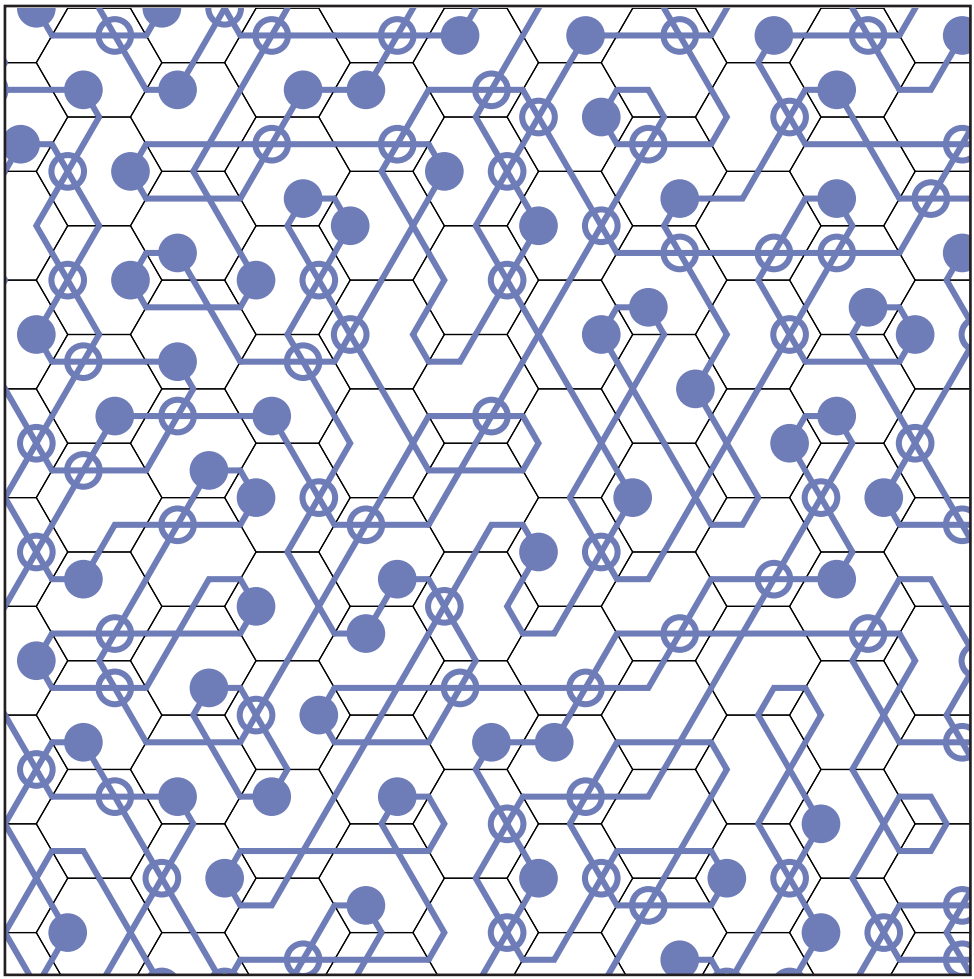
litmuspaper
Daily news from The Times Cheltenham Science Festival
Saturday 16 June 2012

News stories from the festival day 4
Open source science
Douglas Rushkoff on 'Program or be programmed'

World of science



DAY 4: INTERVIEW

Astrobiologist, science writer and presenter Lewis Dartnell spoke to *Litmus Paper* about his event 'Space:3D'

What information can you get from 3D images of the universe that you can't get from 2D images?
The third dimension is depth, and a lot of the examples I'll be talking about [in the event] are cases where it's really important for scientists to have this sense of depth. For example, if you're looking at the sun in 3D – as the stereo space craft now allow us to do – you can see if some kind of eruption from the sun is heading towards the earth. It allows you to track things through space. But many of my other examples are exquisite photographs of the surface of Mars. By using that third dimension, by having these stereo cameras, you can start measuring the depth of canyons and craters and building up what is known at digital terrain models of the landscape, which allows you to work out how that landscape was created.

How do the images from the satellites and probes sent out into space reach us back on earth?
They're beamed back by radio. The spacecraft will have a radio dish or antenna on them, then information is beamed back to a mission control [and] then distributed amongst all the scientists. But what's been happening more recently, which is very exciting, is that very rapidly those raw images as well as the processed images (the refined images) are uploaded almost immediately to websites. So you can be looking at stuff with your own eyes that was only sent back from space last week – almost the same time that scientists are seeing it. There are lot of blogs [by] amateurs discussing these images of Mars at the same time as scientists are churning through them and writing papers and presenting them at conferences.

What might the next step be in terms of imaging the universe?
Looking beyond vision, beyond the 3D, what people are trying to do nowadays is use more and more instruments to work out what it is they're looking at. [They] use things like a spectrometer to work out what mineral they're looking at, and if that mineral was formed under water or maybe was a dry mineral.

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Editors: Lizzie Crouch, Anne Odling-Smee, Anna Perman, Rosie Waldron @ DesignScience

Art Director: Anne Odling-Smee @ DesignScience

Cover design coding: Phillip Kent

Contributing writers
Helen Czerski, Russell Foster, Daisy Ginsberg, Phillip Kent, Catriona Manville (British Library), Rudy Rucker, Douglas Rushkoff, Camila Ruz, Kathy Sykes, Phil Wagner

Volunteer writers
Amanda Hardy, Josh Howego, Louisa Connolly, Chloe Partridge, Harriett Jarlett, Susan Vickers

62 Hatton Garden, London EC1N 8LR
T. +44 (0)20 76311570
info@designscience.org.uk

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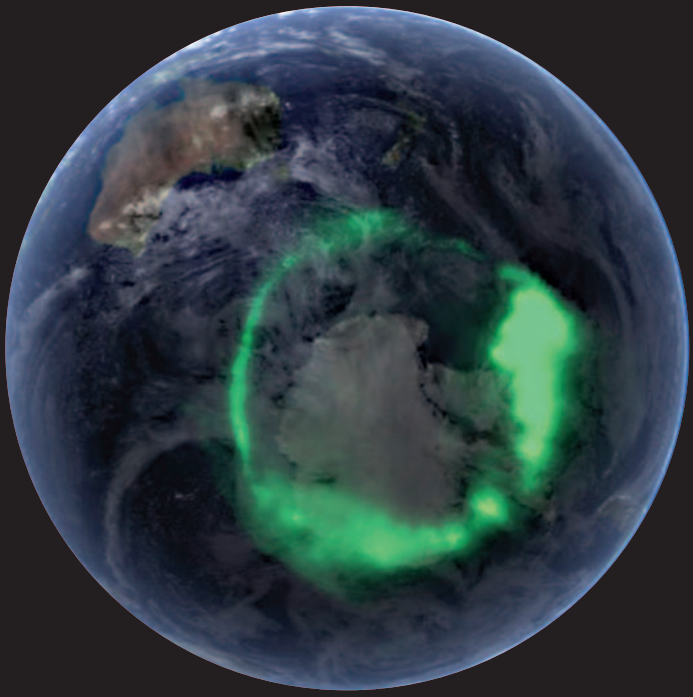
Nightlights

An aurora is a natural light display in the sky, usually seen in the polar regions. In southern latitudes the effect is known as the *aurora australis*, or the Southern Lights. The colourful patterns of aurorae are a result of collisions between charged particles from the sun and gases in the upper atmosphere of the Earth. There is a constant flow of charged particles from the sun, known as the solar wind. This travels at speeds of several hundred kilometres per second and constantly buffets the Earth.

These charged particles are mostly deflected by the Earth's magnetic field. Some particles enter the Earth's atmosphere and accelerate along its magnetic field towards the poles, where they collide with gas particles. The gases in the Earth's atmosphere are ionized and excited by the collision. As they to return to a stable, low energy state they emit energy that we perceive as light.

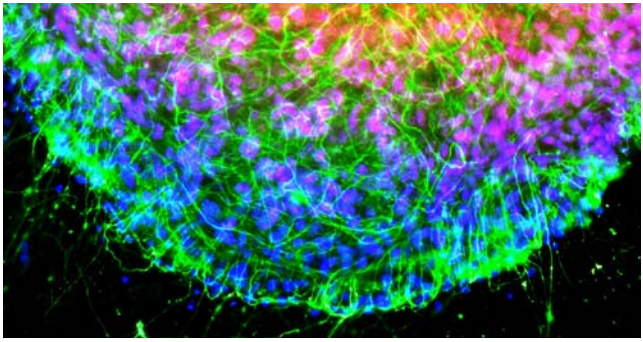


Aurora australis,11 September 2005

Variations in colour are due to the type of gas particles that are colliding. The most common auroral colour, pale green, is produced by oxygen molecules located about 60 miles above the earth. Rare red auroras are produced by high altitude oxygen at heights of up to 200 miles.

Other planets in the solar system have aurorae too, which come in a variety of colours. For instance, Saturn's tend to be red. More recently astronomers discovered that the solar wind isn't the only outflow from the sun. The very high temperatures just above the sun's surface mean that collisions between gas molecules are frequent and explosive. This causes a massive burst of solar wind and magnetic field to be released. This is known as a Coronal Mass Ejection. If these eruptions reach the Earth's atmosphere they can energise the atmospheric gases to intensify and extend the aurora.

Developing alternatives to walking



It is important to get spinal cord injury patients back doing what they love most in life, western Australia's Chief Scientist Lyn Beazley told the audience at *Modern Day Miracles* yesterday. She illustrated this using the story of a young man who rode the first and only motorbike to be modified for someone with severe spinal cord injuries. Every spinal cord injury patient is unique and has their own priorities for rehabilitation. Researchers and clinicians must learn to listen to their patients.

Cambridge neuroscientist James Fawcett agreed, 'Walking again is not a priority for many spinal cord injury patients' he said. He explained how wheelchairs have come a long way and 'unreliable walking can be worse than no walking at all'. Instead, sexual function is the number one priority for many paraplegics (patients with loss of sensation in the legs only), and second on the list for those with no limb movement after hand and arm control.

DNA with a difference

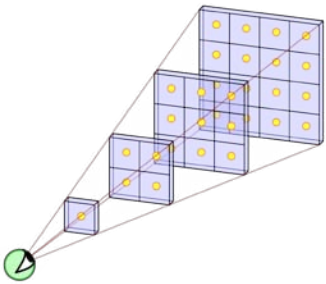
How do you begin to find life in a universe where one hand-sized piece of space in the sky holds over 3,000 potential candidates for life? Shawn Domagal-Goldman, of NASA Goddard Space Flight Centre, has been investigating possible candidates for life in our solar system and beyond. Even more exciting however, is that scientists are now also looking for life which

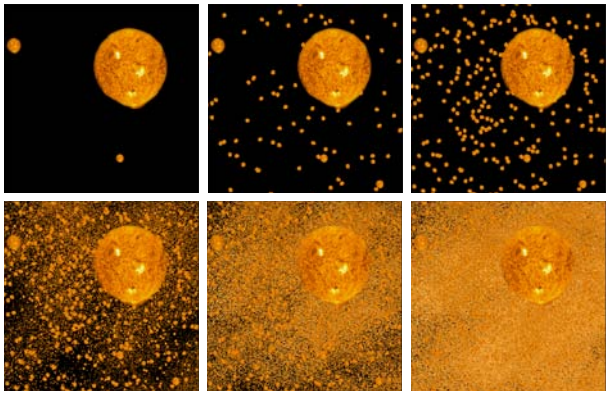
may have a completely different DNA to our own. If these different life sources could be found on Earth then they could potentially be found beyond our solar system. They might give rise, perhaps, to something more alien than we could have imagined.

‘Accepting ageing as natural is inhumane’

‘The way that medicine works at the moment is nuts’, scientist David Gems told the festival on Friday; he was referring to the tendency of doctors to treat individual health problems, but not the ageing process. Gems suggested ageing was the ‘disease’ underlying other conditions. His team at the UCL Institute of Healthy Ageing study the effects of interventions like reducing protein intake or genetic modification on the lifespan of animal models. Many in the audience seemed uncomfortable about the potential implications of this life-extending research. Some were concerned about the environmental impacts of a longer-lived population. Others were interested in the ethical and cultural implications of interfering in something so fundamental to human life, suggesting it was ‘tinkering with the machine’. Gems suggested, however, that this research was no different to finding a solution to diseases like smallpox. ‘Any treatment of any kind is essentially replacing one fatal illness with another’, he said, ‘it hurts as much if you’re a child as if you’re old.’ Gems predicted that in the near future people in their fifties would get a polypill, a cocktail of anti-ageing drugs that would slow the ageing process and allow them to avoid the health problems that come with getting older.

Olber's Paradox





Improbable truths

Theoretical physicist Jim Al-Khalili has written about black holes, neutrinos and science in Islam, and has fronted science programmes on the BBC. *Litmus Paper* talks to him about his new book, *Paradox: The Nine Greatest Enigmas in Science*.

A paradox is a situation where two statements are true but they seem to contradict one another. They are used frequently in science. The most famous is probably Schroedinger's cat, where a cat in a sealed box is simultaneously alive and dead. Jim Al-Khalili finds such experiments useful in teaching physics. 'They get the brain heated up a bit', he says. Al-Khalili divides paradoxes into two groups: *falsidical* and *veridical*. He explains that finding a true paradox is rare; 'a lot of these examples are seen as paradoxes and they're not. They've all got perfectly reasonable explanations.' But to him, that's the beauty of these problems. They show up the things that we thought were true and force us to use our brain to solve a problem. 'You explain it and use logic until the paradox dissolves away.'

FALSIDICAL PARADOXES
In these cases a result is established that not only appears false, but actually is false due to the reasoning itself being invalid. The statements seem as though they cannot possibly be true but there is a subtle trick hidden somewhere in the explanation.

VERIDICAL PARADOXES
Here a seemingly impossible idea turns out to be true when it is worked out logically. For instance, the Birthday Paradox: in a room of 57 people there is a 99% chance that two share the same birthday. Seems ridiculous? With a little mathematical reasoning it turns out to be true. Although this is called a paradox, it isn't paradoxical in the true sense of the word, but simply because it is an outlandish statement that contradicts what we intuitively think.

OLBER'S PARADOX
Why is the night dark? The question seems absurd but the darkness of the night sky conflicts with the assumption of an infinite and eternal static universe. This is known as Olbers' paradox, after the German astronomer Heinrich Wilhelm Olbers. The light from many stars can be seen in the night sky. If the universe is static and made up of an infinite number of stars then the light from all of these stars would eventually reach the Earth. And then every part of the sky would be in view of a star making night as bright as day. But if we assume that the universe is finitely old and expanding as predicted by the Big Bang model then the light from distant stars would not have yet reached Earth.

A universal path to knowledge?

Lizzie Crouch examines how an article published by school children raises questions about CP Snow's *Two Cultures*

Last year at one of the Science Museum's after-hours events, a crowd of adults had gathered around a researcher, captivated as she presented her latest paper. They all stood memorised as she explained how her research team had designed their latest experiment.

This may not sound surprising for a Science Museum event, but there is a twist. Amy O'Toole, on whose words the audience hung, was only ten years old. The research team she spoke so eloquently about consisted of 25 children from Blackawton Primary School whose paper had been published in the Royal Society's *Biology Letters* in April 2011. The great thing about the project was how the children were guided through the design of the research; enticed to ask questions and think their own way through the problem. The children designed, carried out, and wrote up the research almost entirely by themselves.

The publication of the journal article and the process taken to get there seems to contradict aspects of CP Snow's *Two Cultures*. Snow believed that a dangerous gulf was opening between scientific and humanities disciplines; they kept to themselves and formed 'two cultures'. Over 60 years on, Snow's ideas are frequently cited. Increased specialisation within the sciences inevitably leads to a choice of subjects having to be made when going through the education system. These decisions do often separate literary and humanities subjects from the natural sciences.

Mark Lythgoe, co-founder and director of the Times Cheltenham Science Festival, explained that, having fought so hard for equality, we are now afraid to say that people have natural predispositions or skills, such as a natural ability for humanities or sciences. What is a problem, he said, is that the education system does not recognise this and take the responsibility to ensure a more well-rounded education.

The important thing to note, however, is that the pursuit for truth or knowledge is similar across all disciples. Latour and Woolgar noted in their analysis of researchers in the lab that 'there are no significant differences between the search for knowledge that takes place in a laboratory and what happens, for example, in a law court.' The publication of the Blackawton bee research identified this.

There is no difference in the pursuit of knowledge, it is just a matter of allowing people to think in a slightly different way from what they might be used to. Emotionless language and technical jargon might make science appear inaccessible, but anyone is capable of thinking 'scientifically' and understanding what is required of experimentation.

Open sesame!

BRITISH LIBRARY

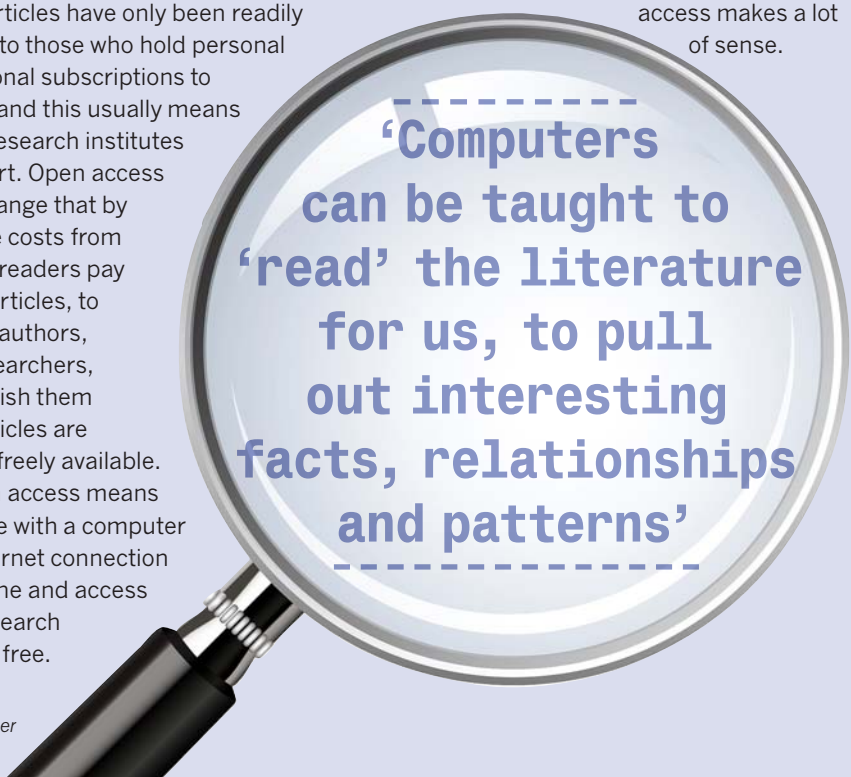
Recently there has been increasing support for journal articles and scientific data to be made freely available. The British Library explores the Open Access movement and its potential consequences.

Imagine for a moment that you read about a recent scientific breakthrough in the popular press – and want to investigate a bit further. You follow the hyperlink from the newspaper's Twitter feed, excited to delve into the figures and data within the original article – only find yourself faced by a pay-wall – £20 for this article. But there is a movement afoot to change things – it's called **Open Access**.

So, what is open access? Traditionally, research articles have only been readily accessible to those who hold personal or institutional subscriptions to journals – and this usually means people in research institutes of some sort. Open access looks to change that by shifting the costs from one where readers pay to access articles, to one where authors, i.e. the researchers, pay to publish them and the articles are thereafter freely available. Thus, open access means that anyone with a computer and an internet connection can go online and access original research articles for free.

A knowledge free-for-all?

This April saw a deluge of newspaper articles[1] about the open access movement, including an article by David Willetts, Minister for Universities and Science, essentially saying that the UK Government backs the move to open access[2]. For the government and research funders, who want to see the greatest possible return on their investment in scientific research, open access makes a lot of sense.



So how do you get to these open access articles? One route is an online open access resource such as **UK PubMed Central** (UKPMC).[3] UKPMC is backed by the major UK and European biomedical and health sciences funders who expect their researchers to make their published research available to the widest possible audience. UKPMC provides a single search portal to enable users to access over 26 million abstracts (summaries) and full articles, covering cutting-edge biomedical and health research from around the world. Whether you are searching for something specific or just browsing – why not give it a go?

Mining for gold

There are many potential benefits provided by open access, some more obvious than others. For example, have you heard about 'text mining'?[4] This describes the way in which computers can be taught to 'read' the literature for us, to pull out interesting facts, relationships and patterns across a large number of articles, something that the average researcher would never have the time to do. This is still in experimental stages but new technologies such as these can be developed when articles are made truly open access.

But does accessible mean understandable? Of course widespread availability of research articles does not always mean that they are easily understood. Like most of us, many scientists will use Google or Wikipedia when reading about a new topic as their first port of call to find an easy-to-understand summary. However, for those of us who do want to look at the very latest research findings, the style and jargon of research articles puts much exciting biomedical research out of reach.

Patients Participate![5] was a project that looked at this very issue. The British Library in partnership with the Association of Medical Research Charities and others, used Patients Participate to bring together patients, public and researchers to explore how best to present new research findings to the public. The project produced an introductory leaflet for those new to the world of research findings, and a set of case studies that highlighted how research charities and publishers are beginning to bridge the gap between access and understanding of online health research information.

Open up your mind!

One recommendation that came out of Patients Participate was that providing an easy-to-understand summary with every research article published would be an important first step towards opening up understanding. Some publishers are already taking the initiative. The Public Library of Science (PLoS) produces ScienceBytes[6], short videos based on recently published studies, and the forthcoming eLife[7] journal is pledging to produce 'text-book summaries' to make its research articles more understandable to a wider audience.

The open access movement is gaining momentum. Open your mind to the possibilities!

1. ukpmc.blogspot.co.uk/2012/05/april-deluge.html
2. researchprofessional.com/media/pdf/Willetts3917.pdf
3. ukpmc.ac.uk
4. guardian.co.uk/science/2012/may/23/text-mining-research-tool-forbidden
5. bl.uk/science-patients-participate
6. sciencebytes.org/
7. elifesciences.org/

Program or be programmed

An extract from Douglas Rushkoff's 2010 publication, *Program or be Programmed: Ten Commands for the Digital Age*

When human beings acquired language, we learned not just how to listen but how to speak. When we gained literacy, we learned not just how to read but how to write. And as we move into an increasingly digital reality, we must learn not just how to use programs but how to make them.

In the emerging, highly programmed landscape ahead, you will either create the software or you will be the software. It is really that simple: Program, or be programmed. Choose the former, and you gain access to the control panel of civilisation. Choose the latter, and it could be the last real choice you get to make.

For while digital technologies are in many ways a natural outgrowth of what went before, they are also markedly different. Computers and networks are more than mere tools: They are like living things, themselves. Unlike a rake, a pen, or even a jackhammer, a digital technology is programmed. This means it comes with instructions not just for its use, but also for itself. And as such technologies come to characterise the future of the way we live and work, the people programming them take on an increasingly important role in shaping our world and how it works. After that, it is the digital technologies themselves that will be shaping our world, both with and without our explicit cooperation.

That's why this moment matters. We are creating a blueprint together – a design for our collective future. The possibilities for social, economic, practical, artistic, and even spiritual progress are tremendous. Just as words gave people the ability to pass on knowledge for what we now call civilisation, networked activity could soon offer us access to shared thinking – an extension of consciousness still inconceivable to most of us today.

But so far, anyway, too many of us are finding our digital networks responding unpredictably or even opposed to our intentions.

Faced with a networked future that seems to favor the distracted over the focused, the automatic over the considered, and the contrary over the compassionate, it's time to press the pause button and ask what all this means to the future of our work, our lives, and even our species.

Only by understanding the biases of the media through which we engage with the world can we differentiate between what we intend, and what the machines we're using intend for us – whether they or their programmers even know it.

The human response, if humanity is going to make this leap along with our networked machines, must be a wholesale reorganisation of the way we operate our work, our schools, our lives, and ultimately our nervous systems in this new environment. Like the participants of media revolutions before our own, we have embraced the new technologies and literacies of our age without actually learning how they work and work on us. And so we, too, remain one step behind the capability actually being off ered us. Only an elite – sometimes a new elite, but an elite nonetheless – gains the ability to fully exploit the new medium on offer. The rest learn to be satisfied with gaining the ability offered by the last new medium. The people hear while the rabbis read; the people read while those with access to the printing press write; today we write, while our techno-elite programs. As a result, most of society remains one full dimensional leap of awareness and capability behind the few who manage to monopolise access to the real power of any media age.

Meanwhile, we tend to think less about how to integrate new tools into our lives than about how simply to keep up. Businesses throw money at social networks because they think that's the way to market in a digital age. Newspapers go online less because they want to than because they think they have to – and with largely disastrous results. Likewise, elementary school boards adopt 'laptop' curriculums less because they believe that they'll teach better than because they fear their students will miss out on something if they don't. We feel proud that we're willing to do or spend whatever it takes to use this stuff – with little regard to how it actually impacts our lives. Who has time to think about it, anyway?

We are living through a real shift – one that has already crashed our economy twice, changed the way we educate and entertain ourselves, and altered the very fabric of human relationships. Yet, so far, we have very little understanding of what is happening to us and how to cope. Most of the smart folks who could help us are too busy consulting to corporations – teaching them how to maintain their faltering monopolies in the face of the digital tsunami. Who has time to consider much else, and who is going to pay for it?

Most of society remains one full dimensional leap of awareness and capability behind the few who manage to monopolise access to the real power of any media age.

It's a conversation that needs to be started now. To most of us, though, that 'click'still feels the same, even though the results are very different. We can't quite feel the biases shifting as we move from technology to technology, or task to task. Writing an email is not the same as writing a letter, and sending a message through a social networking service is not the same as writing an email. Each of the acts not only yields diff erent results, but demands different mindsets and approaches from us. Just as we think and behave differently in different settings, we think and behave differently when operating different technology.

Only by understanding the biases of the media through which we engage with the world can we differentiate between what we intend, and what the machines we're using intend for us – whether they or their programmers even know it.

www.rushkoff.com/program-or-be-programmed

'Program or be programmed' is downloadable as an e-book at www.orbooks.com/catalog/program

Today's cover by Phillip Kent

Issue 3's Vitruvian Man forms the 'centre of symmetry' of the covers sequence. Therefore covers 4 and 5 will reflect covers 2 and 1, as variations on the same design concepts. Today's cover returns to the hexagonal tiling of cover 2, however the tile pattern is changed so that the feel becomes linear and angular instead of sinuous. Working with images generated by programs is an interesting experience in 'themes and variations', systematic, yet chance generates results that are both unpredictable and useful; each program has a life of its own. As usual, the interactive version of this cover is at www.design-science.org.uk/litmus-paper, offering a richer experience of the design.

phillip.kent@gmail.com

Today's free activities

DISCOVER ZONE

Town Hall 10am – 5pm

For all ages, the Discover Zone is open every day of the Festival, and gives kids the perfect opportunity to get hands-on with interactive technology and experiments.

cheltenhamfestivals.com/discoverzone

SAFRAN Messier-Bugatti-Dowty GE imagination at work

BBC SCIENCE ZONE

Imperial Gardens, all day

For all ages, the BBC Science Zone gives you the opportunity to meet the production teams and presenters responsible for some of your favourite BBC science programmes, explore the content further, get hands-on with science.

For the full programme visit cheltenhamfestivals.com/bbc-science-zone

CHELTENHAM EDITIONS

Imperial Gardens, all day

Want a taste of the Festival? Want to hear some mind-blowing ideas? For just £3 per event you can hear some of the most inspiring speakers the Festival has to offer in our bite-size 15 minute sessions.

For the full programme visit cheltenhamfestivals.com/cheltenhameditions

FAMILY FUN DAY

Imperial Gardens 11am – 4pm

The Festival weekend is packed with exciting free activities for all ages at our family fun day. Make your own pinhole camera, create a cure for the worlds nastiest diseases, make bouncy balls, make your own jewellery and more!

SCIENCE STORY ZONE

Queen's Hotel 11am – 4pm

For under 7s, six interactive zones, each with their own inspiring story. The Science Story Zone is for young children to explore science by looking, touching and carrying out simple experiments.

LEGO® EDUCATION ZONE

Imperial Gardens 11am – 5pm

Get involved a building challenge and help create the Green City of the Future. Build the Change is designed for children and parents as an opportunity to envision, design and share the change you want to see for your city. There will be a competition to showcase your creations with the opportunity to win LEGO® Education resources for your local school.

A DUPLO Zone is also available inside the marquee for younger children. Sessions last 1hr

LEGO education

EDF ENERGY ZONE

Imperial Gardens, 11am – 6pm

Come to the EDF Energy Zone to pick up the Energy Trail quiz forms with a chance to win tickets to the Olympics. Stop a while to visit the fascinating interactive exhibits exploring the world of energy.

EDF ENERGY

GE PAVILION

Imperial Gardens 11am – 6pm

The GE team are offering lots of things to do and see for all ages including a Caterham Formula 1 racing car, the hugely popular flight demonstrator, a model of the first jet engine and much more!

GE imagination at work

AREA 42

Imperial Gardens 12pm – 8pm

For over 16s, Area 42 is the Discover Zone just for adults. See and get hands-on with some of the best cutting edge research and technology science and engineering have to offer.

cheltenhamfestivals.com/area42