighteenth Century Centre. Her research interests focus on global trade and material culture in the early modern world and, with colleagues in the History Department and the wider Faculty of Arts, she has been instrumental in developing a new area of expertise for Warwick in the field of global history.

Opposite: A Gentleman and Two Ladies Taking Breakfast, by Abraham B van Worrell, 1819.

PROFESSOR MAXINE BERG FBA, FRHS
DIRECTOR, GLOBAL HISTORY & CULTURE CENTRE
maxine.berg@warwick.ac.uk

The Complex Road to Industrialisation

BY MAXINE BERG

Europeans who, in the late seventeenth and eighteenth centuries, first turned to Asia for exotic ornaments soon benefited from a globally organised trade in Asian export ware. The result by the nineteenth century was Europe's industrialisation and China's and India's displacement as the world's manufacturers. Turning our historical gaze outward from Europe invites more complex accounts of industrialisation than our simpler national narratives have allowed.

More complex accounts are also, however, simplified through comparison and the discovery of common features across European countries, across Asian regions and empires and across Europe and Asia. One of those common features was an Asian export ware sector. This was a Chinese, Indian and wider Asian achievement, but one also stimulated by, intervened in, and redirected by Europe's merchants and companies. Merchants, East India companies, dealers and manufacturers transformed objects which once entered Europe as oriental luxuries into an Asian export-ware sector of high-quality consumer products. Those products stimulated consumers and changed households and everyday life.

PROFESSOR MAXINE BERG FBA, FRHS
DIRECTOR, GLOBAL HISTORY & CULTURE CENTRE
maxine.berg@warwick.ac.uk

As manufactures those Asian-sourced products demanded complex skills, networks of information, communication arteries and nodes of knowledge, production and distribution. Yet, paradoxically, they stimulated large-scale productivity growth, and ultimately industrialisation not in Asia, but in Europe. Looking across the products and the regions of the world that produced and consumed them allows us to simplify a complex historical narrative, and to analyse an Asian export-ware sector as an industrial system, one that contributed in crucial ways to that later industrial system, European factories, mechanisation and industrial revolutions.

Asia also introduced to Europe lessons of complexity and of simplicity in product design and in the techniques and skills to produce those products. China and India produced fine cottons, silks, porcelain and many other fine manufactured products for world markets from an early period. Skills and designs were honed to captivate the tastes of consumers in Malacca and Isfahan, Istanbul and Cairo, Lisbon and Amsterdam. Manufacturers adapted shapes, patterns, weaves and yarn counts, colours and patterns to meet merchant demands to provide far parts of the world. Long-distance seaborne trade organised by East India Companies by the seventeenth century brought unimaginable volumes of these goods to Europe: 5 million pieces of textiles between 1670 and 1760 and over 70 million pieces of porcelain between 1600 and 1800.

The skills that made these products were complex – the undefinable aspects of tacit knowledge. The products offered a new design complexity: new, even magical,materials such as porcelain, hard, translucent and heat resistant; new colours that did not fade, seemingly endless variety of prints, patterns and weaves. Different production systems in China and India yielded distinctive responses in Europe. China's export-ware porcelain production centralised in Jingdezhen developed versatile production techniques for wide overseas markets. New kilns, densely packed, firing a range of wares over wide temperature differences, extensive division of labour and assembly-line processes, modular systems and interchangeability filled the tonnage of Europe's ships and placed the once precious object within the experience of up to thirty per cent of Northern Europe's population. China's simplified production systems produced a quality and design complexity, but within limits to meet standardised market demands for expected and similar designs.

There were two responses in Europe. Imitators in Europe learned the porcelain secret, but produced high quality art objects in princely and aristocratic workshops; not for them the tons of export ware. Earthenware producers, first of faience and delft, then most notably of North Staffordshire creamware, learned the lessons of quality, standardisation and reliability from their Chinese competitors. Asian export ware globalised a semi-luxury product; those lessons turned Staffordshire ware into the new global product of the eighteenth century.

PROFESSOR MAXINE BERG FBA, FRHS
DIRECTOR, GLOBAL HISTORY & CULTURE CENTRE
maxine.berg@warwick.ac.uk

Complexity brought to Europe the surprise and delight of Indian cotton textiles. The finest of muslins and the most intricately patterned and painted of fine cotton calicoes offered a complexity of versatile designs to Europe's newly emerging fashion markets. But this worked to the advantage of Europe and the disadvantage of India. Those textiles were intensively specialised by skills and product, manufactured in the first place for specific groups, courts and individuals. Indian textile production followed what David Washbrook has called an 'alternative economics' of artisan expertise focused on highly specialised markets and a division of labour elaborated through the caste system. Minute and complex divisions of labour were developed through subcastes; dynasties of craftspeople produced unique forms of quality. The complexities of these products and their speciality markets led into the rigidities of endlessly proliferating niche markets.

This Indian production system was high on quality at low relative prices, but low on the consistency, predictability and confidence needed for European fashion markets. European merchants tapped into the skills that could produce high quality and endless variety, and Indian artisans rose to these new global opportunities. Europe's East India Companies directed Indian print designs to meet European tastes. Artisans innovated, and created new designs and fabrics, but in doing so their production systems created more specialisation, more status distinctions and further refinements of skill. Along with this, while there was always a high demand for oriental prints in London, access to those was uncertain, unreliable; retailers fought a constant battle to get the right textiles at the right time. The effect of this global trade was to embed India deeper into specialisation based in skills, and to open her to vulnerabilities. The complexity of these skill specialisations reinforced 'luxury in a poor country'.

East India Companies brought Indian fabrics into Europe's markets not as cheap substitutes for linens and silks or even wool, but along with new fashion products in interior decoration and dress: palampores and curtains, banyans and waistcoats, neckcloths and handkerchiefs, head-dresses, pockets and petticoats. In the highly-charged fashion textile markets of eighteenth century Europe and a high-income Atlantic free-trade zone, manufacturers now pursued mechanical inventions and new production systems to deliver a product competitive with Indian imports. The characteristics they sought were not the complexities of refined skills, but variety and novelty that could also be achieved along with rapid turnover, warehouse selling, precision, exactness and order. Europeans looked to an alternative cotton product, one produced by machinery, to produce the varied high quality product mix they sought. As a result, Irish, Scots and even Indian hand-made goods now looked unreliable, even second best. Ü

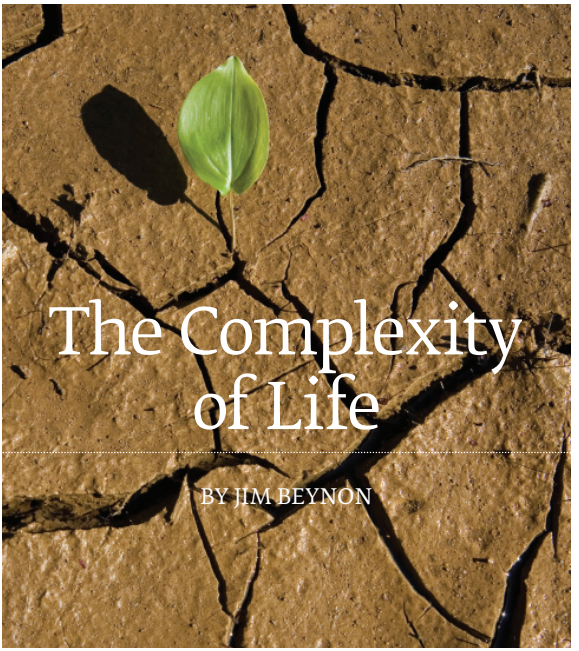
PROFESSOR JIM BEYNON
WARWICK HRI
jim.beynon@warwick.ac.uk

COMMENT

'The key to understanding the complexity of living things is to understand the interactions between all the components that lead to a successful functioning cell.'

Jim Beynon is Chair of Plant Systems Biology at Warwick HRI. He works on host-pathogen interactions in the field of plant science research, and has been building key genomic resources to exploit the new systems biology approach to science, involving extensive collaboration with consortia in Belgium and France.

PROFESSOR JIM BEYNON
WARWICK HRI
jim.beynon@warwick.ac.uk



The Complexity of Life

BY JIM BEYNON

Life is complex, probably the most complex subject for science to unravel. At the core of the system are the DNA molecules that encode the blueprints for life; in humans this contains the codes for 20,000 to 25,000 proteins. Some of these proteins interact to control the expression of the genes and only subsets of the genes are expressed in any one cell type. So to be a brain or kidney cell, different combinations of the blueprint need to be turned on or off. Interwoven with this process are more levels of control in that more than one regulatory protein can regulate expression of any gene and structural changes to the DNA itself; also a whole suite of small molecules similar to DNA exist that alter when and where any gene can be expressed. So controlling the expression of the blueprint is complex. However, in addition, proteins can interact with one another in a range of different ways depending on the environment in which the cell is existing and the consequence of many cellular processes produces or modifies chemicals (or metabolites), the profiles of which will be different in varying

PROFESSOR JIM BEYNON
WARWICK HRI
jim.beynon@warwick.ac.uk

cell types. The key to understanding the complexity of living things is to understand the interactions between all these components that lead to a successful functioning cell. However, the challenge does not stop there but extends to the world that we see daily, and to understanding how species interact with one another to create life-sustaining communities. At each stage, it is interactions between many different components that result in a viable living organism or the community of species within which it will exist.

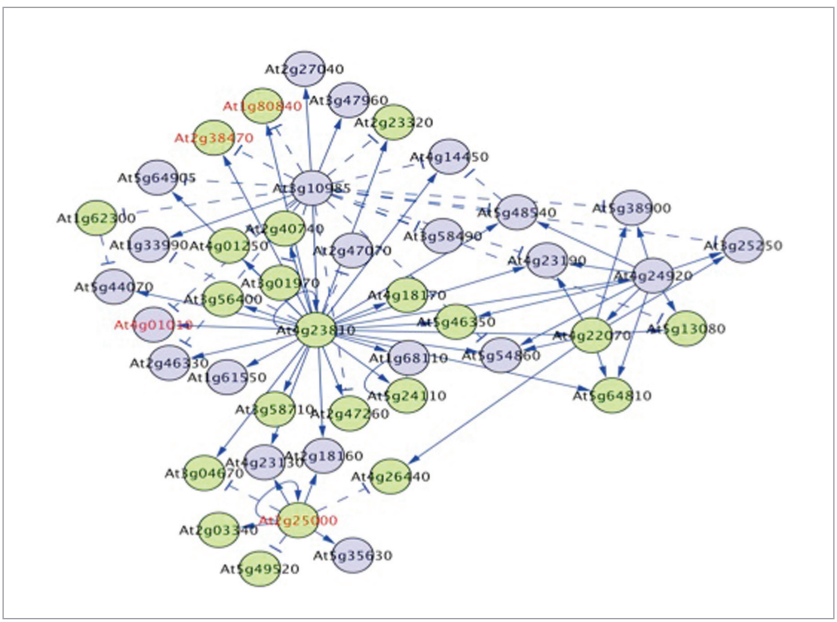
A major impact that the human species is having on the planet is causing global warming resulting in a changing environment. This will be a major challenge to crop scientists in the coming decades as it will place our food producing plants under a range of new stresses that will affect their productivity. These environmental changes will include higher temperatures, altered growing seasons and the arrival of new pests and disease. Plants' responses to environmental changes such as drought, disease and pests are complex. The model plant, *Arabidopsis*, contains some 30,000 genes, more than humans but less than many crops. When exposed to environmental stress, several thousand of these change whether they are on or off compared to growing in benign conditions. Within this complex response some of the genes produce proteins that control the expression of others and, hence, are key players in the response. Identifying these key controlling genes in the face of all this complexity is a major challenge. This requires collaboration between biologists, statisticians, engineers and mathematicians to bring new analysis techniques to enable biology to begin to unravel this complexity. This in itself is a major challenge to the theoretical sciences as many techniques are not capable of dealing with so many variable components. However, using this interaction between scientists from different backgrounds, we have created models of gene networks with the key genes at the centre of spider web like predicted gene/protein interactions. We have now shown that preventing the function of many of these genes, predicted to play a significant role in stress responses, results in a change in the way the plants respond to environmental stress. This suggests that bringing diverse approaches to building models to understand the complexity of these responses has successfully de-convoluted some of the complexity in the system.

Yet this is only the beginning, as we are only looking at one stress, but in the crop field the situation is much more complex as plants are exposed to many stresses at once. Therefore, we are extending these studies to understand how these gene networks respond to multiple stresses. However, changes in levels of gene expression is only one component of the complexity. Another key network involved in plant environmental responses is the interaction between the proteins encoded by the genes. When pathogens (disease-causing bacteria or fungi) attack plants, many introduce proteins

PROFESSOR JIM BEYNON
WARWICK HRI
jim.beynon@warwick.ac.uk

into plant cells to disrupt the protein networks of the host. We are working with leading groups in the USA to reveal the complexity of the protein interactions between the 25,000 plus proteins in the model plant and how the pathogen proteins disrupt this complex network. Identifying the targets of the pathogen proteins will lead to new ways of protecting plants from disease.

The complexity of living systems may seem contradictory to having a reliable and easily maintainable method to maintain life. Nevertheless, it is this complexity that gives living systems robustness. It prevents the failure of one component disrupting the functioning of the system as a whole. Modulating the response to a particular stress prevents overreaction, acting as a buffer to stop catastrophic outcomes unless that stress becomes overwhelming. Having many forms of particular proteins or altering their relative expression levels enables members of a species to be diverse, so maintaining the ability to survive even when the environment is changing. So complexity of interactions is fundamental to the successful evolution of life and it remains one of the greatest challenges for mankind to understand. ü



Gene regulatory network inferred from expression data from B. cinerea infected Arabidopsis leaves

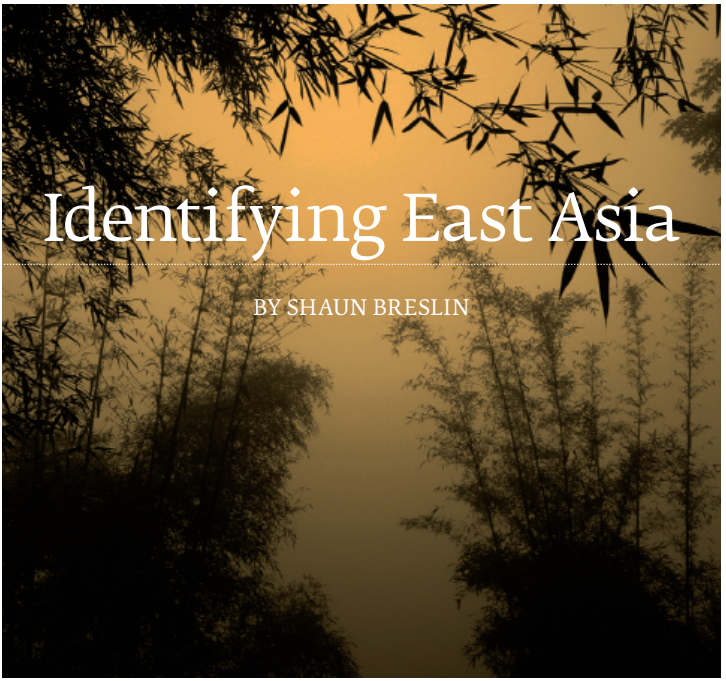
PROFESSOR SHAUN BRESLIN
DEPARTMENT OF POLITICS & INTERNATIONAL STUDIES
shaun.breslin@warwick.ac.uk

COMMENT

'Sometimes what appears to be the simplest of tasks can take you into a world of confusing complexity. Take, for example, a question that has been concerning me for some time now: where is East Asia? You have probably already formed your own answer in your mind – I wonder if it's the same as my initial response?'

Shaun Breslin is Professor of Politics and International Studies. He is also an Honorary Professorial Fellow at the Centre for European Studies, Renmin University, Beijing, and has been a Visiting Fellow at the City University of Hong Kong and the University of Stellenbosch, and a Visiting Professor at Beijing University. He has undertaken policy work for, and given presentations to many government bodies including the Foreign and Commonwealth Office and the Foreign Affairs Committee of the House of Commons. Professor Breslin is co-editor of 'The Pacific Review'.

PROFESSOR SHAUN BRESLIN
DEPARTMENT OF POLITICS & INTERNATIONAL STUDIES
shaun.breslin@warwick.ac.uk



Identifying East Asia

BY SHAUN BRESLIN

Since my days as an undergraduate I've always thought of East Asia as China, Japan and the Koreas – because these were the countries we studied on my degree! But there is also something about these countries that marked them out as being in some way separate or different from Southeast Asia. These were the countries that were most influenced by Confucian political thought (as opposed to Buddhist philosophies and traditions) and part of the core of the ancient Sinitic world order.

And in any case, we knew where Southeast Asia was and knew that it wasn't the same as East Asia. Well, we sort of knew where Southeast Asia was, though the understanding of what this region was changed over the years. The idea of a distinct Southeast Asian region actually owes much to exogenous actors – to French colonial rule and through military-defined theatres of operation in the war against Japan.

This understanding of a region called Southeast Asia was subsequently cemented by the creation of a formal regional institution – the Association of Southeast Asian Nations (ASEAN). OK, this region was not static – something

PROFESSOR SHAUN BRESLIN
DEPARTMENT OF POLITICS & INTERNATIONAL STUDIES
shaun.breslin@warwick.ac.uk

that those of us in 'Europe' know only too well – with new members joining in the shape of Brunei, Burma, Laos, Cambodia and Vietnam. So what we mean by Southeast Asia might not be static, but at least we know that East Asia and Southeast Asia are different.

But of course, it's not that easy. I write this as Visiting Professor in the Centre for Northeast Asian Regional Integration Research at Beijing University at the kind invitation of Professor Wang Zhengyi. Northeast Asia here refers to – well, China, Japan and the Koreas. To get to an understanding of East Asia under this definition we need to add on the ASEAN member states. So 'East' Asia is a combination of 'Northeast' and 'Southeast' Asia – which seems to make sense.

But of course, it's not that easy either. In political terms, there is much to commend (or do I mean cement?) this definition of East Asia. The addition of Japan, South Korea and China to the (then) members of ASEAN formed the heart of Malaysian leader Mohamad Mahathir's idea of an East Asian Economic Group to stand for Asian interests and values in opposition to the dominant norms of the West. Although the group was downgraded to a caucus within the bigger Asian Pacific Economic Co-operation (APEC), it was an important symbol of self-identification of a region: not so much based on a shared conception of what the region was, but more what it wasn't – East Asia as different from the Australasian and continental American members of APEC where liberal political and economic norms dominated.

After the East Asian financial crisis, the (now expanded) members of ASEAN again came together with their three northeast Asian partners in the first 'ASEAN+3' summit in December 1997. The idea of region seemed to be firmly in place: a region that knew what it was in terms of who was in and who was out; a region that felt the need to find its own solutions in the face of what were thought to be inappropriate and perhaps even recriminatory solutions to the crisis promoted by the western dominated international financial institutions; a region that began to institutionalise formal co-operation and co-ordination at the ASEAN+3 level. Moreover, this was a region where trade and investment flows were increasingly binding individual economies together into a complex web of economic interactions that reinforced the idea of a regional economic effort, and also perhaps increasingly required the region's elites to come together to find common solutions to common economic problems.

Yet when the region came together in the first East Asia Summit (EAS) in 2005, it did not map onto the ASEAN+3 vision of region but instead included India, Australia, and New Zealand. East Asia was now defined as Northeast Asia plus Southeast Asia plus (parts of) South Asia plus Australasia. And ironically, it seems that one of the main impulses behind the establishment of an ASEAN+3 vision of region also did much to promote the alternative wider understanding of region as well – the rise of China.

PROFESSOR SHAUN BRESLIN
DEPARTMENT OF POLITICS & INTERNATIONAL STUDIES
shaun.breslin@warwick.ac.uk

Chinese policy towards regional integration has gone from considering the region to be an automatic ally of the US opposed to Chinese interests in the 1980s, to proactive engagement and indeed the promotion of a regional free trade agenda by the beginning of the millennium. And, of course, China has emerged as the hub of a new region of production and trade, absorbing resources and finances to become the workshop of the world (and is increasingly becoming a major source of outward investment to the rest of the region as well). But just as China's inclusion in any regional effort seemed to become increasingly essential, so the fear of a China dominated region also began to take on increasing significance in Tokyo and other regional capitals.

Thus the inclusion of another massive emerging market in the form of India and the democracies of Australasia in the EAS might be seen as not so much an exercise in region building, but an exercise in preventing the emergence of a sino-centric regional order. And moving away from the ASEAN+3 idea of region immediately re-opens the question of who or what is East Asia. Mongolia and Pakistan are not members, but from 2008 became part of the 'Asia' that meets with Europe in the bi-annual Asia-Europe Meeting – an Asia in this case that does not include New Zealand and Australia.

So where does this leave us? Well, it partly leaves us in an alphabet soup of acronyms that all seem to contain the letters E and A – but not always in the same order and not always standing for the same thing! And this multitude of acronyms is a sign that understandings of regions are fluid with compass points far less important in identifying a region than the complex array of other political, economic and ideational factors. I think I know where East Asia is, and I think I know what the region thinks it is – but despite all this (or do I mean 'because' of all this?), I'm far from sure that it's where the East Asian region will be in the future. Ü

PROFESSOR MATTHEW COOKE FRCS (Ed), FFAEM
WARWICK MEDICAL SCHOOL
m.w.cooke@warwick.ac.uk

COMMENT

'Hospitals should be able to organise their beds just like a hotel. A simple system to ensure a bed is available for the next guest. A simple formula should allow calculation of the bed state for the rest of the day. Beds available at present – today's discharges + today's elective admissions + today's emergencies = beds at the end of the day. As long as that figure for the end of the day is positive, then we have no problems.

But it is not always that easy...'

Matthew Cooke FRCS (Ed), FFAEM is Professor of Emergency Care and Director of the Warwick Clinical Systems Improvement Group at Warwick Medical School. This group teaches and researches on systems thinking to improve the quality and safety of care. Matthew was adviser in emergency medicine to the Department of Health until 2007, and has also advised overseas governments on the organisation of emergency care. He is an Emergency Medicine Consultant at the Heart of England NHS Foundation Trust.

PROFESSOR MATTHEW COOKE FRCS (Ed), FFAEM
WARWICK MEDICAL SCHOOL
m.w.cooke@warwick.ac.uk

The Complex World of Hospital Bed Management

BY MATTHEW COOKE

Most hospitals do not know how many patients they are going to discharge the next day. The highly professional staff of a hospital may be over obsessed with accuracy and individuals. The Apollo Syndrome* abounds, where they demonstrate a fixation on showing how a firm figure cannot be achieved and that they know of individual cases where the prediction was wrong. Despite knowing that most people having a certain operation will stay in for 5 days, they will not label an individual patient because they know some go home earlier and some may develop complications and stay longer. Rather than developing a mathematical model, we end up with no suggested discharge date for anyone. It comes as a surprise to everyone on the day of discharge. This also means that preparations have not been made and so they cannot achieve the hotel's midday checkout.

Today's elective admissions (our hotel bookings) should be under our control. We book them and so we can use them to balance the equation. Most elective cases are surgical and surgeons like the ability to select their own lists.

PROFESSOR MATTHEW COOKE FRCS (Ed), FFAEM
WARWICK MEDICAL SCHOOL
m.w.cooke@warwick.ac.uk

PROFESSOR MATTHEW COOKE FRCS (Ed), FFAEM
WARWICK MEDICAL SCHOOL
m.w.cooke@warwick.ac.uk

One major operation may occupy one bed for 10 days whereas ten small operations may each occupy a bed for two days. By balancing the lists, the bed requirements can be manipulated.

But what actually decides the mix of the list? Clinical priorities will override all. A case needing urgent care will jump the queue, but it may also be that the consultant is away and so his junior does smaller cases or consultants have heard of the advantages of standardisation and want to do ten similar cases in one day. Each surgeon makes this decision as an individual. If all twenty surgeons choose to do a big case, we only need twenty beds tomorrow: if they all do small cases, we may need 200 and it is random choice. But no, it may be school holidays and the bosses are mostly away, so that is why hospitals are so crowded in the holiday week.

The system is perhaps partially rescued by its adaptive nature. If admissions are not possible then people may be sent home earlier; more may be managed as out-patients; less may be added to the waiting list, but, as soon as beds become available, a pool of unmet need floods through the doors. But there is also maladaptive behaviour – a doctor may keep a patient in hospital to block the bed until he next needs one; patients may be sent home before they are ready to make an extra bed. A simple formula is in reality a complexly interacting system of negative and positive feedback.

So the irony of all this is that the emergency is actually more predictable than the electives. The random event of the emergency seems to provide the stability in the NHS 'hotel' system! ü

**A management term describing a phenomenon where teams of highly capable individuals collectively perform badly*

DR JUSTIN GREAVES, DR DAVID CARSLAKE,
DR HABTU WELDEGEBRIEL & PROFESSOR GRAHAM MEDLEY
GoLD PROJECT
www.warwick.ac.uk/go/gold

COMMENT

'One of the greatest challenges of interdisciplinarity is to maintain a parsimonious simplicity in the face of the complexity brought about when disciplines combine.'

The authors of this article, who represent three different academic departments in the University, are collaborating in a research project on the Governance of Livestock Disease (GoLD), funded by the UK Research Councils' Rural Economy and Land Use Programme.This project considers a range of issues around animal disease: how policy is decided; who should decide whether a disease should be controlled by elimination and how they should make that decision; for a given level of regulation, to what extent disease is controlled, and who should decide the target level to which any disease should be controlled.

DR JUSTIN GREAVES, DR DAVID CARSLAKE,
DR HABTU WELDEGEBRIEL & PROFESSOR GRAHAM MEDLEY
GoLD PROJECT
www.warwick.ac.uk/go/gold

Governance of Livestock Disease: Interdisciplinarity as Complexity

BY JUSTIN GREAVES, DAVID CARSLAKE,
HABTU WELDEGEBRIEL & GRAHAM MEDLEY

Infectious disease of livestock remains an important problem, seriously damaging rural economies, producing social disruption and impairing public trust and confidence in government. It can result in animal suffering, and potentially affect the health of humans and wildlife.

Livestock disease has generally been seen as a scientific, public health or epidemiological problem, and it has traditionally remained the responsibility of scientific and veterinary professionals. However, retrospective analysis of the 2001 foot and mouth disease epidemic has shown that there are clear, strong economic, political and legal dimensions to livestock disease. The interaction of all these dimensions creates a complexity, which is particularly apparent when policy must be formulated to control disease.

Policy choices are shaped both by specialist advisors within government and by external stakeholders such as farmers, drug companies, vets and international organisations which set standards and rules. Political analysis, therefore, should focus on the response of stakeholders to the disease control interventions identified by epidemiological modelling and to the incentives

emerging from economic analysis. There is a great deal of complexity in this area in terms of the range of different diseases and the menu of policy options. For example, livestock disease in the UK is divided between the 'endemic' (those that are always present) and the 'exotic' (those which are usually absent but may appear as occasional epidemics). Exotic disease has largely driven disease management policy (at least at government level), partly because endemic disease is embedded within the system, and is more difficult to understand as the epidemiological, economic and political impacts are less easy to discern when nothing changes. Such complexity results in a need to bring together a variety of theoretical and analytical perspectives from different disciplines, which highlights the link between complexity and the need for interdisciplinarity.

In recognition of this need for interdisciplinary research into the understanding and control of livestock diseases, academics from the departments of Biological Sciences, Politics, Law and Economics at the University of Warwick have been working together under the umbrella of the Governance of Livestock Disease (GoLD) project. The project is funded by the Research Councils' Rural Economy and Land Use programme (RELU) which supports interdisciplinary collaboration between natural and social scientists.

Traditionally, problems have been framed from a mono-disciplinary standpoint so that, for example, an epidemiologist will see an epidemiological problem and provide an epidemiological solution. But many are now making an overt connection between interdisciplinarity and complexity. The argument is that real world problems are too multi-faceted for one discipline (or scholar) to address and thus require solutions which involve multiple disciplines.

Work within disciplines is now complemented by interdisciplinary co-operation which offers a more effective mechanism for tackling the challenges faced by society. This shift in perception regarding the mode of knowledge generation is reflected in the break away from the use of linear models to represent and solve complex problems to the adoption of network or web models of learning, with multiple nodes of connection. It is also reflected in a break with the notion that the best way to understand social reality is to break it down into separate chunks which can then be neutrally observed.

It is argued that interdisciplinarity is most useful if the object studied is complex but its various components fall within the research boundaries of different disciplines. In the context of GoLD, we can consider the challenges faced in getting insight into the economic aspect of livestock disease. On its own, economics cannot provide such an insight without biological information regarding prevalence and without epidemiological information regarding disease spread. Even when such a set of information is made available, the economic model which is thus built will not be complete

without information regarding the political interaction among stakeholders and decision-makers in designing and implementing legislation. Since this information base has spatio-temporal dimensions, the economic model that is built needs to be non-linear. Therefore, given that, on its own, economics is not adequate to analyse the economic aspects of livestock disease and that use of a linear model falls short of the challenging task of dealing with a complex problem, it becomes mandatory that the economist work in collaboration with other disciplines within the framework of non-linear models. The complexity arises in this case both within the disciplines (for example, the economics of livestock disease is not simple), but also in the interaction between the processes acting within the different disciplinary spheres.

It is very important to get the balance right between 'complex problems' and 'complex solutions'. In any analytical strategy, there is a trade-off between parsimony and complexity. In cases where the links between the various facets of the object of study are insufficiently robust for interdisciplinary solutions, a given discipline can (and should) work primarily within its own boundaries. Adding more variables to an explanation will always improve the match with the reality that we observe, but at the cost of a cumbersome solution that is hard to interpret and implement. We need to get value for our variables, including only those with the greatest explanatory power. Simple models may best explain complex problems. One of the greatest challenges of interdisciplinarity is to maintain a parsimonious simplicity in the face of the complexity brought about when disciplines combine. ü

PROFESSOR JACQUELINE HODGSON
SCHOOL OF LAW
jackie.hodgson@warwick.ac.uk

COMMENT

'The growing use of intelligence in counter-terrorist investigations poses real problems for the legal system. It is often left to the courts to adjudicate on the protection of sensitive information whilst also ensuring that the accused knows and can challenge the evidence against her. In short, how much evidence can remain secret in a fair trial?.'

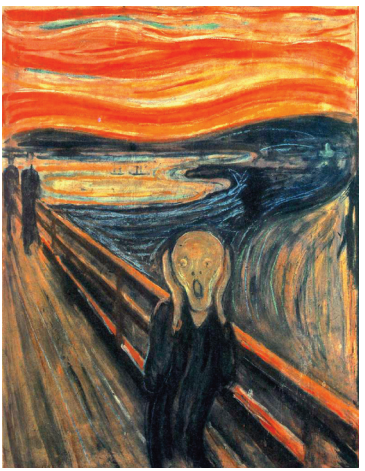
Professor Jacqueline Hodgson works in the area of UK, French, comparative and European criminal justice, and is currently making an empirical study of the role of the Criminal Case Review Commission – the body that investigates possible miscarriages of justice in England, Wales and Northern Ireland.

Opposite: The Scream by Edvard Munch, 1893.

PROFESSOR JACQUELINE HODGSON
SCHOOL OF LAW
jackie.hodgson@warwick.ac.uk

The Complexity of Terrorism

BY JACQUELINE HODGSON



The concern with security is everywhere it seems. Whether it is terrorism or climate change, knife crime or the global financial recession, immigration or paedophiles, there is a discourse of managing risk and uncertainty in order to provide greater security. Within criminal justice, government policy centres on the premise that the price of more security is less freedom. In order to protect us from terrorists, we need to have wider police powers to stop and search individuals without the need for reasonable suspicion; fewer due process rights during police detention and interrogation; broader legal offences that criminalise activity before any harm is caused; and, until the House of Lords ruled that it was contrary to the European Convention on Human Rights (ECHR), the power of indefinite detention without charge. The issue is, of course, much more complex than this simple dichotomising suggests; liberty and security are not necessarily antithetical. In the UK, the Joint Committee on Human Rights[1] rejects this approach:

PROFESSOR JACQUELINE HODGSON
SCHOOL OF LAW
jackie.hodgson@warwick.ac.uk

> *We reiterate the importance of not seeing liberty and security as being in an inverse relationship with each other... We agree with the view expressed by the European Commission for Democracy through Law (the Venice Commission) that 'State security and fundamental rights are not competitive values: they are each other's precondition'.*

The House of Lords expressed a similar view in *A v Secretary of State for the Home Department* [2004], the case that led to the discontinuance of indefinite detention in the high security Belmarsh prison and the establishment of the replacement regime of control orders. Lord Hoffman cautioned (at para 97) that

> *[t]he real threat to the life of the nation, in the sense of a people living in accordance with its traditional laws and political values, comes not from terrorism but from laws such as these. That is the true measure of what terrorism may achieve.*

In France, these two perspectives reflect in part the political debate around *sûreté* (inspired by the right of *habeas corpus*, the freedom from arbitrary arrest or detention, established in the 1789 *Déclaration des Droits de l'Homme et du Citoyen*) and the more contemporary theme championed by the Right – *sécurité* – now the first article of the legislation passed on 18 March 2003 declaring the right of *sécurité* as a fundamental right and one of the conditions for the exercise of individual and collective freedoms.

Most recently, we have witnessed the argument that security requires that some (often crucial) evidence against a person must remain secret. The right to know the case against you and to be able to challenge it in open court are basic requirements of a fair trial under Article 6 ECHR. However, evidence remains secret in an increasing number of cases, including deportation hearings, pre-charge detention hearings in terrorism cases, and even planning tribunals. Control orders are issued against those who cannot be deported for fear of facing torture or similar treatment, or cannot be prosecuted because the case against them is based on intelligence rather than legal evidence that will withstand scrutiny and challenge in a court of law. For this reason, control order hearings often include 'closed' evidence that is not revealed to the controlee on the grounds of national security. The only way in which the defence can challenge such evidence is through the special advocate procedure. The special advocate is a security-cleared lawyer appointed to 'represent' the controlee. The advocate may see the closed evidence, the controlee may not; the advocate may not discuss any aspect of the closed evidence with her 'client', but may take 'instructions' before then challenging the evidence on behalf of the defence. This Kafkaesque procedure is of limited benefit to the controlee who is not permitted to see or know anything of the evidence and so will not know on what basis she should be instructing the advocate. In the unanimous judgment of nine

PROFESSOR JACQUELINE HODGSON
SCHOOL OF LAW
jackie.hodgson@warwick.ac.uk

Lords of Appeal, the House of Lords in *Secretary of State for the Home Department v AF and others* [2009] held that unless the controlee is given sufficient information about the allegations against her to enable her to give effective instructions to the special advocate, there will be a breach of Article 6 ECHR. The House was clear that security cannot trump liberty in every case. Lord Hope of Craighead said (at para 79):

> *The consequences of a successful terrorist attack are likely to be so appalling that there is an understandable wish to support the system that keeps those who are considered to be most dangerous out of circulation for as long as possible. But the slow creep of complacency must be resisted. If the rule of law is to mean anything, it is in cases such as these that the court must stand by principle. It must insist that the person affected be told what is alleged against him.*

The sensitive nature of evidence gathered in terrorist cases makes its investigation and prosecution different from other offences. In particular, the ways in which intelligence is used can be problematic. At a policy level, intelligence informs the perceived threat to security and so the government and legal response. This may be at an international level (as with the Iraq war) or domestically (as with detention without charge and now control orders, and extended 28 day pre-charge detention for police interrogation). In criminal prosecutions, the same issues of disclosure arise as with control orders. Evidence may relate to covert surveillance or other operations about which any revelation might compromise the security of those working in the field. Telephone intercepts are used widely in other jurisdictions and are admitted as evidence, but in England and Wales the prosecution is reluctant to reveal their use in individual cases. If the fair trial principles of disclosure are to be upheld, this leaves the prosecution between a rock and a hard place: it must either disclose material (in which case it fears the risk to field agents) or discontinue the case and so abandon the prosecution of a terrorist suspect. France has a criminal procedure more accustomed to accepting evidence that has been filtered by the judge pre-trial, enabling sensitive evidence to be admitted without the defence having a full opportunity to challenge its reliability. But in the more adversarial criminal process of England and Wales, where non-disclosure has resulted in appalling miscarriages of justice, this would not be acceptable. The balance between an effective investigation on the one hand, and the due process rights of the accused to ensure a fair trial on the other, is a difficult one to strike in terrorist cases. Ü

REFERENCE

1 *Joint Committee on Human Rights, 'Counter-Terrorism Policy and Human Rights, Prosecution and Pre-Charge Detention' (Twenty-fourth Report of Session 2005-06), London, The Stationery Office, 2006, page 13*

DR ANDREW HOSKINS
DEPARTMENT OF SOCIOLOGY
andrew.hoskins@warwick.ac.uk

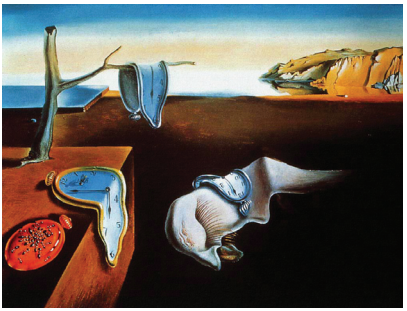
COMMENT

'In the emergent field of memory studies, 'collective memory' remains a hugely influential concept. A legacy of the era of mass media, this concept is now challenged by the theoretical demands of the new, post-broadcast age, with its contingencies and complexities of connectivity.'

Andrew Hoskins is Associate Professor of Sociology and Director of the Warwick Centre for Memory Studies (go.warwick.ac.uk/memorystudies). He is founding editor-in-chief of the Sage Journal of 'Memory Studies' (http://mss.sagepub.com) and his latest book, 'Save As... Digital Memories' (Palgrave Macmillan, 2009), is co-edited with Joanne Garde-Hansen and Anna Reading.

Opposite: 'La persistencia de la memoria', by Salvador Dali, 1931.

DR ANDREW HOSKINS
DEPARTMENT OF SOCIOLOGY
andrew.hoskins@warwick.ac.uk



The Diffusion of Media/Memory: the new complexity

BY ANDREW HOSKINS

Collective memory dominates as a concept, metaphor and form, in the study of memory that goes beyond (but also includes) that of the individual, as well as imposing a significant presence in the lexicon of debates about societal orientations to the past more broadly conceived. Despite the extensive conceptual and theoretical critiques, the comprehensive splintering of 'memory' into an array of metaphors, forms and taxonomies, and even, and especially, the discomfort claimed by some as they continue nonetheless to employ the term as pivotal to their analysis, collective memory weighs heavy on and in the emergent field of memory studies.

At the same time, there is an emergent tension between a perspective overwhelmingly informed by the theories, models and methods of an era of unambiguously 'mass' media (including the idea of 'media events') and a diverse if somewhat fragmented scholarship that adopts a more radical position. Notably, the latter envisages a paradigmatic shift to a new media ecology (NME) that necessitates a critical re-evaluation of the legacy of mass communication/media studies, and proposes a more dynamic and diffused model of 'the mediation of everything'.[1]

DR ANDREW HOSKINS
DEPARTMENT OF SOCIOLOGY
andrew.hoskins@warwick.ac.uk

It occurs to me that these two conceptual overhangs of 'collective memory' and 'mass media' are connected. Notably, the paradigms if they can be identified as such are both fundamentally undermined by radical connectivity. For example, in relation to the media, William Merrin (2008) provides an excellent and detailed characterisation of a paradigm shift from mass media to a new post-broadcast age. Here is just a short extract:

'In place of a top-down, one-to-many vertical cascade from centralised industry sources we discover today bottom-up, many-to-many, horizontal, peer-to-peer communication. 'Pull' media challenge 'push' media; open structures challenge hierarchical structures; micro-production challenges macro-production; open-access amateur production challenges closed access, elite-professions; economic and technological barriers to media production are transformed by cheap, democratised, easy-to-use technologies.'[2]

At the same time, in relation to memory, the continual emergence of sets of 'new' pasts, a 'new memory' challenges unified or unifying 'collective' orientations to the past. This includes the media of memory. So, for instance, the idea of the static and material archive as a permanent place of storage, is being undermined by the much more fluid temporalities and dynamics of 'permanent data transfer'[3] or at least 'networked' for reactivation at any time. Indeed, a 'diffused memory' is a living memory that is articulated through the everyday digital connectivity of the self (with others and with the past) that can be continually produced, accessed and updated, but which is also subject to different although nonetheless highly significant modes of 'forgetting'. To provide one example, recent research shows that a good deal of associations on Facebook, are not active and interactional, but passive in terms of the archiving and storing of relational encounters with the potential to be reactivated.[4] In this way social networking sites facilitate a continuous, accumulating, dormant memory, with ongoing potential to transform past relations through the re-activation of latent and semi-latent connections.

Collective memory and mass media as foundational forms for their respective disciplines are both undermined by the new contingencies and complexities of connectivity. Yet what I am identifying as the 'connective turn' is not just the new temporal and spatial flux shaping an emergent NME, but it is also the clash of philosophies over the very nature, pace, extent, and value of the ushering in of the digital. Of course, there is some deep convergence ongoing between that presented here as dichotomous broadcast and post-broadcast cultures and medias. Ultimately, however, the medias that produce, reproduce, and remediate increasingly digital content, contribute to a more fluid, diffused and unpredictable media/memory ecology.

Moreover, the kinds of debates around 'collective memory' and 'mass media' are prohibitively generational, in the academy as well as much more widely. Rather, it is the profound shift in the underlying structure of the common experiences – what Ingrid Volkmer terms the 'entelechy'[5] – of those

'born digital'[6] that requires our attention. Notably, those who are socialised in the NME, in which media production and consumption have become de-differentiated, circumvent or at least re-configure that which Margalit argues is central to the forming of 'shared memory', namely 'mnemonic labour'[7] thus, a digital network memory.

Some sociologists distinguish between a 'collective' and 'collected' memory, but nonetheless often fail to state what the threshold for such a constituency might be. Most conceptualisations of this term, 'describe exclusively institutional manifestations of collective memory'.[8] In this way it is the quantitative as well as the qualitative vagueness of collective memory that has helped to ease its establishment as an ill-defined yet defining concept. One way forward is to extract from the work of Karin Knorr Cetina to see the phenomena here as 'based on microstructural principles [which] do not exhibit institutional complexity but rather the asymmetries, unpredictabilities and playfulness of complex (and dispersed) interaction patterns'.[9] It is more useful, then, to develop this idea to speak of 'diffused' media, memory, war etc. Indeed, diffusion is the new complexity. ü

REFERENCES

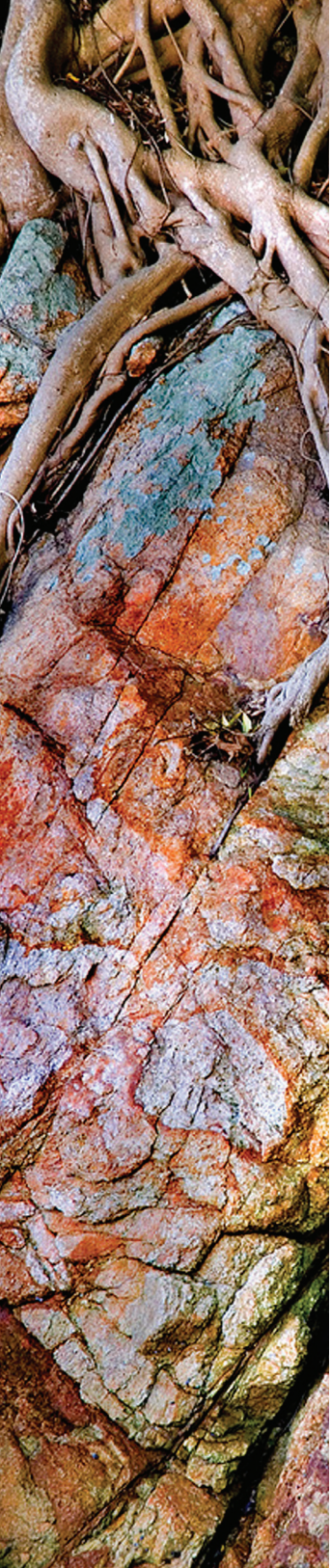
1 *Livingstone, Sonia (2009), 'On the Mediation of Everything', Journal of Communication, 59(1): 1-18.*
2 *Merrin, William (2008), 'Media Studies 2.0', at: http://mediastudies2point0.blogspot.com/*
3 *Ernst, Wolfgang (2004), 'The Archive As Metaphor', Open, 7: 46-43.*
4 *Richardson, Kathleen and Hessey, Sue (2009), 'Archiving the self? Facebook as biography of social and relational memory', Journal of Information, Communication and Ethics in Society, 7(1): 25-38.*
5 *Volkmer, Ingrid (Ed.) (2006), News in Public Memory: An International Study of Media Memories across Generations, New York: Peter Lang.*
6 *Palfrey, John and Gasser, Urs (2008), Born Digital: Understanding the First Generation of Digital Natives, New York: Basic Books.*
7 *Margalit, Avishai (2002), The Ethics of Memory, Cambridge, MA: Harvard University Press.*
8 *Beim, Aaron (2007), 'The Cognitive Aspects of Collective Memory', Symbolic Interaction, 30(1): 7-26.*
9 *Knorr Cetina, Karin (2005), 'Complex global microstructures: The new terrorist societies, Theory, Culture & Society, 22(5): 213-234.*

PROFESSOR DAVID MORLEY
DEPARTMENT OF ENGLISH & COMPARATIVE LITERARY STUDIES
www.davidmorley.org.uk

COMMENT

'As I have written elsewhere, complexity is what writers pass through to gain simplicity and clarity, and this poem represents that journey for me. It opens on an image of an araucaria in a poem of the same title by the Italian poet Ungaretti, but then unfolds its own complex, interweaving storyline. The poem is stripped to clear images and winds through one sentence of one hundred and ninety-five words. *You Were Broken* is a poem about the complexity of connectivity; biological connectivity but also the intricacy and vulnerability of emotional connections. In some ways it's a terribly lonely poem, but also a poem about companionship even if the tree's companions are stones. To finish: any poem should be the visible part of an iceberg. As Hemingway put it, the knowledge a writer brings to the creation of a literary work is the unrevealed submerged section of that same iceberg. The passage from complexity to simplicity is about making sure most of that hidden iceberg remains invisible.'

David Morley is Director of the Warwick Writing Programme and Professor of Creative Writing. He is a poet, critic, ecologist, editor and scientist. He has published 18 books, including 9 collections of poetry and his work has been translated into several languages including Arabic. He has received 13 literary awards and 2 awards for his teaching. David was also the inaugural Director of the Warwick Prize for Writing, which made its first award in February 2009.



You were broken

BY DAVID MORLEY

The amazed, massing shade
for the glacial valley, made
from a single araucaria
that smashed its way
by micrometers of birth-push
under five centuries of dusks
of carbon dioxide and rainfall,
while the volcanic rocks made landfall
against its unrolled, harbouring roots;

and the roots took the rocks in their arms
and placed them, magically,
like stone children, about itself
as it unfolded its fabulous tale:
of the wood heart mourned to flint
by slow labour and loneliness,
by what it could not reach, yet see
at distance, and of the sound of that sea,
and of the cruel brightness

of butterflies and grasses,
foreknowledge of their brevity,
of a heard stream, overhearing
prints of otters on its plane stones,
gold wagtails sprying over
the gravel and shallows of courtship;
of orange blames of gall-wasps, honey fungus,
the watch-turning of tree-creepers;
of blights of summer lightning,

of fire damage and that dark
year's mark worn secretly,
a ring, forged inside a ring;
then the winter's coronation closing
in a swaying crown of redwings,
cones, drab diagonals of pine-fall,
the lead winds hardening, and while
the stone children wept with rain
the great tree sheltered them.

PROFESSOR ANDREW OSWALD
DEPARTMENT OF ECONOMICS
www.andrewoswald.com

COMMENT

'Empirical evidence is more important than theory. But when I was young I did not appreciate how easy it is to find exciting, but illusory, patterns in data. In this piece, I offer an illustration of this all-too-common attempt to produce order out of complexity: it is about how to write an article called *Gravity Works Differently on Wednesday Afternoons*.

Andrew Oswald is Professor of Economics. His current research lies at the borders between economics, epidemiology, and psychology. He previously held permanent and visiting posts at Oxford, the London School of Economics, Princeton, Dartmouth, Harvard, and Cornell, and has received various awards for contributions to research in economics and social science.

PROFESSOR ANDREW OSWALD
DEPARTMENT OF ECONOMICS
www.andrewoswald.com

Heads and Reds: the human tendency to see patterns in random data

BY ANDREW OSWALD

With a collaborator, I am doing experiments. We have a theory that we call Time of the Day Effects. We believe that the time of day has important consequences. I am Andrew and I run my lab. She is called Amanda and runs hers.

I am working on coin-tossing – heads and tails. She is working on the spin of a roulette wheel, with only two colours – red and black. I throw a coin each morning 6 times; then the same in the afternoon: 12 throws a day. I do this for a week, so sample size is 84. In the other experiment, Amanda is spinning her roulette wheel. She also does it 6 times in the morning, and 6 in the afternoon – for 7 days.

Our total observations are therefore 168. We agree to collaborate on any finding in either experiment, whatever turns up, and to send a jointly authored paper to the prestigious journal, *The Journal of Scientific Discoveries*.

How likely are Andrew and Amanda to be able to write a paper with a time-of-the-day effect that is statistically significant at the 2% level ($p < 0.02$)?

The probability of throwing a dice 6 times in a row and getting a head each time is one half to the power 6. Write this as $(0.5)^6 = 1/64$. Hence the probability of this event is less than 2%. So what is the chance that, if I search across all my data, there will be at least one morning or afternoon with a run of a head or a tail? It is 1 – probability there will be neither a Heads Run nor a Tails Run.

Well, there are two types of run, one for heads and one for tails. So the probability of no Heads-or-Tails Run for my experiment during the week is $(31/32)^{14} = 0.64$. Therefore 36% of the time we will be able to write a paper

finding some version of 'Heads come up on Wednesday afternoons'. But Amanda is also working in her lab, and also generating data. The probability that EITHER Amanda or I find a result is 1 – probability there will neither a Heads-or-Tails Run nor a Red-or-Black Run.

The probability that there will be neither is (31/32)^28 = 0.41.

Thus 59% of the time we will be able to write a paper proving, in a way that greatly exceeds the ninety-five confidence level, some version of 'Heads come up on Wednesday afternoons' or 'Reds occur on Saturday mornings'…

Yet our paper will be wrong. The pattern is an illusion caused by too much searching.

Say we extend our theory to Day of the Year Effects. Say that referees tell us we need to enforce a 0.001 statistical-significance level. We now throw the coin ten times every day for a whole year, and also spin the wheel ten times. The chance of a head coming down ten times in a row is 1/1024. Because there are 365 days in a year, the chance that neither Amanda nor I get any run of 10 in a single day is thus (511/512)^730 = 0.24.

Hence, 76% of the time we will be able to write a paper proving, at the 0.001 level of statistical significance, some version of Coins Come Down Heads on March 27th… Yet our new paper will be wrong. Again, we have subconsciously searched too much.

When they start to look at data, human beings speedily discard theories and patterns that do not work. Without even being aware of it, they dream up new theories. They latch on to exciting results they had not forecast or expected.

If quizzed by sceptics in seminars, researchers tend to reply: "But my result is statistically significant at the 1% level." This is a pervasive problem; we are all prone to the error, and it is a mistake to be haughty about it. But independent replication is the only convincing check on a finding.

We all – I include myself – need humility when we do empirical research. This is especially true if we use small data sets of less than 1000 observations. So these days I try to ask myself: (i) can I check my exciting discovery by making sure that it is there within subsamples of my own data, by splitting the sample into men and women, or young and old, or before-1980 and after-1980? (ii) did I come up with my theory ex post, after already seeing the data? (iii) have I, without realising it, searched across lots of possible empirical patterns before stumbling on my exciting finding? Unfortunately, if we subconsciously pre-search for patterns then we cannot apply conventional statistical significance levels when we hit upon an exciting discovery in the data.

Humans' minds work so flexibly that they can see convincing patterns where there are none. To try to guard against this, I find (i), (ii), and (iii) helpful, and would cautiously recommend them. But being human makes us all prone to this phenomenon. ü


(0.5)^6 = 1/64
(p< 0.02)
(31/32)^14 = 0.64
(31/32)^28 = 0.41
(511/512)^730 = 0.24

PROFESSOR SHIRIN RAI
DEPARTMENT OF POLITICS & INTERNATIONAL STUDIES
www2.warwick.ac.uk/fac/soc/pais/research/gcrp/

COMMENT

'Why does power need glory? Why do representative institutions feel the need to cling on to historical traditions that seem at odds with the spirit of our times? Why do we feel the need to invent traditions and, paradoxically, to reform or reject these? Do ceremony and ritual play a part in cohering societies or underlining social differences? Is coherence another form of social disciplining and is disruption of ceremony and ritual a form of democratic refusal to conform? These are some of the questions that are being addressed by the Leverhulme Trust Programme on Gendered Ceremony and Ritual in Parliament: India, South Africa and Westminster.'

Professor Shirin Rai, Department of Politics and International Studies, is Director of the Leverhulme Trust programme on Gendered Ceremony and Ritual in Parliament. She has written extensively on issues of gender, governance and development and has been a consultant for The United Nations' Division for the Advancement of Women and for The United Nations' Development Programme.

Opposite: a Member of Parliament arriving for the opening of Parliament, South Africa

PROFESSOR SHIRIN RAI
DEPARTMENT OF POLITICS & INTERNATIONAL STUDIES
www2.warwick.ac.uk/fac/soc/pais/research/gcrp/

Gendered Ceremony and Ritual in Parliament

BY SHIRIN RAI

Despite continuing and, some would say, growing attacks on parliamentary institutions as weak, corrupt and out of touch, they continue to be important to the politics of states. Parliaments make laws and develop public norms and also legitimise political systems. For citizens in democratic systems, state openings, debates in parliaments, no-confidence motions or resignation speeches all make for grand theatre. Parliaments are symbolic of the national state and its political system. As representative bodies, they are markers of the developing modes of political activity in a country. Parliamentary institutions seek to legitimise their representative characteristic through invoking historical and nationalist aspirations of the modern nation-state in tandem. While this provides a powerful framework of legitimacy, it also creates tensions in the functioning of parliament leading to a fractured identity of the institution. These tensions are often visible in ways in which ceremony seems to synthesise the historical and everyday rituals of contemporary politics, while at the same time to reveal the gaps between this synthesis and the ever changing political landscape. Often

PROFESSOR SHIRIN RAI
DEPARTMENT OF POLITICS & INTERNATIONAL STUDIES
www2.warwick.ac.uk/fac/soc/pais/research/gcrp/

Parliamentary copyright image reproduced with the permission of Parliament.

parliaments are housed in grand buildings that symbolise the power of these institutions as well as that of the nation. These spectacles, ceremonies and rituals become markers of recognition of us as 'national' subjects as well as of the distance between ordinary citizens and political elites or within sections of political elites and institutional nodes of power.

Parliaments are often presented as undifferentiated institutions although they are historically marked with deep divisions of class, race, gender, (dis) ability and sexuality. In most cases, parliaments remain privileged spaces dominated by men from the upper classes, castes or dominant religions and races. For example, men constitute on average 83% of all members of parliaments world wide (in our current research, 66% in South Africa, 92% in India and 80% in the UK). This privilege finds shape, colour and voice in parliamentary ceremony and ritual as they make visible links with the past, renew a sense of identity of 'the nation' as well as the nation-state and construct/reproduce historical privilege.

Despite significant contribution towards analysing political institutions and their workings, little attempt has been made by political scientists to map out, understand and analyse the significance of the ceremony and rituals through which political institutions take shape and through which they shape political practice. The contemporary study of parliament is dominated by political scientists mainly concerned with policy making and effectiveness in holding the executive to account and few have explored the links between structures of formal and informal power, symbolic communication, and rituals and ceremonies. Only a handful of anthropologists have undertaken

ethnographic research into Parliaments and most comparative studies focus on Europe and the US. The Leverhulme Trust Programme seeks to address this gap in the study of political institutions.

It suggests that in order to understand representative institutions we need to understand not only their institutional form, but also the way a particular form takes shape – through modes of behaviour, negotiating the political and physical space and creating an institution specific culture which socialises members in their participation. Through the performance of ceremony and ritual, such institutions create and maintain powerful symbols of democracy and of power. The Programme inquires into how the socialisation of marginalised groups through the performativity of ceremony and ritual within parliaments secures the elite status of these groups on the one hand, and perpetuates their peripheral position as political actors on the other. It explores how traditional analyses of institutions can be complicated by focusing on not just preferences of those who are members but also how these preferences 'play out' within institutions and what this tells us about the evolving nature of institutions. By opening up the field of parliamentary studies, and politics in general, to the study of ceremony and ritual, we can examine how ceremony and ritual in parliament are deployed both to awe and to put beyond contestation the everyday workings of institutions and in so doing secure the dominant social relations that obtain within it.

The Gendered Ceremony and Ritual in Parliament Programme, through a comparative examination of three important parliaments (India, South Africa and Westminster) over space and time explores how ritual and ceremony interact to produce, maintain and undermine the reputations of parliaments and parliamentarians, or how ceremony and ritual frame the functioning of their members – disciplining them through these rituals and ceremonies to function within the parameters of 'reasonableness', accommodation and bargaining. Thus, through its work it posits that studying ceremony and ritual in politics challenges the utilitarian and rational choice understanding of political scope, decision-making and policy-outcomes. It highlights the role of emotion, sentiment and affect in politics and helps us understand how everyday rituals and ceremonial performances hold disparate interests, histories and visions of the future together against all odds, while at the same time embodying the possibilities of evolutionary, transgressive and disruptive change. ü

'Cultures are built on the edge of an abyss.
Ceremony is a declaration
against indeterminancy.'

(KENNETH BURKE)

PROFESSOR IAN STEWART FRS
MATHEMATICS INSTITUTE
http://freespace.virgin.net/ianstewart.joat/index.htm

COMMENT

'Complexity Science is one of the most fascinating and unorthodox areas at the frontiers of science and mathematics. To those with imagination, it offers new hope of understanding apparently intractable problems of huge importance to humanity. To its critics, its aspirations exceed its achievements. However, when classical approaches to such problems fail – as they are doing, spectacularly, in global economics, to name one topical example – it only seems wise to consider alternatives.'

Ian Stewart FRS, is Emeritus Professor of Mathematics and Digital Media Fellow. His research interests include dynamical systems, bifurcation theory, pattern formation, and biomathematics. He is also a writer of popular science and of science fiction. He was awarded the Royal Society's Michael Faraday Medal for furthering the public understanding of science, and has also delivered the Royal Institution's Christmas Lectures.

PROFESSOR IAN STEWART FRS
MATHEMATICS INSTITUTE
http://freespace.virgin.net/ianstewart.joat/index.htm

Complexity in Mathematics

BY IAN STEWART

In complexity science, the phrase 'complex system' has a specific technical meaning. It is not merely something very complicated. In fact, there is a sense in which complex systems are not complicated at all – even if that is how they seem. The key feature of a complex system is that it is composed of large numbers of entities or agents, interacting according to specific rules. Usually the number of distinct types of entity is small, and the rules for interaction are fairly simple. The surprise is that these simple ingredients can generate astonishingly complicated 'emergent' behaviour, which often appears to transcend the limitations of the individual entities and rules.

The brain is an example. Here the entities are nerve cells, which interact by transmitting signals. Consciousness is an emergent property. In a crowd, the entities are individual people, which interact by avoiding occupying the same location; emergent properties are things like stampedes. An ecosystem is a third example: the entities are living creatures, the interactions are things like predation or reproduction, and the emergent properties are most of the things we encounter in daily life. Stockmarkets, national economies, living cells, and storm clouds can also be viewed as complex systems.

PROFESSOR IAN STEWART FRS
MATHEMATICS INSTITUTE
http://freespace.virgin.net/ianstewart.joat/index.htm

Classically, science and mathematics have modelled systems of this type by aggregating the individual entities into some kind of continuum, and measuring the state of the system by large-scale averages or other 'smoothed' quantities. A crowd, for example, becomes a kind of fluid, where what matters is the local density of people, not the people themselves. An economy is also a fluid, and what flows is money. But it is becoming ever more apparent that this classical approach can miss important kinds of behaviour, and is inadequate for many purposes. A crowd, for instance, can flow in opposite directions along the same corridor. People naturally play follow-my-leader through gaps in the approaching crowd, so the flow can change direction completely from one person to the next. Fluids are not like that.

During the last quarter of the 20th century, a number of research centres started to develop alternative approaches, in which the entities were modelled as individuals. Perhaps the best known is the Santa Fe Institute, which pioneered this point of view before it became fashionable. Much of the early work relied on computer simulations, which revealed many interesting new phenomena, but at a price. Simulations are seldom 'realistic', in the sense that they include all relevant features of the real world. On the contrary, they deliberately simplify or ignore many aspects of reality, hoping to focus on those aspects that are most important for the phenomena under investigation.

When modelling a crowd, for example, many aspects of human psychology are ignored. What matters is that at each moment, each individual has a target direction, where they want to go, and a small range of options – move into a nearby space, stay put, bump into someone. Real people are less limited. Nevertheless, models of this kind are sufficiently accurate to be used commercially in the design of large public buildings, like railway stations. They predict places where a crowd may become dangerously dense, and they make it possible to investigate potential methods of crowd control when the building is still just an architect's plan in a computer.

There is a big opportunity here for mathematics. We need to develop an improved understanding of the link between the small-scale rules governing individual entities, and the large-scale features of the entire system that become apparent in simulations. Which rules give rise to which features? In some areas of the physical sciences, such questions have led to important discoveries, and computer simulations alone may not offer sufficient insight. A wealth of new and important mathematics awaits discovery. ü

Opposite: a network of nerve cells

PROFESSOR NIGEL THRIFT FBA
VICE-CHANCELLOR
www2.warwick.ac.uk/services/vco/vc

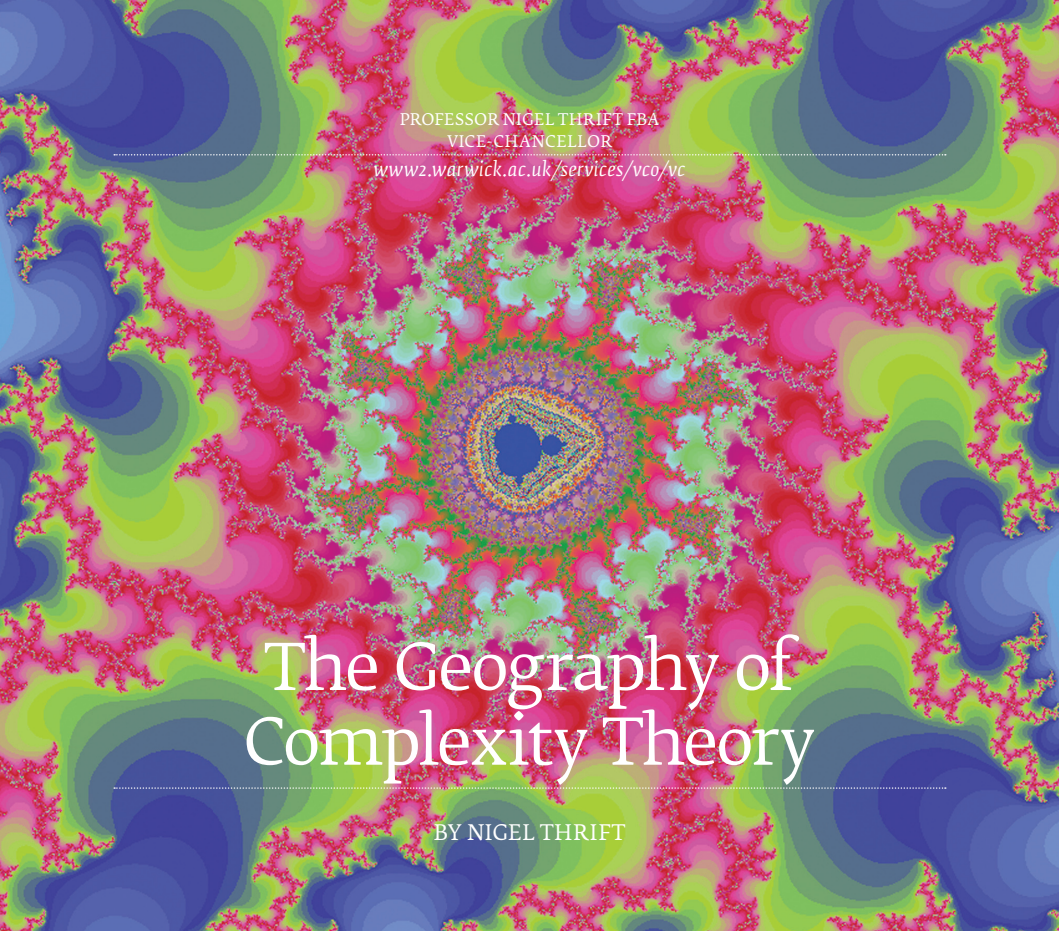
COMMENT

'Complexity theory has reached beyond science into subjects like economics, literary theory, history, sociology and anthropology. It has become the stuff of art, film, drama and imaginative fiction; it has become inscribed in consumer objects (such as Donna Karen's scent 'Chaos'); it has even become a feature of garden design…'

Professor Nigel Thrift FBA is Vice-Chancellor of the University of Warwick. He is one of the world's leading human geographers and social scientists. He received the Royal Society Victoria Medal for contributions to geographic research in 2003, and Distinguished Scholarship Honours from the Association of American Geographers in 2007, and is an Academician of the Academy of Learned Societies for the Social Sciences.

Opposite: the Mandelbrot set – a visual metaphor of complexity theory
Image courtesy of Robert P Whitney (whitneyrp@comcast.net)

PROFESSOR NIGEL THRIFT FBA
VICE-CHANCELLOR
www2.warwick.ac.uk/services/vco/vc



The Geography of Complexity Theory

BY NIGEL THRIFT

Complexity theory is a scientific amalgam –an accretion of ideas representing a shift towards understanding the properties of interaction of systems as more than the sum of their parts. While previous bodies of scientific theory were chiefly concerned with temporal progression, complexity theory is equally concerned with space. It's a theory that asks questions about crises and catastrophes, instability and impasse – a theory that, in other words, one would expect geographers to take to like ducks to water. And yet, geographers have – for various reasons – remained firmly on the land.

In this article, I want to produce an account of the dissemination of complexity theory that reinstates the links with geography. In mapping the geography of complexity theory, I want to look at how its metaphors – the verbal or visual images we use to describe it – have circulated around the world through three different but related social networks, whose main purpose is the production of new knowledges: global science, global business and New Age practices. I have chosen these particular three because they are

Designed with complexity theory in mind: the Garden of Cosmic Speculation, Dumfries, by Charles Jencks

important determinants of our everyday lives. Science, business and New Age matter to people – their discourses are touchstones of many practices; they increasingly play to publics created and driven by the media; and, finally, they are networks that trade with each other.

Let's start by considering the network that is science. Science has changed hugely over the last 20 years. It has become common cultural currency, with scientific and quasi-scientific language widely used in everyday discourse. It has become cosmopolitan on an entirely different scale, and a vital part of this new, cosmopolitan science is 'mediatisation'. Books, television programmes, and the like sell science: in turn, science sells books, television programmes... Science and the media have become more and more closely intertwined and complexity theory is now one of the major scientific media exports. We can see this in, for example, the activities of the Santa Fe Institute. Founded in New Mexico in 1984, this organisation has attempted to be a centre not only for complexity theory research, but also for its dissemination. It has moved into many fields outside the natural sciences, including archaeology, linguistics, political science, economics, history and now management.

Secondly, global business. Since the 1960s, we have witnessed the development of what I call the 'cultural circuit' of capitalism, consisting of business schools, management consultants, management gurus and the media. This burgeoning network of business practices has a constant and voracious need for new knowledges and, from the beginning, has provided particularly fertile ground for the dissemination of complexity theory. The need for a constant flow of ideas (often called 'business fads') means that complexity theory is likely to receive a warm welcome, while the management seminar has proved a useful way of introducing ideas of complexity into corporate practice. The production of complexity theory is now bound up with business – for example, companies have been established that apply complexity theory to financial markets. Finally, complexity theory has been used to produce a new management paradigm of emergence and self-organisation that can be marketed as a simple set of principles for designing, managing and viewing organisations: these are concepts that particularly fit with many current ideas of management thinking.

Finally, New Age practices. New Age consists of a set of organisations which, though not so coherent as the cultural circuit of capital, have nevertheless become a functioning international circuit dependent upon a constant through flow of new ideas. The producers of these ideas are diverse, including new religious movements and communities, spirituality and healing centres, camps, gatherings and businesses. The ideas are distributed in many ways, the chief of which is the seminar or workshop, now a pivot of New Age practices. Complexity theory seems to provide a ready-made vocabulary with which to talk spirituality and metaphors of complexity have

become steadily more popular in New Age since the 1980s: they are easily interpreted as the language of the self and self-making; they have provided a vehicle for dissemination of older New Age ideas (such as Lovelock's Gaia), and their 'scientific' vocabulary adds a touch of legitimacy for a relatively small and insecure network.

The practices of these three networks have therefore produced a rapid diffusion of the metaphors of complexity which, in turn, have been changed by the new networks in which they can circulate. This trade in metaphors takes place between the network of science and the other two networks and between the two newer networks as well: complexity metaphors travel between science and New Age, between New Age and business and between science and business. Moreover, at certain sites, these networks can physically coincide, and these sites provide particularly important points for the transmission of metaphors since they allow direct interaction to take place. For example, the Santa Fe Institute – one of the major scientific centres of complexity theory – is situated amid the New Mexico desert landscape, which often appears in the work emanating from the Institute as an illustration of the importance of complexity metaphors. As well, however, Santa Fe is one of the key centres of New Age in the United States.

In the example of Santa Fe, we can see how networks both interweave in spaces and also interweave spaces. For in all the travellings and encounters of complexity metaphors, the importance of space clearly stands out : the space-time geographies of the social networks have helped to shape their function as shifters of metaphors. They provide a map of *where counts*: in science, there are the main sites where complexity theory is produced; in business, the map is of the main poles of managerial innovation like Boston; for the New Age network, the map in Britain has been one of margins (for example, Glastonbury). The cultural valuation of the landscapes inscribed on these maps provides a *force of identity*: thus science gains extra validation from certain stock landscapes such as the two Cambridges; business has its stock of familiar landscapes on both sides of the Atlantic; New Age sites in Britain are often woven together into a mystical geography centred on notions such as Avalon. They are *geographies of interaction* – of meetings, conferences, symposia, seminars, workshops and emails for science and business, face-to-face interaction through seminars, workshops, festivals and gatherings for the New Age network. Finally, space provides a *vocabulary* of journeys, maps, shifts and transformations giving the metaphors of complexity a semiotic force, which implies transformation and diffusion – and, of course, also reflects the vocabulary of the geographer. ü

This article is based on 'The Place of Complexity' in Nigel Thrift, 'Knowing Capitalism', Sage Publications Ltd, pp 51-74, © Nigel Thrift 2005, with permission from the publisher.

PROFESSOR ROBERT MACKAY FRS, FInstP, FIMA
CENTRE FOR COMPLEXITY SCIENCE
http://go.warwick.ac.uk/complexity

The University of Warwick's Complexity Complex and Centre for Complexity Science

BY ROBERT MACKAY

COMMENT

'As this book shows, 'complexity' means many different things to many different people. Yet, as with the blind men and the elephant, it is possible that each of us is sensing some aspect of a common underlying concept. This is the basis on which the University of Warwick's Complexity Complex and Centre for Complexity Science were set up.'

Professor Robert MacKay FRS, FInstP, FIMA is Director of Mathematical Interdisciplinary Research and of the Centre for Complexity Science.

PROFESSOR ROBERT MACKAY FRS, FInstP, FIMA
CENTRE FOR COMPLEXITY SCIENCE
http://go.warwick.ac.uk/complexity

The complexity complex is a cross-campus association of research groups active in Complexity Science, defined broadly as the study of systems with many interacting components. Its purpose is to catalyse interactions and research developments in the area. In more detail, it aims to connect and develop interdisciplinary research in Complexity Science at all levels and train a new generation of complexity scientists to understand, control and design complex systems, produce breakthroughs in the principles and applications of complexity science, link with end-users as sources of real-world problems and beneficiaries from the resulting knowledge and trainees, and sustain a lively intellectual and practically based environment for Complexity Science.

It was established in 2005 on the basis of a joint seminar series between Mathematics and Physics on Complex Systems and Quantum Phenomena; an Economic and Social Research Council (ESRC) supported series of workshops on Socio-economic Dynamics; an EC newly emerging science and technology network on Unifying Networks in Science and Society; another on Complex Financial Markets, and interest from the Medical School, Business School, Chemistry, Computer Science and others. Some of the larger research groups associated with the Complexity Complex are Systems Biology, Centre for Scientific Computing, Molecular Organisation and Assembly in Cells Doctoral Training Centre, Centre for Fusion, Space and Astrophysics, Ecology and Epidemiology Group, Centre for Primary Health Care Studies, and the Centre for Discrete Mathematics and its Applications.

Doctoral Training Centre (DTC)

The Complexity Complex successfully raised funds from the Engineering and Physical Sciences Research Council (EPSRC) for a Doctoral Training Centre (DTC) in Complexity Science, with 31 four-year studentships and six new lectureships. The DTC took its first students in September 2007. Its management includes co-directors from Mathematics, Physics, Computer Science, Warwick Manufacturing Group, Chemistry, Medical School, Business School, Statistics and Economics, and its students do research projects with co-supervision from an even broader range of departments. It is firmly committed to interacting with 'end-users', our official partners being IBM, HP, Jaguar-Land Rover, British Antarctic Survey, Met Office, Department of Health, NHS Institute for Innovation and Improvement, and the RAND Corporation.

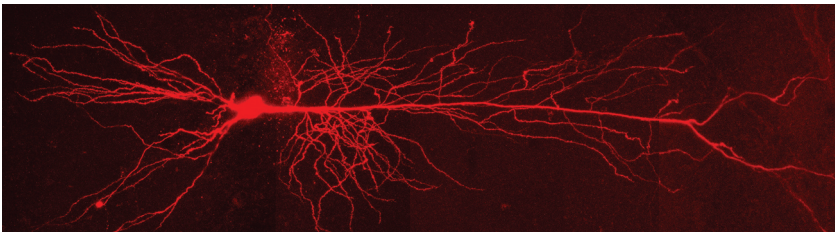
The Zeeman Building, the location of the Centre for Complexity Science

Centre for Complexity Science

In November 2007, the Centre for Complexity Science was created as a focus for research at Warwick in Complexity Science, with the DTC at its core and the Complexity Complex around it. The University built dedicated accommodation for it in a new extension to the Zeeman Building, to which the DTC and core staff moved in June 2008.

Principal research themes of the Centre for Complexity Science are dynamics on networks; granular flows; interacting particle systems; spatio-temporal complexity, and inference for complex systems. Application areas range from neuroscience and geophysics to polymer translocation and cell biology.

One direction in which we are exploring potential for Complexity Science



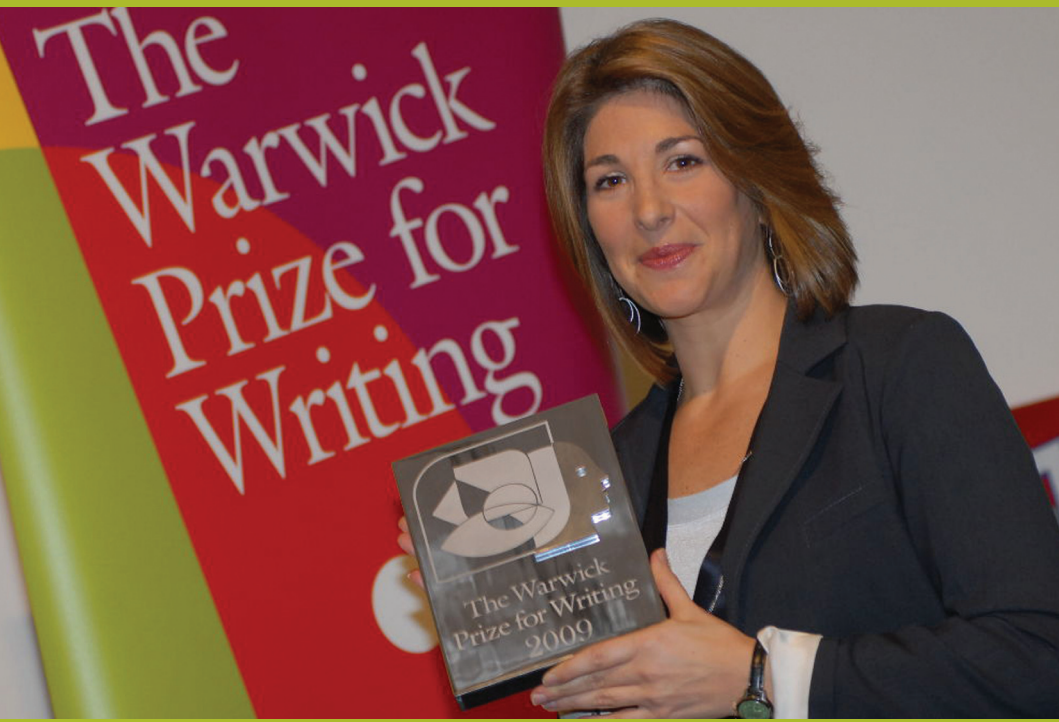
A confocal image of a rat CA1 hippocampal pyramidal cell

is in the Social Sciences. With a combination of reading groups, workshops, some financial support from the University, and a collaboration with Boston University, we are focusing on Complexity Science in Healthcare Delivery, including social networks, structure, function and evolution in health care organisations, new methods of analysis of health datasets and on the socio-eonomics of smart energy.

The Centre for Complexity Science puts on or collaborates in many workshops. Those for the last 12 months include Networks and Organisation in Cell Biology, Fractional Brownian Flows, Climate Change, Health Policy, Traffic Flow, Out of Equilibrium Markets, Aggregation, Condensation and Coagulation, Confronting Complexity with Real World Problems, Public Transport and Services, and Tasters in Complex Systems. This summer has seen a Computational Neuroscience and Gene Circuits international summer school, funded by Warwick Institute for Advanced Study and Fudan University (Shanghai); the sixth annual European Conference on Complex Systems, hosted by the Centre for Complexity Science; and the start of a Warwick EPSRC Symposium year, September 2009 to July 2010, on The Mathematics of Complexity Science and Systems Biology, jointly run by Complexity Science and Systems Biology.

The Centre for Complexity Science is developing links at local, national and international levels. For example, it is involved in the University's initiatives on low carbon society and international security, in a UK mathematical neuroscience network, in a Warwick-Boston collaboration, and with a EC co-ordination action for the science of complex systems and socially intelligent information and communication technologies (ASSYST).

A major ambition for the Centre for Complexity Science is to obtain substantial funding for postdoctoral researcher teams to work on topical research programmes in Complexity Science, such as dynamical networks; management and design of complex systems; human patterns; energy challenges; space-time phases for spatially extended dynamics; transmission and response, and evaluating climate risks. ü
For more, see www.go.warwick.ac.uk/complexity

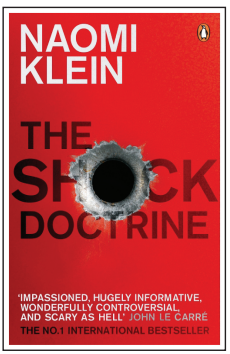


Exploring Complexity: The Warwick Prize for Writing

'COMPLEXITY' WAS THE THEME OF THE FIRST EVER WARWICK PRIZE FOR WRITING, AWARDED IN FEBRUARY 2009 TO CANADIAN JOURNALIST NAOMI KLEIN FOR HER BOOK *THE SHOCK DOCTRINE*.

The Warwick Prize for Writing

This unique prize aims to identify and promote excellence and innovation in new writing. It is an international, cross-disciplinary award, given biennially for an excellent and substantial piece of writing in the English language, in any genre or form, on a theme that changes with every award. Firmly focussed on the writing of the 21st century, the Prize helps to define where writing might be going; what new shapes and forms it might take, and through what media it might be conducted – including electronic forms as well as the traditional medium of print. The Prize is a substantial one, indicating the importance the University places on this new venture.



The Shock Doctrine was chosen from a shortlist of six international titles, whose subjects ranged from music criticism and scientific theory to fiction. Thus, the theme of complexity was interpreted differently by each writer, all experts in their genres – a practice followed by the writers in this Collection of Essays which represents a cross section of the academic departments in the University.

In her acceptance speech, Naomi Klein quoted from Oliver Wendell Homes – 'There is simplicity on the other side of complexity'. She said: "And that is what I think so many of us are striving for, that place on the other side of the creative process where the breathing is a little bit easier; suddenly there is a sense of calm and clarity. That kind of complexity is actually inclusive and empowering, it brings more people into the learning process and that's what I think we should strive for and celebrate and do better. But there is another kind of complexity... one that seems designed not to illuminate but to obscure, not to include but to exclude – let's call it false complexity, for lack of a better phrase. It acts as a kind of shield, keeping crucial information, crucial to our democracy, locked in a kind of experts-only club. This is one of the themes of *The Shock Doctrine*."

The Warwick Prize for Writing

In this Collection of Essays, the writers have followed Naomi Klein's precepts, striving never to obscure and always to illuminate.ü

ISBN 978-0-902683-95-2
Edited and produced in the Communications Office, The University of Warwick
Design by Mustard: www.mustardhot.com