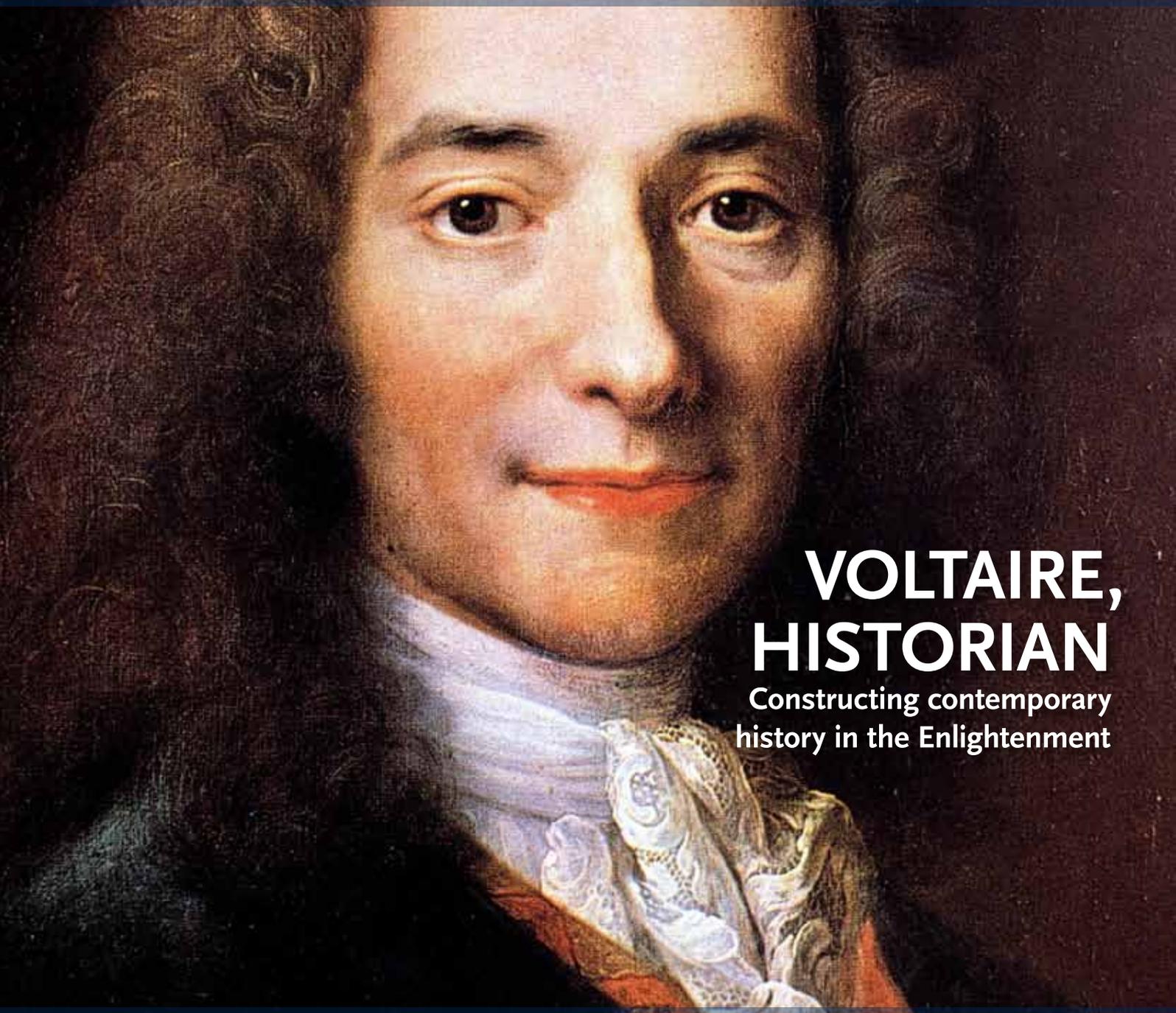


The Leverhulme Trust

NEWSLETTER

SCHOLARSHIPS FOR RESEARCH AND EDUCATION

JANUARY 2014



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HISTORIAN**
Constructing contemporary
history in the Enlightenment

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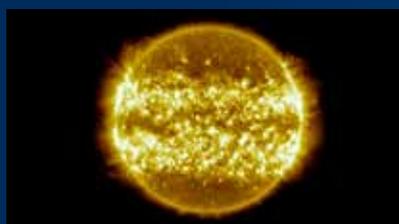
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FUNDING FOR THE FUTURE



As discussion continues on the future impact of student debt on numbers of students progressing to doctoral studies, the Leverhulme Trust is launching a new £10 million doctoral scholarships funding scheme.

Higher education in the UK has seen some big changes in recent years. One of the most significant was the introduction of increased tuition fees—up to £9,000 a year—payable by home and EU undergraduates entering universities in 2011.

In the aftermath of the new policy there followed much public discussion about the possible consequences of student debt. One dimension of this debate has from the outset engaged the Leverhulme Trust: the risk that increased indebtedness will discourage graduates from undertaking doctoral study, and therefore that the indigenous supply of new researchers to UK universities, institutes and businesses will be seriously diminished. It is in all our interests to ensure that the new undergraduate fee regime in the UK does not have an adverse impact on the flow of new research talent into the system.

For that reason, the Trust Board determined at its most recent meeting to send a clear signal to aspiring young researchers and to the sector as a whole, in order to demonstrate the commitment of the Trust to the nurturing of the next generation of potential grant earners. We are therefore launching the Leverhulme Doctoral Scholarship Awards, a new competition that will see some 150

fully-funded studentships for doctoral study placed in UK universities over the next three years, an initial investment in excess of £10 million by the Trust.

We will be inviting all universities to submit one bid for fifteen full-time scholarships over three years. Scholarships will be available for UK and EU students and are offered in subject areas identified by each applying university as a research priority for that institution. Such priorities are likely to include so-called grand challenges, research themes, or perhaps new initiatives which an institution wishes to promote and develop. Each three-year scholarship will have a value of £70,000, providing maintenance, tuition fees, and an element for research expenses and training.

The programme opens to applications on 7 March 2014, and full details will be available on the Trust's website from that date. The closing date for applications will be in mid-September, with decisions on applications to be taken in December 2014, in time for successful universities to begin recruiting in January 2015, ready for the first tranche Leverhulme scholars to start in autumn 2015.

My conversations with senior figures in the higher education and grant-making sectors suggest that the scheme will be warmly welcomed by UK universities. It is to be hoped that it also acts as a stimulus to further investment in the coming generations of researchers by other interested parties.

SCHEME NEWS

PHILIP LEVERHULME PRIZE ROUND OPENS WITH INCREASED VALUE

The Leverhulme Trust opened its 2014 call for Philip Leverhulme Prize nominations with the announcement that the prize value has increased to £100,000 and that nominations are now to be invited in a broader range of subject areas.

The increased value of the prize—which has risen from £70,000 to £100,000—is intended to allow prize-winners continued flexibility in pursuing their work, despite rising research and teaching replacement costs. 'The Trust Board wanted to set the prize at a level that reflected its prestige in the academic community and that was generous enough to offer prize-holders genuine latitude in the pursuit of their research,' says Anna Grundy, Grants Manager at the Leverhulme Trust. 'Increasing the award value will ensure that prizes continue to offer that kind of flexibility in the years ahead.'

From 2014 onwards, the range of subject areas under which nominations can be made increases to 18, with a fixed rotation over the next three rounds. The new subject areas will broaden the scope of the prizes, explains Anna: 'Our intention is to open the scheme up to a wider range of fields. We've deliberately chosen broad categories because we want we want nominees to think creatively about where their work fits, regardless of what department they are based in.' The subject areas accepting nominations in 2014 are biological sciences, history, law, mathematics and statistics, philosophy and theology, and sociology and social policy. A full list of the new subject areas and timetable for their rotation are available on the Leverhulme Trust website.

The 2014 call for nominations opened on 6 January and closes on 14 May 2014. Full details of the scheme and guidance for applicants is available at www.leverhulme.ac.uk

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For more profiles of current research and full awards listings, please visit the Leverhulme Trust website (www.leverhulme.ac.uk). To order additional copies of this newsletter, please contact Daniel Mapp on 020 7042 9875 or email dmapp@leverhulme.ac.uk.

Engineering the Byzantine water supply

Could modern modelling techniques help archaeologists understand the topography and infrastructure of the ancient water supply system of Byzantium? Professor James Crow explains how an interdisciplinary approach will answer important questions about the building and maintenance of this exceptional hydraulic system.

Astride one of Istanbul's main boulevards, like a comb parting the constant lines of traffic, the multi-arched aqueduct of Valens or Bozdoğan Kemer is amongst the longest Roman aqueduct bridges known from antiquity, only 29 metres short of a full kilometre in length. Terminating at the huge underground cistern of Binbirdirek ('One Thousand and One Columns'), one of at least 160 cisterns known from the Byzantine city, this bridge was a vital link, enabling water to flow throughout the new city of Constantinople.

My earlier research on the water supply system of Byzantine Constantinople, supported by the Leverhulme Trust and completed nearly a decade ago, was able to estimate that the trunk network of water channels constructed to sustain the new city was over 450 km in length, sourced from springs in the hills west of the city, and constructed over less than a century; the system was comparable in scale to the eleven aqueducts supplying ancient Rome.

This new project will build on my



earlier archaeological research, but will also draw on the expertise of Dr Martin Crapper and Dr Simon Smith at the School of Engineering at the University of Edinburgh. It provides an exciting opportunity to utilise a new interdisciplinary approach in the study of this exceptional system. Our research will focus on two interrelated themes.

First, by using network modelling software, we aim to model gravity-flow water systems within the area of the old city and conduct a series of simulations representing the water system through its various historical evolutions. Application of these models will then enable a significant step-change in understanding the functioning of this significant

ancient hydraulic system and present a range of scenarios which can offer new insights and questions into the urban topography and the life of the Byzantine and Ottoman city. Secondly, we will examine the construction and project management issues of the ancient water system, including the procurement of materials, manpower, and skills, as well as transport to site, organisation, and funding. For this we will apply a number of approaches designed for contemporary mega projects such as discrete-event simulation regression modelling and artificial neural networks to help determine the set of possible approaches that were required to undertake the exceptional scale of organised work necessary to deliver the water systems of Constantinople.

The two themes will inform wider questions concerning the topography, infrastructure and organisation of the late antique and Byzantine city itself and how this evolved over nearly a millennium. Additionally we hope that this evidence can serve as a proxy to estimate the overall 'cost' of the massive building programme and its maintenance for the late Roman and Byzantine state.

TOP: *The aqueduct bridge at Kursunlugerme outside Istanbul.*

LEFT: *The Aqueduct of Valens in Istanbul.*



Voltaire, historian: constructing contemporary history in the Enlightenment

Could a re-evaluation of Voltaire's neglected historical works enhance our understanding of his overall philosophical project? As he begins a three-year research project, Professor Nicholas Cronk explains why Voltaire's histories should be seen as central to his oeuvre, rather than on the margins.

Voltaire (1694–1778) is widely acknowledged as the dominant figure of the Age of the Enlightenment, and his historical writings form a significant part of his output, including works on Louis XIV, Louis XV, Charles XII, Peter the Great, the Holy Roman Empire, and even a pioneering universal history. These histories were highly regarded in his lifetime, and Voltaire was a powerful influence on the other great historians of the age, Hume, Gibbon and Robertson.

Despite this, writers today are uncomfortable in trying to explain the importance of Voltaire as a historian. Karen O'Brien, for example, remarks that 'Voltaire's histories have not recovered today from the low reputation to which they sank after the French Revolution'. We typically criticise Voltaire's histories for being polemical and tendentious: his determination to view everything from a resolutely modern point of view can make him seem naïve, and we find it puzzling that his histories were once held in such esteem.

The aim of this project is to come to a better understanding of Voltaire's overall philosophical project, by focusing on a neglected aspect of his work: his determination to write 'modern' history. Much of his historical writing, especially in the earlier years, is devoted to the modern world. Voltaire first explores the defining characteristics of the modern world (the benefits of trade, the scientific revolution, religious toleration) in a book about England (*Lettres philosophiques*), before studying the flourishing culture of France during the previous century (*Le Siècle de Louis XIV*). He then extends this exploration, forwards into modern



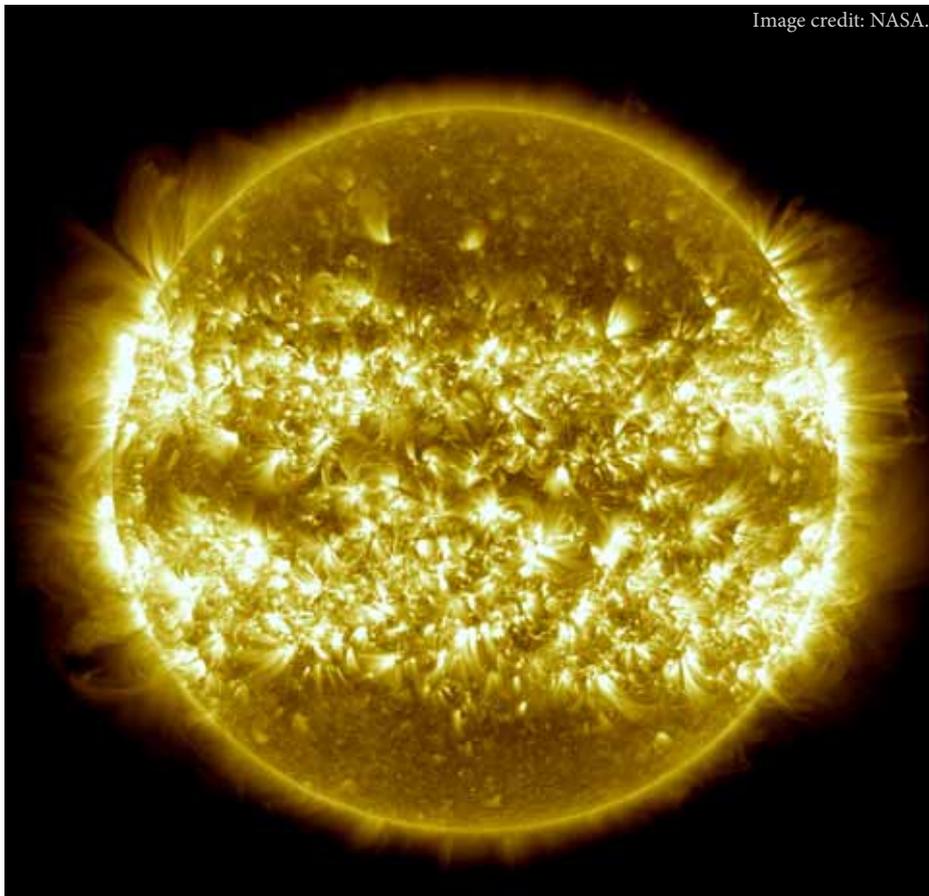
France (*Précis du Siècle de Louis XV*), and outwards into the recent history of the whole world (*Essai sur les mœurs*).

The study of recent history was, Voltaire declared bluntly, 'a matter of necessity'. The study of modern times was more precise than the study of ancient history, because sources were more numerous and more reliable. Most importantly—and here Voltaire seems influenced by the English writer Bolingbroke—modern history is best placed to offer us instructive examples. Traditionally, it had always been ancient history that was thought to be significant as a source of morally improving examples of conduct. Voltaire turns that idea on its head. As an Enlightenment philosopher, he wants to teach the lessons of free thought and religious tolerance, and he turns to modern history for telling examples to prove his point.

Voltaire's histories are not in a separate category on the margins of his oeuvre: they are at its very core. We need to (re)read the modern histories alongside Voltaire's other polemical works, and to understand them as part of one and the same project. The spirit of criticism that characterises the Enlightenment begins when we scrutinise our own age, and we cannot fully understand Voltaire the philosopher without appreciating his commitment to the study of modern history.

LEFT: Voltaire, ca. 1778, statuette modelled by William Keeling, Josiah Wedgwood & Sons, photograph © Voltaire Foundation, Oxford.

Image credit: NASA.

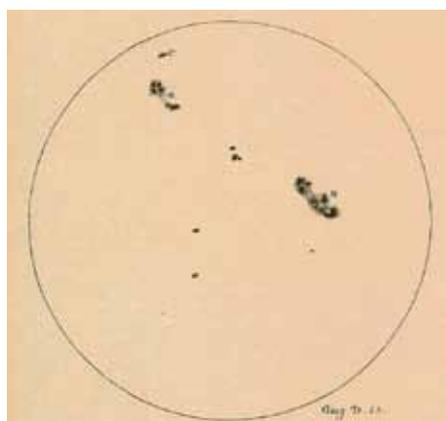


LEFT: *The modern view of the Sun, taken in ultraviolet light by NASA's Solar Dynamics Observatory spacecraft. The two bright bands above and below the solar equator are the result of sunspots. Image credit: NASA.*

Space climate-change

Philip Leverhulme Prize-winner Dr Mathew Owens is combining historical observations and modern modelling techniques to better understand the configuration of the Sun's magnetic field during the Maunder minimum, a period of exceptionally low sunspot activity that occurred in the seventeenth century.

To the naked eye, the Sun is a featureless yellow disc, occasionally tarnished by a few dark sunspots. But when viewed in ultraviolet and X-ray light, these tiny sunspots are actually shown to be huge magnetic structures, and the solar magnetic field is revealed as both highly structured and dynamic. Indeed, the Sun's magnetic field varies on an enormous range of time scales, from seconds, as solar flares convert magnetic energy to intense X-ray bursts, to decades, as the ultraviolet brightness of the Sun waxes and wanes over the approximately eleven-year sunspot cycle. There is also indirect evidence that the Sun's magnetic field varies over centuries and millennia: near-continuous sunspot observations date back to Galileo in



ABOVE: *One of Galileo's sunspot observations, made in the summer of 1612. These historic records may help understand how stellar magnetic fields are generated and how space-weather threats to humans and technology will change over the coming decade.*

1612, while ice-cores and tree trunks contain traces of isotopes produced by high-energy galactic particles, which can be used to infer the solar magnetic field nearly ten thousand years into the past. Both these records show significant long-term trends in solar magnetism, and reveal in particular periods of 'grand solar minima', such as the sunspot-free period from 1650–1700, referred to as the Maunder minimum.

My work will combine historical observations with modelling of the solar magnetic field to determine the configuration and evolution of the Sun's magnetic field during the Maunder minimum. This will provide a key constraint on the workings of the solar and stellar dynamos, which operate deep within a star and are the ultimate source of its magnetism. This is the first step to understanding how and why long-term solar magnetic variations exist.

The research also has more pragmatic applications. Rapid changes in the Sun's magnetic field result in space weather, which directly affects space- and ground-based technologies, as well as posing a threat to the health of humans in space and on high-altitude flights. It is not clear how space weather events respond to changes in 'space climate', the longer-term variations in the Sun's magnetic field, such as the Maunder minimum. This is a timely question, as while the solar magnetic field was generally observed to increase over the first half of the twentieth century, resulting in a 'grand solar maximum' over the space-age, it has been declining steadily since the mid-1980s and is currently at a level not seen since 1900. Some researchers are predicting a further decline to levels similar to those of the Maunder minimum. Thus space-weather over the coming decade is likely to be well outside the realm experienced during the space age, and the risk to humans and technology can only be assessed through modelling efforts and comparison with historical observations.

Having found a rich food source, the chimpanzees in the study usually only informed their closest friends, where friendship was measured in terms of how much they exchanged grooming and sat together.



Primate minds and the foundations of language

Klaus Zuberbuehler's work on communication in primates suggests that many of the basic elements of human language and culture, once thought unique to our species, actually have their evolutionary roots deep in the primate lineage, writes Carolyn Allen of the Trust.

Supported by a Research Leadership Award of £766,000, Professor Zuberbuehler and his colleagues at the University of St Andrews investigated natural vocal communication in three groups of primates: human infants; our closest relatives, the great apes; and our more distant relatives, monkeys. The five-year research project concluded in autumn 2012.

Field studies carried out in Africa, South America, Asia, and Scotland allowed the researchers to observe the vocal signals produced by primates during their daily activities, and the responses that these vocalisations elicited from listeners.

Their findings added to the growing

evidence that many non-human primate calls are word-like, in that they carry a specific meaning about an object or event. They also identified signs of primitive grammar in the vocal calls of many primate species, including a Brazilian New World monkey, the black-fronted titi (*Callicebus nigrifrons*). In a field study at the Caraca Natural Reserve in Brazil, postgraduate student, Cris Caesar analysed the alarm calls given by titi monkeys in response to models of two of their native predators: caracara, a bird of prey, and oncilla, a small spotted cat.

She found that, although the titis only used two acoustically distinct calls—one with a rising pitch and one with

a falling pitch—specific sequences of these calls alerted others, not only to the type of predator that endangered them, but also to whether that predator was on the ground or in a tree. As Professor Zuberbuehler explains, this is an example of basic syntax because it is the sequence of the calls that carries the meaning rather than the individual calls themselves. New World monkeys split from the lineage that became human more than twenty million years ago so the discovery of a primitive form of grammar in this group suggests that this is an ancient communication skill.

In contrast, the researchers found no evidence of social awareness in any of the monkey groups, suggesting that this is a much more recent innovation in evolutionary terms. Nevertheless, it appears that even this ability is not uniquely human; observing the vocal behaviour of groups of free-ranging chimpanzees in Uganda, the researchers found that certain alarm calls and food calls were directed towards specific individuals. A chimpanzee that encountered a snake, for example, would usually only produce an alarm call if he saw a close friend arriving, particularly if that friend was not aware of the snake.

This challenges the traditional view that non-human primate vocalisations are just involuntary expressions of emotion: ‘Chimpanzees don’t just throw calls out into the universe. It is an act of informing about the world rather than just responding to it and they bias their information towards socially valuable partners,’ Professor Zuberbuehler says.

Still more controversial, was the discovery that human infants appear to use a similar vocal communication system to that of our ancient primate ancestors. Observing the non-linguistic vocal behaviour of infants aged around twelve to eighteen months in their natural habitat (in this case one of two nurseries in St Andrews), postgraduate



Credit: Florian Moellers/RZSS

‘Chimpanzees don’t just throw calls out into the universe...’

student Verena Kersken noticed that there were a number of vocalisations that appeared to be strongly linked to the contexts in which they were made. For example, the sound that an infant made when pointing out something interesting, was quite distinct from the sound made when asking to be picked up.

By analysing video recordings made in the nursery environment, Verena identified five acoustically distinct vocalisations that all the infants used, each of which was uniquely linked with a specific social situation. At first, the researchers thought that the sounds

could be related in some way to the language that the children were exposed to, but in a field study in rural Uganda, they found that infants who were not growing up with English as their first language made the same five context-linked vocal calls.

Kersken played back recordings of the different calls to Ugandan parents and non-parents, and to Scottish parents and non-parents and asked them to match the calls with the context in which they were made. She found that the adults correctly identified what infants were trying to say significantly more often than would be

expected by chance, regardless of their own or the caller’s culture. Experience with young children appeared to enhance this ability, and parents from Scotland were slightly better at identifying the meaning of Scottish than Ugandan baby talk: indicating, the researchers suggest, that we have an innate and hard-wired ability to recognize a broader ‘meaning’ of a core set of sounds, which can be fine-tuned with practice.

‘We suspect this is an ancestral primate behaviour: still visible in humans even though it has lost its importance with the advent of modern speech capacities. For me, this is the most exciting finding but we are struggling to get it published. It was a only small sample size and, when a finding is beyond what people expect, you always have to work even harder to convince them,’ said Professor Zuberbuehler.



Credit: Florian Moellers/RZSS

ABOVE: Female Chimpanzee (*Pan troglodytes schweinfurthii*) “Kwera” (25 years) grooming subadult male “Squibs” (15 years) on forest floor. Budongo Forest Reserve, Masindi, Uganda, Africa.

LEFT: Chimpanzees (*Pan troglodytes schweinfurthii*) feeding on *Raffia palm*, an important source of salt and minerals in the rainforest. Budongo Forest Reserve, Masindi, Uganda, Africa.



Networking for fisheries co-management on Lake Victoria, East Africa

The status of fisheries globally is a cause of much concern, with declining stocks and threatened livelihoods in many parts of the world, writes Dr Fiona Nunan. If co-management has been introduced as a way of better managing fisheries, could this approach be improved through an understanding of how the personal networks of fisheries stakeholders influence their knowledge and behaviour?

Fisheries everywhere are under pressure, with concerns about overfishing and illegal fishing practices prevalent in many parts of the world. In the global south, inland fisheries make a significant contribution to local livelihoods, national economies and international trade, but reflect the global pressure within fisheries due to insufficient alternative livelihood opportunities and ineffective governance. Many governments have responded to such challenges by adopting co-management, where resource-users manage the fisheries with government agencies and other stakeholders. There is much evidence, however, that co-management is not working as well as hoped in African inland fisheries.

This is the case for the fisheries of Lake Victoria in East Africa. The lake is the second largest freshwater body in the world, with the fisheries supporting the livelihoods of around two million

people. The governance of the fisheries is complex, with three countries, Kenya, Tanzania and Uganda, bordering the lake and a multi-level co-management system introduced from the late 1990s. Co-management has yet to have a significant impact on the sustainability of the fisheries, however, and there is increasing concern about the declining stock of a key species.

Researchers have drawn on many approaches to investigate how co-management works and how people cooperate for natural resource management. My own research utilises social network

analysis, which focuses on the network of relationships between people, and how these relationships affect the behaviour and knowledge of people within a co-management system, and thereby the success or otherwise of the co-management system itself. Examples of such relationships include the provision of credit by fish buyers to boat owners or crew; the employment of crew by boat owners; boat crew providing support to each other in finding employment and good places to fish; and inspectors monitoring the practices at fish processing plants.

My research has three key strands:

1. The identification of personal relations that influence fisheries stakeholders' decision-making
2. Investigation of how personal networks influence attitudes to co-management of fisheries stakeholders
3. A contribution to the further development of co-management theory and practice.

The findings will feed into regional and national policy on fisheries management and will have significance for the design and implementation of co-management in other parts of the world, supporting global efforts towards more effective fisheries governance.

TOP: *Catch of the day.*

BELOW: *Trading fish at a landing site on Lake Victoria, Tanzania*



Scents and sensibility: perfume in Victorian literary culture

Professor Catherine Maxwell explains how her research on the role of perfume in nineteenth-century British literary culture will reinstate the imagination's hidden links with the historically neglected sense of smell.

Reflecting on smell's ability to transport the mind and emotions, the psychologist Havelock Ellis noted in 1905 how many literary writers had described it 'as, above all others, the sense of imagination'. Smell's evocative capacity, its connection to atmosphere and memory, make it a potent means of registering the particularity of a historical and cultural moment. Perfume, representing the exaltation of smell through the olfactory enhancement of the environment and the body, is a concerted attempt to engage the imagination through the creation, projection, and influence of different kinds of identity, mood, and aura.

My project is the first to examine the role played by perfume in nineteenth-century British literary culture. It explores perfume-associated notions of imaginative influence and identity, concentrating on the many late Victorian aesthetic and decadent texts where fragrance is most strongly indicated, but also notes important anticipations in key Romantic poets such as Shelley and Keats, earlier Victorians such as Tennyson, Browning, and Gaskell, and early nineteenth-century dandy literature.

Victorian fragrance is a surprisingly under-researched field, with histories of perfume focused on nineteenth-century France. While primarily literary, my study provides valuable new information about Victorian tastes



ABOVE: *Photograph Flower study, Lilies, Frederick Hollyer, ca. 1880–1900, Great Britain*
© Victoria and Albert Museum, London.

'Smell's evocative capacity, its connection to atmosphere and memory, make it a potent means of registering the particularity of a historical and cultural moment.'

in perfume for men and women, with regard to both personal adornment and the wider ambient environment. Thus, besides manufactured perfume, soap, and toiletries, it also considers flowers and floral ornaments such as corsages and buttonholes; aromatic jewellery; the scenting of garments, linen, fans, furniture, books, and paper; aromatic salts, perfumed snuff and tobacco; and pot pourri, pastilles, and incense. In addition to literary sources, it draws on an extensive range of material such as perfume manuals and perfumers' guides, etiquette guides, beauty and hygiene manuals, advertising, works on floriculture and gardening, journalistic articles, diaries, letters, interviews, memoirs, and biographies.

British aesthetic and decadent literature with its watchword of 'art for art's sake' is the perfect partner for perfumery as they share the desire to improve on nature. Smell has often been deprecated for its association with a rude physicality at odds with civilised manners and values, but perfume is the sublimation of that rawness into a higher-level experience. As a luxury product it forms an aura of exclusivity that announces the superior status of its wearer, and is thus an ideal accessory for aesthetes and decadents who elevate art, imagination, and culture over nature and regard themselves as members of a higher order.

The larger part of this project explores the emergence of the aesthetic or decadent *olfactif* (the individual with a refined sense of smell), key examples being Algernon Swinburne, Walter Pater, and Oscar Wilde; the cultivation of scent sensitivity; the perfume aura as a marker of personal style or dandified bohemian individuality; and the notional scented ambience of individual writers and literary-cultural schools.

Contributing to contemporary research on the cultural history of the senses, this examination of the literary and literal Victorian applications of perfume offers new ways of reinstating the imagination's hidden links with the historically neglected sense of smell.



LEFT: Ian Bastow working in the field with a student in South-east Canada.

ABOVE: Ian Bastow (right) and David Hawthorn from SEIS-UK, Leicester (left) installing a seismograph station in a museum on Grand Manan Island in the Bay of Fundy, Canada.

The building of North America

Dr Ian Bastow explains how his research project will use evidence from seismology to improve understanding of the geological evolution of North America and gain insights into how tectonic processes have developed over geological time.

With the notable exception of the plate boundaries, most of the geology we observe was sculpted by Earth processes that have long-since ceased. Thus we are left with indelible but incomplete evidence as to the nature of this ancient activity. We can partially overcome this by comparing rocks in the plate interiors with those presently being formed in active areas (mostly the plate margins). By constructing models based on observed tectonics we can often predict with remarkable accuracy the salient geological features seen elsewhere. For Proterozoic (younger than 570 million year old) rocks this works well, but Earth conditions during the Precambrian (older than 570 million years ago) formation of the oldest rocks were likely very different, so analogies with modern day tectonics are much less certain. The Earth's interior was significantly hotter then, with the implication that modern plate tectonics perhaps did not begin until after the

Archean (2.5–4 billion years ago). Gathering geological evidence preserved deep within the plates in these ancient regions is thus essential to improving our understanding of the early Earth, but this cannot always be achieved by traditional field geology.

As a research tool, seismology is increasingly being used to solve problems of a geological, rather than seismological,

‘South-east Canada is home to rocks that span more than three billion years of Earth history ... ’

nature. Seismic networks are now deployed in regions of tectonic interest in order to detect distant earthquakes because seismograms record not just the earthquake itself, but the deep Earth geology encountered by the seismic waves en route to the seismograph station. The chemistry and temperature of rocks at depth affect the speed at which seismic waves travel through them, so measuring arrival times of

seismic energy can be used like X-rays in medical tomography to map the structure of the deep Earth. After crustal formation, deformation can impart fabrics that remain preserved, hundreds of millions of years after they formed. This too can be detected seismically rather like a remote structural geology tool.

South-east Canada is home to rocks that span more than three billion years of Earth history and is thus an excellent place to understand how tectonic processes have developed over geological time. With the support of the Leverhulme Trust, geophysicists at Imperial College, in collaboration with researchers in the USA (Lamont Doherty Earth Observatory and Rutgers University) and Canada (L'Université du Québec à Montréal) will use seismology to unravel how North America was assembled and to discover how the extremely thick plate developed beneath the heart of it.

Credit: Jennifer Allen.



Multi-agent modelling of humpback song

Dr Luke Rendell explains how modelling techniques from computer music research could provide new insight into one of the most striking examples of non-human cultural evolution: how humpback whales learn their songs from each other.

The evolution of animal communication, from honeybee dances to human language, is a research theme that spans biology, psychology and linguistics. Compared to other animals, cetaceans, the whales and dolphins, stand out because of the complexity and diversity of their communication systems. One example, the song of the humpback whale, is one of the most striking displays in nature. It has captivated the general public, musical composers, and scientific experts since their complexity was first described in 1971.

In the song, individual calls are gathered into phrases that are repeated in complex themes sung for hours on end. All males in a breeding population sing nearly the same song, but the song evolves gradually over time. For this to happen, whales must be learning their song from each other, and therefore change in the song is an example of cultural evolution. More recently, researchers have shown that songs can also be completely replaced within one or two breeding seasons in a process that is more revolutionary than evolutionary. In studies across the South Pacific, songs from neighbouring

populations regularly replaced existing songs, leading to songs propagating between populations from Australia all the way to French Polynesia. Having cultural evolution progress at these two different rates in the same populations is very rare outside humans, and the learning processes and rules that produce it are completely unknown.

Our project is an interdisciplinary collaboration bringing together experts from the Interdisciplinary Centre for Computer Music Research at Plymouth University, the Sea Mammal Research Unit at the University of St Andrews, and the Cetacean Ecology and Acoustics Laboratory of Queensland University, Australia. We will use agent-based

modelling techniques from computer music research to understand the cultural evolution of humpback whale song. Agent-based modelling simulates individual animals inhabiting a virtual environment. The animals have rules about how they interact, and in our case these rules will determine how the song produced by one individual will be influenced by hearing a song from a different individual. By tuning the model so that it reproduces the kinds of song change we observe in nature, we will understand more about how humpbacks learn their song from each other.

This innovative project takes an original approach to understanding a biological system that is difficult to study in the field. We hope to bring new insights into one of the most striking examples of non-human cultural evolution and to explore the evolutionary origins of such collective vocal displays.

The interdisciplinary nature of the collaboration will lead to cross-fertilisation, both in our understanding of animal communication, but also in the way in which we understand how music is made. Social robotics and other artificial intelligence research areas have investigated the possibility of humans and robots communicating by non-verbal sounds, and our modelling framework can provide a bio-engineering foundation for such efforts with potential impacts in information technology, gaming, and therapy for conditions such as autism.

TOP: *Humpback lobtailing.*

BELOW: *Humpback whales migrate from near the poles to tropical waters.*



Credit: OAR/National Undersea Research Program, University of North Carolina at Wilmington.

Awards approved at the November 2013 meeting of the Leverhulme Trust Board

RESEARCH PROJECT GRANTS

Humanities

Dr Nick Ashton

British Museum

Mapping Palaeolithic Britain: place, space and time

£159,347

Dr Silvia M Bello

Natural History Museum

Cutmark micro-morphometrics and the stage of carcass decay: a pilot study using 3D microscopy

£89,389

Dr Paul Botley

University of Warwick

Isaac Casaubon in England (1610–1614): a critical edition of his correspondence

£184,040

Professor Nicholas Cronk

University of Oxford

Constructing contemporary history in the enlightenment: Voltaire historian

£115,530

Professor James Crow

University of Edinburgh

Engineering the Byzantine water supply: procurement, construction and operation

£250,795

Professor Clive Gamble

University of Southampton

Seasonality, mobility and storage in Palaeolithic hunting societies

£163,228

Dr Jules Holroyd

University of Nottingham

Bias and blame: do moral interactions modulate the expression of implicit bias?

£220,608

Professor Adrian Johnstone

Royal Holloway, University of London

Notions and notation: Babbage's language of thought

£222,540

Dr William Lyons

University of Bristol

Scripture, dissent and Deaf space: St Saviour's, Oxford Street

£244,911

Dr Abigail Williams

University of Oxford

A new history of reading and authorship in the eighteenth century

£206,386

Sciences

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£14,392

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University of Gloucestershire
Artist in Residence: Antony Lyons
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£14,500

Dr Noelle Odling
University of Leeds
Artist in Residence: Sue Lawty
Visual art
£15,000

Professor Paul Overton
University of Sheffield
Artist in Residence: Dr Rachel Genn
Installation and writing
£14,674

Dr Angie Voela
University of East London
Artist in Residence: Barbara Loftus
Visual art
£11,493

Dr Jeff Warburton
Durham University
Artist in Residence: Laura Harrington
Filmmaking
£15,000



MAIN PICTURE: Sue Lawty, 'Lead Weave (detail)', 2m x 2m, woven and beaten lead (Photograph: Jerry Hardman-Jones)

ABOVE: Artist Sue Lawty (Photograph: Peter Kelleher, courtesy of V&A images, Victoria and Albert Museum)

Art, earth and environment

Dr Noelle Odling explains how a new Leverhulme artist's residency at the University of Leeds will create dialogues between artistic and scientific approaches to the natural environment.

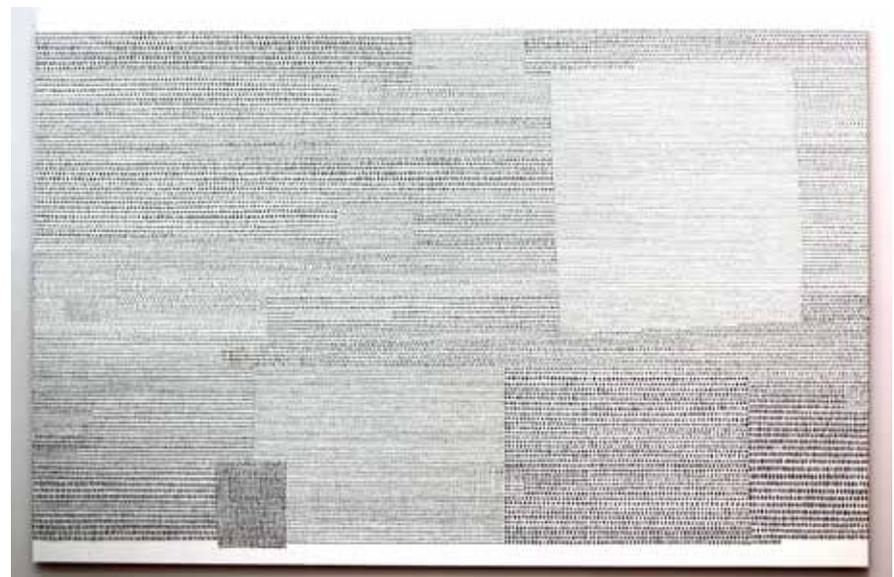
Artist Sue Lawty joins the staff and students of the School of Earth and Environment at the University of Leeds, as Leverhulme Artist in Residence. The central focus of the residency will be to create dialogues between the different approaches to the natural environment employed by the scientific and artistic communities, with the aim of creating shared ground between scientific methodology as practised by staff and students in the School and the creative process generated by the artist.

Sue Lawty is a visual artist investigating individuality and universality: a single thread within a piece of cloth, or a single stone on a beach formed from millions of stones. She works extensively with earth materials (stones, metal, textiles) and associated words to create assemblages and drawings that express the process of creating order from disorder, bringing to light that which is hidden or overlooked. The work quietly draws the viewer in to notice the most subtle of nuances inherent in our world. Her work includes large, meticulous and contemplative drawings made from many minute stones, creating pixelated 'cloths' which engage with subtle nuances and languages in nature. Parallels can be drawn here with the world of

scientific enquiry where scientists collect, compile, order and classify data in order to interpret underlying structure and process, a methodology that lies at the heart of scientific research and student learning in the School.

The residency will provide Sue Lawty with the opportunity to underpin her creative research by furthering her own scientific knowledge, understanding of scientific research methods, and the learning process experienced by the students through collaboration with staff and students and participation in courses and student field trips. As part of the residency, she will initiate

collaborative creative works that reflect the three areas of research and learning in the School: geological sciences, environmental sciences and sustainability, and atmospheric sciences. Through these projects staff and students will have the opportunity to participate in the creation of art works that are rooted in their scientific learning and research. Other initiatives planned as part of the residency include workshops for students, from undergraduate to PhD level, on field sketching methods, and the creation of a blog, which will track residency activities and feature contributions from the artist, students, staff, and external invitees.



ABOVE: Sue Lawty, 'Calculus', natural stone on gesso, 2m x 3m (Photograph: John Coombes)