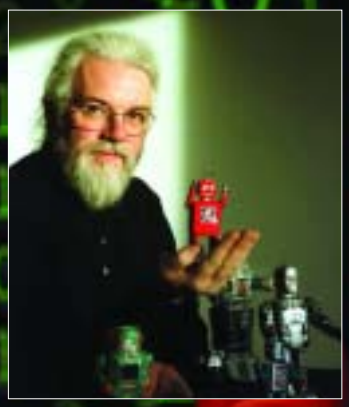
CS4FN

Computer Science for Fun

Issue 3



How Madonna crashed the Internet

The Maths of the Matrix

Interview with Robot Wars Noel Sharkey

Special Issue on

Computer Science and Entertainment

The magazine about the fun side of computer science

Welcome to the third issue of cs4fn where we take a Computer Science look at Entertainment. Of course we think that Computer Science is fun in itself – after all we do it for a hobby as well as a job, but Computer Science's touch pervades the way everyone has fun. The most visible link is in the film industry where the computer generated imagery used is based on leading edge research in computer graphics and artificial life (page 4). Pop concerts and TV shows like Big Brother can be streamed live round the world thanks to computer science, though see how Madonna crashed the Internet (page 8) in the early days. Listen to your iPod or other MP3 player or use your mobile phone and you will almost certainly be using a RISC chip – a technology that helped power the personal entertainment revolution (see page 17). Support for printing this issue has been kindly given by both Microsoft and ARM the leading designer of RISC technology. The next step in the mobile revolution is wearable computing - clothes with computing power – so if fashion is your hobby, computer science is soon going to play a part.

We also have an exclusive interview with Noel Sharkey, Professor of Computer Science and judge on the cult TV shows Robot Wars and TechnoGames (page 10).

Also don't forget to have a go at our BrainAcademy competition which this year is about entertainment. There are still University places up for grabs, but this year there are prizes for those who aren't about to apply to Univeristy – iPod nanos donated by ARM and the chance to visit our Augmented Human Interaction Lab which includes a motion capture system (see the Maths of the Matrix).

Music to your ears

Making music has always been a social thing. People play in bands or orchestras, and even composers often work in pairs like the Beatle's Lennon and McCartney, Rolling Stones Mick Jagger and Keith Richards or Neil Tennant and Chris Lowe of the Pet Shop Boys.

Up till now playing or composing in groups has tended to need the people concerned to be in the same place at the same time. That used to be the case for people working together as well. The Internet and mobile phones have changed all that though. Networked games allow people to play together without ever meeting too. So if we can both work and play together in groups across continents, what about making music? What kind of instruments would allow people to work creatively and compose together, and what kind of music would you get?

Daisyphone, is a new way of finding out that you can take part in. Its floral dot-to-dot design lets people play loops of music together, continually adapting the loop depending on the sound and on what others do. You can all see and hear what the others taking part do, wherever in the world they are. It is also very visual – you can hear the patterns you doodle, or even what your name sounds like. It was developed as part of a research project at Queen Mary that is also exploring the collaborations of jazz musicians jamming and how their creative intensity can be captured online, but it is freely available for anyone to use.

So give it a go, learn to play a new group instrument, exploring the emerging world of online group creativity and maybe make some new musical friends at the same time.

Visit www.dcs.qmul.ac.uk/cs4fn/music

You can hear the patterns you jointly doodle

In this issue:

In the cs4fn webzine

- more interactive games and puzzles, quizzes and votes
- a cs4fn beginners guide to computer science
- the computer mathemagician that can read your mind

Never a crossword

Is access to Google the same as having great intelligence? Some people think so. The Internet could give computers the vast amount of everyday knowledge that forms the basis of our intelligence. The web is not only a giant store of human knowledge but is also self-updating in that a computer making use of it doesn't need to worry about keeping it's knowledge up to date. If crosswords are anything to go by then there may be some truth in it. Solving a crossword is a task that needs human level knowledge, but a new program called WebCrow (webcrow.dii.unisi.it) developed by researchers at the University of Sienna in Italy successfully uses Google to help it answer crossword clues. It brings together several areas of computer science: Artificial Intelligence, search engines, information retrieval and machine learning techniques. As a result it is already better than most undergraduates at solving crosswords. It gets 80% of all words right inside a quarter of an hour. It can also do them in any language.

3 across: to cook a small fish [3]

So you can get a long way doing intelligent sounding tasks just by Googling blindly, but it isn't everything. WebCrow still has trouble with general questions where there are very many possible answers. There is more to human intelligence than knowing facts, so having Google at your fingertips doesn't mean the end of school. Having facts isn't the same as having skills or wisdom – the real aim of learning.

Crosswords helped the war effort

Intelligence is a tricky thing to tie down, though crosswords have a history of being used to indicate intelligence. In World War II British 'Intelligence' even used the ability to do the Times crossword as a recruitment tool – for the people they needed to help crack the German codes working with the very first computers.

A funny thing happened on the way to the computer

Laugh and the world laughs with you they say, but what if you're a computer. Can a computer have a 'sense of humour'? Try our joke 'Turing Test':

Can you tell which joke is written by a human and which by a computer program (called JAPE) Have your vote on the cs4fn website.

Lacking a sense of humour? WebCrow has trouble with puns too ... perhaps it needs to be introduced to JAPE, the joke telling computer (see box)

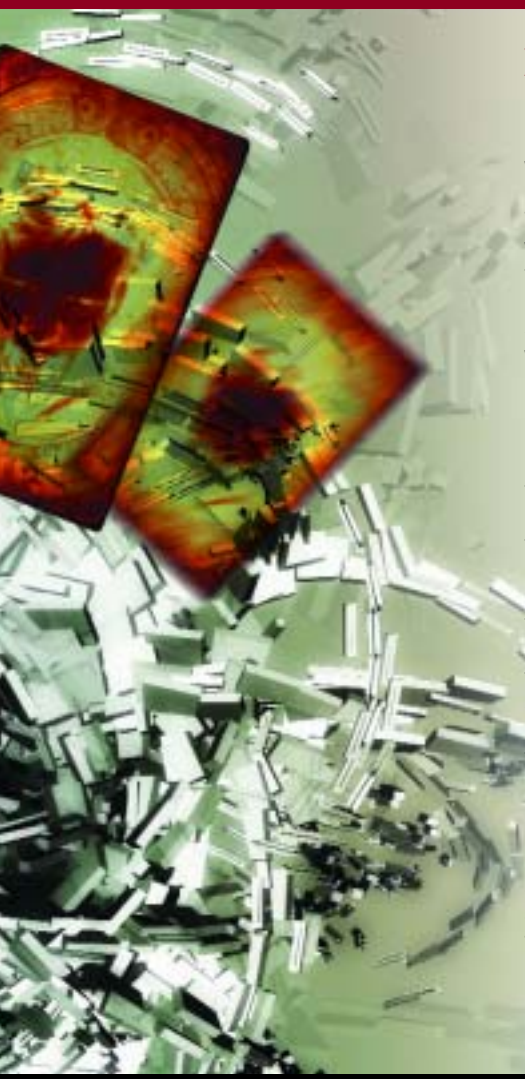
Join the Space Invader Experiment

The first results from the cs4fn SpaceInvaders experiment, that you can take part in, are out. It's a version of the classic Spaceinvaders game with a human error twist. The program, written by Queen Mary student, Rob Dann, contains opportunities to make errors that lead to you losing all your points: forgetting to reactivate your gun after rescuing an astronaut.

Our Spaceinvader participants usually avoided making the error as expected, but sometimes they did make it even with the strong motivation not to. Also players were much more likely to make the mistake if it took longer than usual to complete an astronaut rescue. This all helps us understand how to design other interactive systems in a way that reduces the chance of people making mistakes: vitally important in situations where lives are at stake such as in the way cockpits are designed. We can only design better systems if we understand more about the situations where people are most likely to make mistakes in the first place. cs4fn Spaceinvaders is a fun way to help us find out.

What we need now is for people to play the game ideally all the way to level 6…and then to come back and play again at a later time. That way we will be able to see if people are more or less likely to make errors from gaming session to gaming session.

Go to www.dcs.qmul.ac.uk/cs4fn/humanerror/spaceinvaders.html if you want to take part.



Hogwarts magic?

Dragons, floating candles, talking portraits, house elves, Hippogriffs and even werewolves, such are the magical and mythical contents of Hogwarts school. The Harry Potter movies have been a worldwide success. Amazing when you think they all started in the fertile imagination of author JK Rowling as she sat in a café in Edinburgh. So how have the wonderful magical creations written on the page been able to spring to life to amaze Harry, Ron and Hermione. Muggles without magical talent turn to the computer to make the pages come alive, and with today's astonishing computer graphics it's possible to turn magic and imagination into film reality.

Computer graphics imagery, or CGI, is at the heart of many of today's most popular movies, from Harry Potter to Spiderman, from Mission Impossible to the Matrix and beyond. Sometimes they create the impossible like the Hippogriff. Sometimes they allow actors to do impossible things by replacing the real actor with a digital copy, called a synthespian.

CGI for movies often makes use of cutting edge computer science research. For example the genesis wave in Star Trek 2: The Wrath of Khan was the first time so called particle systems were used: a method of modelling natural phenomena like fire by hundreds of interacting parts.

The watery aliens in James Cameron's the Abyss were produced using new computer modelling methods to create realistic water shapes, and the animal stampede in The Lion King cartoon, made use of models of herding behaviours in real animals to make it frighteningly realistic. Often the computer scientists working on these films use their results in scientific papers, which they present at scientific conferences. What we see on the screen as movie magic today is frequently in fact the state of the art in computer science research. More recent films like the Pirates of the Caribbean: The Curse of the Black Pearl, The Chronicles of Narnia: The Lion, the Witch and the Wardrobe, King Kong, and War of the Worlds would not have been the smash hits they were without their stunning computer graphics.

The importance of research into new and better CGI has been part and parcel of the success of filmmakers like George Lucas, Steven Spielberg and Peter Jackson. For example, George Lucas set up his own computer graphics research laboratory called Pixar to ensure his films can benefit from new and previously unseen special effects on screen. Most of the people working in this company have PhD's in computer science, and it's their creativity and hard work along with those like them who help put the Magic into Hogwarts.

The maths of the Matrix

In the hit movies series 'The Matrix' the heroes and villains undertake spectacular fight sequences, on the ground, in the air and even on busy motorways. The film called on some state-of-the-art special effects to take the movements of actors and seamlessly put them into the picture or replace them with computer-generated doubles. At the heart of these effects is the ability to 'capture' human motion. That is to be able to exactly record how the actors' body, face and hands move. With this information special effects wizards can apply the motions to computer generated 'puppets', such as the loathsome Golem in the Lord of the Rings films, King Kong or even Clone Troopers in Star Wars. With the advent of new ways to capture actors movements, quicker and better ways to produce increasingly realistic computer graphics, and super fast computer hardware to do all the calculations, film making today is limited only by the filmmakers' imagination and budget.

How do motion capture systems work? These systems need to be able to find the positioning of parts of the actors body accurately as they move round, and the principle they often use is as old as the hills. In days of yore when people wanted to find the distance to an object, such as a ship at sea or the target for a cannon ball, they would use trigonometry. Yes it's all done with school maths: sines, cosines and tangents. Suppose you had two lookouts a known distance apart on two hilltops. If each lookout could see the 'target' and measure the angle to that target, then some simple trigonometry, the law of sines, would give you the distance. This process was known as triangulation, as the two lookouts and the target form the three corners of a triangle, and the laws of triangle geometry give you the answer you need.

Surveyors still use the same method to make the accurate maps used for in-car navigation systems. Satnav systems work out positions from satellites — 21st century navigation only exists thanks to simple trig.

Jump forward to motion capture

You may have seen 'behind the scenes' DVD extras on 'The making of...' movies where the actors jump around wearing lycra bodysuits covered with small reflective bobbles on stage. This isn't a fashion statement, its just triangulation for the 21st century (see the 'Maths of the Matrix). The 'bobbles' on the suits provide 'landmarks'. They are just something obvious to look for. Around the studio are multiple cameras that can track the position of the bobbles. Cameras work in pairs (sometimes more) to calculate the distance by triangulation to the body landmarks they can see. As the actors move they recalculate the distances to producing a track of how that landmark has moved over time.

So what happens when a camera looses track of a landmark? For example the actor might turn away. The answer is simple. There are enough cameras looking into the area that at least two will always be able to see each of the bobbles wherever they are. It's like having ten or twenty lookouts stationed around the place, each keeping an eye on a different part of the studio.

Clearly there's a lot of calculations to do, hundreds of triangulations per second using some clever maths and geometry. Getting accurate motion from, for example, people's faces means even more markers need to be added (normally with a special gum that sticks them to the actors face!). The computer software is able to put together all the data from the different triangulations to measure the actor's movements, which is normally displayed on a 'stick man' graphic so the director can see what's been captured. Once the motion sequence is in the computers it can be used to operate a virtual graphics puppet (called an avatar) to replace the actor or allow the avatar to interact with other graphics generated characters in a scene in a movie or computer game.

Motion capture can also be used in sports, to see how well athletes are performing, in medicine to detect problems in how people walk or move, and in engineering to see how people move for example in a new design for a car. There is also work underway to use motion capture to try and understand how people interact with one another in group conversations and meetings, so psychologists can benefit from using this 'Movie magic' too.

What's been described above is called optical motion capture, as the cameras 'see' the landmarks, but some motion capture systems work with magnetic markers, some work with sound, using acoustic signals like a sonar to find the distances, and some even strap the poor actors into a mechanical 'rig' to measure how their body moves. Whatever technology is used the software does the schoolkid sums to produce the motion sequence to let the movie magic happen. Quite moving in its simplicity really.

Werewolf Bobble Hats

To animate the werewolf in the Dr Who episode "Tooth and Claw" the actor had to wear a hat containing a bobble on a stick to mark the top of his head, as the werewolf was so much taller than the actor was. It also helped the other actors look in the right place and meant the actor knew when to duck as he went through doors.

If you love Dr Who or read our predictions about the viral marketing of the 2006 series of Dr Who, you might be interested in www.visittorchwood.co.uk/ ... the Ice Cream sounds yummy!

Swat a way to drive

Flies are small, fast and rather cunning. Try to swat one and you will see just how efficient their brain is, even though it has so few brain cells that each one of them can be counted and given a number. A fly's brain is a wonderful proof that, if you know what you're doing, you can efficiently perform clever calculations with a minimum of hardware. The average household fly's ability to detect movement in the surrounding environment, whether it's a fly swat or your hand, is due to some cunning wiring in their brain.

Speedy calculations

Movement is measured by detecting something changing position over time. The ratio distance/time gives us the speed, and flies have built in speed detectors. In the fly's eye, a wonderful piece of optical engineering in itself with hundreds of lenses forming the mosaic of the compound eye, each lens looks at a different part of the surrounding world, and so each registers if something is at a particular position in space.

All the lenses are also linked by a series of nerve cells. These nerve cells each have a different delay. That means a signal takes longer to pass along one nerve than another. When a lens spots an object in its part of the world, say position A, this causes a signal to fire into the nerve cells, and these signals spread out with different delays to the other lenses' positions.

The separation between the different areas that the lenses view (distance) and the delays in the connecting nerve cells (time) are such that a whole range of possible speeds are coded in the nerve cells. The fly's brain just has to match the speed of the passing object with one of the speeds that are encoded in the nerve cells. When the object moves from A to B, the fly knows the correct speed if the first delayed signal from position A arrives at the same time as the new signal at position B. The arrival of the two signals is correlated. That means they are linked by a well-defined relation, in this case the speed they are representing.

Do Locusts like Star Wars?

Understanding the way that insects see gives us clever new ways to build things, and can also lead to some bizarre experiments. Researchers in Newcastle showed locusts edited highlights from the original movie Star Wars. Why you might ask? Do locusts enjoy a good Science Fiction movie? It turns out that the researchers were looking to see if locusts could detect collisions. There are plenty of those in the battles between X-wing fighters and Tie fighters. They also wanted to know if this collision detecting ability could be turned into a design for a computer chip. The work, part-funded by car-maker Volvo, used such a strange way to examine locust's vision that it won an Ig Nobel award in 2005. Ig Noble awards are presented each year for weird and wonderful scientific experiments, and have the motto 'Research that makes people laugh then think'. You can find out more at http://improbable.com

Car Crash– who is to blame?

So what happens when we start to use these insect 'eye' detectors in cars, building smart cars with the artificial intelligence (AI) taking over from the driver to avoid hitting other things? If we do build cars with fly or locust like intelligence, which avoid accidents like flies avoid swatting or can spot possible collisions like locusts, an interesting question arises. Suppose an accident does happen. Who's to blame? Is it the car driver- are they in charge of the vehicle? Is it the AI to blame? Who is responsible for that: the car manufacturers? Is it the computer scientists who wrote the program? What will insurance companies decide? As computer science makes new things possible society will need to decide how to deal with them. Unlike the smart cars, these decisions aren't something we can avoid.

Picture This? JPEG It!

Looking at a picture from your digital camera or a digital movie, it's all just 11001100011– hardly inspiring, and I don't really see what it means!

The human brain is thought to have around half its volume given over to making sense of vision. A surprising fact perhaps, but it just goes to show how hard understanding the world we see around us is. Scientists the world over are interested in vision. We can try to understand it by looking at the biology of the brain. We can do experiments to try and measure how we go from the image in our eyes to being able to understand what we look at. Computer scientists can also try to build machines that can 'see' to give insight into the way human's do it. If half your brain is needed to see then you can be sure that some fairly hefty calculations are going on in your 'little grey cells' and its making use of lots and lots of information.

Information, or data, is something that computer scientists respect. The amount of data needed to accomplish a task determines the amount of calculation needed, and calculations cost, both in the time taken and in the hardware used. The brain obviously does it pretty well. So when computer scientists looked at the problem of making a movie or TV show take up the least possible space on your computer, or of using the least possible amount of data to be transmitted, it's not surprising that they looked to their brains for help.

See it the psychologists way

Psychologists had discovered that human observers are very sensitive to changes in the amount of light in an image (called the luminance), but less so to the changes in colour. This is because our eyes (which turn the light waves from what we are looking at into nerve signals on the retina at the back of your eyes) have two sets of detectors. One is for measuring the amount of light and a separate set help measure the colour of the light. It turns out there are less colour detectors. So when we look at what data we can remove from the image, represented as a stream of ones and zeros, we choose changes in colour. If we make this reduction, by putting in less colour information, our brains don't miss it. Meddle with the luminance and we pick it up easily.

We can throw out some colour and our brains don't notice, but psychologists tell us there are some other things we can remove too. We often hear that people don't bother to read the 'small print' in contracts, or that a 'small detail' was easily overlooked. Well our brains do the same with everything we see. Our brains can't read the 'small print' in images. We can take any image and through some clever maths turn it into a 'top ten' of detail. At number one is the pattern of big changes of light over the image, and way down the list are the pattern of how smaller changes in light affect the image. This 'top ten' is called the spatial frequency spectrum of the image. It tells us what patterns at different levels of detail add together to make the original. So with this knowledge we can decide that our image only needs say the top five, and remove the other lower chart (spectrum) entries. Turns out that again our brains won't miss the data. We don't notice it much, so like colour some levels of detail can be reduced.

Leave it Out?

This 'removing things we won't notice' idea is what makes JPEG images work. We can reduce the data for an image by reducing the way we calculate colour changes and changes in level of detail. We can apply these ideas to little blocks of the images. So we take the whole image and break it into bits, and we cut down the data in each bit using our understanding of the brain. What we end up with is not an image but a set of instructions on how to build the image. We send the instructions and when the computer receives them it uses a 'codex', a small program that knows how to turn the instructions for each block into a picture, to recreate the original (well not quite the original but our brains are sufficiently fooled). We can take this removal to the extreme if we want really small amounts of data, or high data compression, but eventually our brains will notice. So it's about understanding what level of removal our brains won't miss and fixing the minimum amount of data the computer wants to handle. As always it's a trade off, but this trade off is smart.

Streaming big brother

The Big Brother TV show is frighteningly popular, the chance to watch the housemates 24/7 as they do their tasks, bicker and even …sleep. While the housemates are at the mercy of TV producer, Big Brother, behind the scenes the viewer has a new freedom to decide when or where they watch the show. This ability to send video to mobile phones and over the Internet has changed the way people want to watch TV. As the next generation of video mobile phones and the networks capable of sending the signals come on line we will see more TV shows becoming mobile 24/7 digital events. Behind this new TV technology there is some clever computer science. Video signals are big; they have lots of data, both moving pictures and sound. So scientists have had to come up with some clever ways to cut down on the amount of data they send without you noticing. If you want to know how this sneaky trick is done you can read all about it in the cs4fn webzine. For starters, a simpler problem is to learn some tricks with stills (see below). Computer scientists have also had to make sure that popular web broadcasts like Big Brother evictions don't overwhelm the Internet. It wasn't always so. You can read how singer Madonna 'killed' the Internet a few years ago on page 8. Whatever TV producers come up with in the future, as your enjoy the show remember its computer science that's really behind the scenes pulling the strings.

So the next time you're looking at a digital image think how JPEG is playing tricks on you to create the illusion. What you see is all just 11001100011. The same tricks and more are played when you watch a movie. Go to the webzine to find out more.

Die another Day? Or How Madonna crashed the Internet

When pop star Madonna took to the stage at Brixton Academy in 2001 for a rare appearance she made Internet history and caused more that a little Internet misery. Her concert performance was webcast; that is it was broadcast real time over the Internet. A record-breaking audience of 9 million tuned in, and that's where the trouble started...

The Internet's early career

The Internet started its career as a way of sending text messages between military bases. What was important was that the message got through, even if parts of the network were damaged say, during times of war. The vision was to build a communications system that could not fail; even if individual computers did, the Internet would never crash. The text messages were split up into tiny packets of information and each of these was sent with an address and their position in the message over the wire. Going via a series of computer links it reached its destination a bit like someone sending a car home bit by bit through the post and then rebuilding it. Because it's split up the different bits can go by different routes.

Express yourself (but be polite please)

To send all these bits of information a set of protocols (ways of communicating between the computers making up the Internet) were devised. When passing on a packet of information the sending machine first asks the receiving machine if it is both there and ready. If it replies yes then the packet is sent. Then, being a polite protocol, the sender asks the receiver if the packets all arrived safely. This way, with the right address, the packets can find the best way to go from A to B. If on the way some of the links in the chain are damaged and don't reply, the messages can be sent by a different route. Similarly if some of the packets gets lost in transit between links and need to be resent, or packets are delayed in being sent because they have to go by a round about route, the protocol can work round it. It's just a matter of time before all the packets arrive at the final destination and can be put back in order. With text the time taken to get there doesn't really matter that much.

The Internet gets into the groove

The problem with live pop videos, like a Madonna concert, is that it's no use if the last part of the song arrives first, or you have to wait half an hour for the middle chorus to turn up, or the last word in a sentence vanishes. It needs to all arrive| in real time. After all, that is how it's being sung. So to make web casting work there needs to be something different, a new way of sending the packets. It needs to be fast and it needs to deal with lots more packets as video images carry a gigantic amount of data. The solution is to add something new to the Internet, called an overlay network. This sits on top of the normal wiring but behaves very differently.

The Internet turns rock and roll rebel

So the new real time transmission protocol gets a bit rock and roll, and stops being quite so polite. It takes the packets and throws them quickly onto the Internet. If the receiver catches them, fine. If it doesn't, then so what? The sender is too busy to check like in the old days. It has to keep up with the music! If the packets are kept small, an odd one lost won't be missed. This overlay network called the Mbone, lets people tune into the transmissions like a TV station. All these packages are being thrown around and if you want to you can join in and pick them up.

It's like someone sending a car bit by bit through the post... different bits can go by different routes

Crazy for you

The Madonna webcast was one of the first real tests of this new type of approach. She had millions of eager fans, but it was early days for the technology. Most people watching had slow dial-up modems rather than broadband. Also the number of computers making up the links in the Internet were small and of limited power. As more and more people tuned in to watch, more and more packets needed to be sent and more and more of the links started to clog up. Like dozens of cars all racing to get through a tunnel there were traffic jams. Packets that couldn't get through tried to find other routes to their destination … which also ended up blocked. If they did finally arrive they couldn't get through onto the viewers PC as the connection was slow, and if they did, very many were too late to be of any use. It was Internet gridlock.

Like dozens of cars all racing to get through a tunnel there were traffic jams. It was Internet gridlock.

Who's that girl?

Viewers suffered as the pictures and sound cut in and out. Pictures froze then jumped. Packets arrived well after their use by date, meaning earlier images had been shown missing bits and looking fuzzy. You couldn't even recognise Madonna on stage. Some researchers found that packets had, for example, passed over seven different networks to reach a PC in a hotel just four miles away. The packets had taken the scenic route round the world, and arrived too late for the party. It wasn't only the Madonna fans who suffered. The broadcast made use of the underlying wiring of the Internet and it had filled up with millions of frantic Madonna packets. Anyone else trying to use the Internet at the time discovered that it had virtually ground to a halt and was useless. Madonna's fans had effectively crashed the Internet!

Webcasts in Vogue

Today's webcasts have moved on tremendously using the lessons learned from the early days of the Madonna Internet crash. Today video is very much a part of the Internet's day-to-day duties: the speed of the computer links of the Internet and their processing power has increased massively; more homes have broadband so the packets can get to your PC faster; satellite uplinks now allow the network to identify where the traffic jams are and route the data up and over them; extra links are put into the Internet to switch on at busy times; there are now techniques to unnoticeably compress videos down to small numbers of packets, and intelligent algorithms have been developed to reroute data effectively round blocks. We can also now combine the information flowing to the viewers with information coming back from them so allowing interactive webcasts. With the advent of digital television this service is now in our homes and not just on our PC's.

Living in a material world

It's because of thousands of scientists working on new and improved technology and software that we can now watch as the housemate's antics stream live from the Big Brother house, vote from our armchair for our favourite talent show contestant or 'press red' and listen to the director's commentary as we watch our favourite TV show. Like water and electricity the Internet is now an accepted part of our lives. However, as we come up with even more popular TV shows and concerts, strive to improve the quality of sound and pictures, more people upgrade to broadband and more and more video information floods the Internet … will the Internet Die another Day?

Robot Wars: Interview with Noel Sharkey

The television shows, Robot Wars, and its less destructive spin off, TechnoGames were extraordinarily popular and still have massive cult followings. In Robot Wars teams of contestants build their own remote controlled robots, which then attempt to shove, smash or otherwise destroy each other, ably assisted by the show's house robots, Shunt, Matilda, Dead Metal, Sergeant Bash, and Sir Killalot. In Techno Games teams built robots to compete in Olympic type events such as swimming, rope climbing, and javelin throwing – a little like a robot version of our Sodarace (see page 13). The shows have a lot in common, robots obviously, both were produced by Stephen Carsey then at Mentorn TV, and both had human judges to ensure fair play. One of the most popular

judges on both was Professor Noel Sharkey of the University of Sheffield. His research background in robotics and his easy-going sense of humour made him a favourite with viewers. We caught up with a very busy Noel who agreed to do an exclusive interview for cs4fn.

What was it like working on robot wars and TechnoGames?

It was an amazing experience. The most exciting aspect was that it opened a window of communication for me with the public and allowed a dialogue about science and engineering. It also gave me a chance to really get to understand how TV works. Over 16 series of Robot Wars (including the international ones not seen here) I had the opportunity to spend time with camera operators, lighting people, sound engineers, producers, directors and a variety of presenters. Of course I enjoyed the competitions as well - especially TechnoGames. Many of the competitors were such creative engineers it was a sharp learning curve for me.

What was your most successful moment on Robot Wars?

The greatest moment that stands out for me was a kid's Robot Wars made specially for Nickelodeon in the USA. I had long been arguing with the producers about changing the immobilisation rule. That is, if even one motor stops working for at least 30 seconds, the robot is considered to be immobilized and it automatically looses. For me immobilized means that the robot has lost its mobility but I was unsuccessfully putting pressure on the production team to change the rule.

Anyway, the wheels on this kid's robot stopped turning in the middle of the competition and the house robots were sent in to finish it off. This started one of the funniest and most gratifying chases that I have ever seen. The robot had two lifting spikes at the front and it used these like crutches to hobble round. What was so good was that it managed to completely evade the house robots for twenty minutes and one of them ended up in the pit. My face said it all when the producer came to talk to me about it and the immobilisation rule was changed.

Do you think that robots have a future as TV celebrities themselves hosting game shows just like the Dr Who version of the Weakest Link?

Yes, I don't think that it would be too speculative to have a robot TV presenter. I actually worked on a kids TV programme with a robot presenter a year ago but the BBC decided not to commission it - they have really turned sour towards robots. As I said in my pitch at the time, a robot is perfect as a presenter as the main job of many presenters is to read an auto-cue while following a set route on the floor and looking into the correct camera. The robot would have no trouble remembering its lines and it will exactly follow the route that it is told to. The real issue is in giving it a personality.

You designed an emotional robot - can robots ever really have emotions?

There are a number of gestural or expressive robots around at present that can convey some of the language of human

emotion. There are basically five emotions that everyone on the planet (without some mental affliction) agrees upon and can recognise: angry, sad, happy, disgusted and surprised. If you mix this with a chatty robot it will look quite convincing. But expressing emotion and feeling emotion are quite different things for a machine. I personally can't see how an inorganic object will ever feel or be aware of anything. There is a very long and technical argument behind what I am saying but I don't want to bore your readers senseless.

How did you become a Science celeb?

That is like a trick question. I don't view myself as a science celeb or any other kind of celeb (although I desperately wanted to be a famous rock guitarist in my youth). My passion is to communicate some truths about science and engineering to the general public that we should all know. I am just really lucky to have had the opportunity of a little TV fame to help me on my mission.

If someone wanted a career designing and building robots how would they go about it?

The standard answer is to take engineering, science and maths subjects at school, take an engineering degree and then get a job in the robotics industry. But my advice is to just get stuck in. There is plenty of advice on the Internet and there are a lot of little clubs and competitions around if you spend a bit of time looking.

If you like building things and want to be creative, hit the scrap yards where you can buy a lot of cheap motors for windscreen wipers, windows or seats as well as gears axels, batteries and odd bits. If you are more interested in the artificial intelligence side, buy a kit robot (or even Lego Mindstorms) and learn how to program it.

How could you make the applications of robotics of more interest to girls?

Robotics appears to be one of the bits of engineering that females are most interested in. Certainly a number of leaders in the field in the academic world are women. When I was running final year projects in computer science at Sheffield most of the few women did my projects. I wont even begin to speculate on why this might be as one of my five daughters may read it and cut my head off. But I can say that it has something to do with the multidisciplinary aspects of combining engineering, electronics and artificial intelligence. I think that there were not so many women teams in Robot Wars because of the perception of testosterone-fuelled aggression. I say "perception of" because most of the big heavy looking roboteers were real pussycats off screen.

What current research projects in robotics do you find most inspiring and why?

There are so many exciting directions in robotics at the moment that it is impossible to say which is most inspiring or most productive. We have got to a point in technological history that might later be thought of as a golden age of robotics. Robots can walk now and do all manner of acrobatics and so we just need to sort out some decent intelligence for them. For me the most inspiring thing about robotics is how they highlight how remarkable living beings are by comparison. This is one of the main reasons why I work in biologically inspired robots. There are many exciting developments and trends at the moment: humanoid robotics, producing emotional expression and developing speech and language, swarm intelligence, nano-robotics, companions, military …

Can robots be creative?

No, and another question with the same answer might be “Could a robot tell a lie?”

What got you interested in science?

To be honest, I have always been interested in everything. My family used to call it fads. One week I would be obsessed with my little microscope and the next it would be learning some instrument - I am sure that it was frustrating. My interest in science was particularly inspired by a TV programme that I used to watch in the 1950s - I can't remember what it was called - that had a nuclear physicist as one of the main characters. So that is what I wanted to be.

You have said in the past that only a biological machine is able to think. What do you think is special about the slime we are made of?

There are so many ways that I could answer this (and have done) but let me answer it with another question here. Why as a scientist should I be bothered with this "fairy tale" question? For some reason, during the foundations of AI, scientists pulled a fast one on us that wrong footed the issue ever since. In the normal course of science, the theorist puts forwards novel hypotheses that test the theory. The emphasis is on making a test strong enough to falsify the theory convincingly. When the test does not lead to falsification it provides a confirmation that will be part of an accumulation of tests that can eventually lead to acceptance of the theory (for now).

With Artificial Intelligence, we are given, instead, an in-principle argument that combines the idea that we are machines ourselves with minds that compute and the point that anything that is computable can be computed by a computer (by definition). The problem for me is that there is no evidence that our minds work like computers in the first place. The other problem is that there is not one shred of evidence that any machine anywhere has ever felt anything or seen anything (cameras record an image, they don't "see").

You will hear some scientists saying, "I know that machines can think because I can think and I am a machine" without showing any realisation of the circularity of what they are saying. It reminds me a little of the faulty logic in the syllogism, All Greeks are mortal, all humans are mortal, therefore all humans are Greek - get it? Here it is again with the right terms, All humans are machines, computers are machines, therefore computers can think I will get off my soap-box now.

For the full interview go to the webzine.

Cash for pixels

The virtual property market on Planet Entropia is booming. Around the world thousands of fans play online in virtual worlds. In one of these multi-player role-playing games called Project Entropia gamers can buy and sell virtual items using real cash. One 23-year-old Entropia gamer spent £13,700 buying a virtual island, while another bought a virtual space station for £57,000. Real money for computer pixels, but then there is a property boom in cyber space. Other gamers who want to live on the island have paid the owner enough that he recovered his money within a year. The new owner of the space station plans to use it to start an in-game "night club" and persuade the entertainment industry to use it to sell real music and videos to gamers. Planet Entropia seems to be a great place for today's virtual entrepreneurs, so how long before the first virtual property makeover TV show appears, showing you how to increase the market price of your space station with some simple DIY computer coding and new curtains?

It started as a hobby...

ITV bought the school friends reunion website Friends Reunited for an initial £120m and will pay an extra £55m in 2009 depending upon the site's performance. Not bad for something that started as a hobby website.

Listen with Pre Vu

With perseverance and some business and technical savvy simple ideas can become award-winning inventions as Morag Hutcheon has shown.

She had the idea that when buying music in a store it should be possible to listen to the CD first. Turning her idea into reality took time though and only became possible when solid-state digital answering machine technology made the cost of producing it commercially acceptable. She also needed to develop a customised chip. That was out of the scope of her own skills, so she hired a specialist team to do it for her. The final result was Pre Vu.

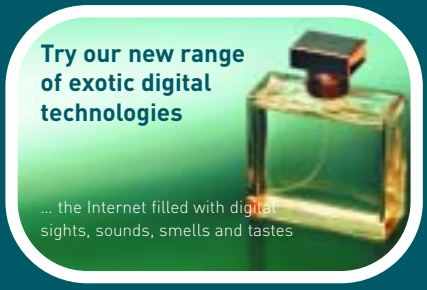
Pre Vu is integrated into the spine of a standard CD case and allows up to 60 seconds of audio content to be sampled. A personal message can also be added, for example when sending the CD as a gift, or for advertisement purposes. Morag's invention includes both the software for compressing the selected audio files and the machinery to upload the samples. As a result in February 2006, Morag was named the British Female Inventor of the Year 2006, at the British Female Inventor and Innovation Network Awards.

If you (or your mum!) are an inventive woman, you too could have your creative output nominated for these annual awards.
For more information check www.gwiin.com

Stinky computers

We all remember from art class that a whole range of colours can be made by mixing together the primary colours, red green and blue, but did you know that the same can be done with smells and tastes? Just as our eyes detect the amount of red, green and blue light being reflected from an object to give us the sensation of colours, smells and tastes can also be made by adding together primary smells and tastes: the building blocks of all we can smell and taste. Now we know what these chemical building blocks are, a whole range of exotic new digital technologies open up.

The rather strangely named iSmell system can create thousands of everyday smells from a small cartridge containing 128 primary odours. A digital signal tells the system how much of each of the chemicals to release in the same way as a computer screen produces colour by mixing red, green and blue. The smell producing chemicals need to be replaced from time to time like a printer toner cartridge to ensure that the smells produced are accurate. So using this technology you can download smells from the Internet. An intriguing thought, and one not to be sniffed at.



Can we do the same with tastes? Yes. A company called TriSenx has developed a technology that allows you to 'print' tastes onto thick fibre paper sheets. Like the iSmell system it contains samples of the primary tastes that are mixed together under computer control to give the required final flavour. To enjoy the taste you simply lick the paper. Yum yum.

A whole new approach to Internet shopping might be possible with these types of technology. You can smell flowers or taste a cake before buying, or even mix your own perfumes and flavours digitally. Just think: a future on the Internet filled with digital sights, sounds, smells and tastes, not to mention the frightening possibility of spam emails that smell of spam!

The Da Vinci Code

Art has been around throughout history, from cave painting through Leonardo Da Vinci, to the modern day. In each generation artists have used the latest technologies to help in their work. Cave paintings used ground-up colours made with stone tools. Leonardo Da Vinci probably used a pinhole camera or a Camera Obscura to help in his paintings. A Camera Obscura is a darkened room with a single tiny hole in the blacked out window. An upside down image of the scene outside is projected on the wall from where it can be copied. Leonardo is quoted as saying about this technology of the time

"Who would believe that so small a space could contain the image of all the universe? O mighty process! What talent can avail to penetrate a nature such as these? What tongue will it be that can unfold so great a wonder? Verily, none! This it is that guides the human discourse to the considering of divine things. Here the figures, here the colours, here all the images of every part of the universe are contracted to a point. O what a point is so marvellous!"

"Who would believe that so small a space could contain the image of all the universe? O mighty process! What talent can avail to penetrate a nature such as these? What tongue will it be that can unfold so great a wonder? Verily, none! This it is that guides the human discourse to the considering of divine things. Here the figures, here the colours, here all the images of every part of the universe are contracted to a point. O what a point is so marvellous!"

He was clearly impressed!

Today's artists are starting to look to the digital medium to create their art works, using computers to allow their imaginations to take flight. Many agree that the start of computer art was in 1956 when American Ben Laposky's created 'Oscillons': artistic images photographed off the screen of an oscilloscope. Later digital artists developed paint box programs to allow others to create digital images on screen easily. Today artists use a whole range of multimedia technologies to manipulate 3D shapes, colours, textures, images and sounds. There are now even museums for digital art, such as the museum in Austin Texas where Sodaconstructor (see the webzine) is exhibited. The new computer technologies are exciting today's artists in the same way as the pinhole camera excited Leonardo.

Unlike paintings on canvas or photographs computer systems are constantly being updated, and as technologies and file storage formats evolve we need to ask "Will today's computer art still be viewable for future generations?" Who knows how we will store tomorrow's computer data? Will we be able to display the JPEG pictures and MPEGmovies of today's digital artists in the future? System upgrades were never a problem for the cave painters.

I hear a tall dark handsome stranger...

Your horoscope for today

'You want others to like you, but inside you tend to be critical of yourself. You can be outgoing and the *'life and soul of the party' but sometimes you feel reserved and simply enjoy your own company. At times you have serious doubts as to whether you have made the right decision or done the right thing.'*

Sound like you? Chances are you think it does. It's called the Barnum Effect after the US showman P.T. Barnum and many people think it's why horoscopes 'work'. The Forer effect, to give it its proper scientific name, is named after the psychologist Bertram R Forer who first investigated it in 1948.

Bill Gates Horoscopes

Microsoft recently applied for a patent that involves sending horoscopes to people via their mobile phones!

Have your vote in our disappearing technology survey in the webzine. Will MP3 players still be around in 50 years?

What he found was that people thought that statements about their personality were very specific to them, when in fact the statements were vague and could apply to a whole range of people. Look at the 'horoscope' again, and you can see how these statements are constructed. They tend to contain generalities, and also a sort of two sidedness, 'You seem to like the colour red, but sometimes you don't' sort of things.

In one TV 'experiment', a 'mystic' described the personalities of a series of women he hadn't previously met. Afterwards they thought he had described them amazingly well. It made some believe he must really be psychic. In fact he had just given each of them the same Barnum description.

So why does it work? One of the common explanations is that the statements tend to appeal to our vanity, wishful thinking or hopes, so our brains tend to remember the parts we want to, the good bits, and ignore the parts we don't want to hear. This sort of selectiveness in the way we store information could be related to the strategy our brains use to survive and make sense of the world. We are bombarded by information constantly, and our brains just can't take it all in. We select what we want to store, and in the Barnum effect we filter out the parts we don't want.

Cocktail Party

Another example of this sort of selective effect in brain processing is the 'Cocktail Party effect'. You've probably experienced this yourself, the effect that is, not the party. If you're in a crowded room with lots of people having conversations your brain ignores the voices. It becomes background noise. However the moment someone mentions your name, 'your ears prick up'. Suddenly your brain hears something it's interested in, 'a good bit', and you focus in on that conversation. In fact your brain has been processing all those voices all the time. It's just there wasn't anything interesting relating to you in the conversation so it was filtered out.

Just give the nod

The cocktail party effect is also being explored by researchers as a way to help people interact with mobile gadgets like mobile phones, radios and iPods without bumping into lampposts. Using 3D sound, different things can be made to appear to be coming from different positions around your head. Nodding towards the sound of lightning switches to a weather report, say, without you taking your eyes off the pavement.

By understanding how our brains select the information to look at, listen to or believe could help computer scientists develop new ways to process massive amounts of data in the future as well as being used to develop new ways of interacting with computers.

Buying Kingda Ka the eBay way

When it was first opened in May of 2005 Kingda Ka, a roller coaster in New Jersey, was the world's tallest and fastest ride. A marvel of mechanical and computer engineering it shares a weird and wonderful connection with a WWII submarine, a Volkswagen Golf car once owned by Pope Benedict XVI and Karolyne Smith's forehead. The connection is Ebay, the phenomenally successful on line auction house. The first rides on Kingda Ka and the Pope's Volkswagen Golf were auctioned on the site, and Karolyne Smith auctioned her forehead as advertisement space and was paid 10,000 dollars to have a company logo permanently tattooed there.

EBay allows the world to sell and buy almost anything as these examples show. The company was set up in 1995 by Pierre Omidyar in his back room, so the story goes, and is among the fastest-growing companies of all time. Buyers and sellers communicate through the web site, and eBay makes a profit by charging them to do so.

With millions of users worldwide, and no personal contact, trust is an important factor. EBay use a form of self-policing where other users can rate buyers on their trustworthiness. This method is needed to keep things as safe as possible but also to allow the service to expand. It could never have expanded so rapidly if eBay had to employ staff to check each sale. Though this self-policing has sometimes been controversial, and eBay has had its share of scams, it is still extremely popular. Many users admit to being hooked on rummaging through the pages and looking for bargains, and there are certainly some wonderful bargains to be had.

But finally, if you're trying to sell a decommissioned aircraft carrier, you should know that the last one put up for auction on ebay Motors didn't sell. Don't say you haven't been warned.

Pushy posters?

It's a long way from the man with the sandwich board standing on the street corner shouting his message about knitwear sales. London underground is planning to introduce smart posters. These interactive posters will have the ability to talk to your mobile phone. The first use for this new smart poster technology, called "Hypertags" will be to give late night travellers a phone number for safe travel information beamed direct to their mobile phones. However this technology could spread, and in the near future we could see posters for all manner of things trying to get our attention and sending us messages as we pass by.

To get a glimpse of what it might be like watch the Tom Cruise film Minority Report – the film makers employed computer scientists and other researchers to give an accurate vision of the future... well for some of it at least.

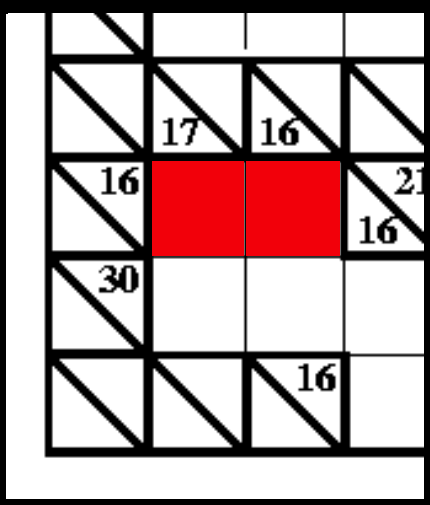
Kakuro, Sudoku and Computer Science

To be a good computer scientist you have to enjoy problem solving. That is what it's all about: working out the best way to do things. You also have to be able to think in a logical way: be a bit of a Vulcan. But what does that mean? It just means being able to think precisely, extracting all the knowledge possible from a situation just by pure reasoning. It's about being able to say what is definitely the case given what is already known...and it's fun to do. That's why there is a Sudoku craze going on as I write. Sudoku are just pure logical thinking puzzles (most of which are generated by computers of course). Personally I like Kakuro better: similar to Sudoku, but with a crossword format.

What is a Kakuro?

A Kakuro is a crossword-like grid, but where each square has to be filled in with a digit from 1 to 9 rather than a letter. Each horizontal or vertical block of digits must add up to the number given to the left or above, respectively. All the digits in each such block must be different. That part is similar to Sudoku, though unlike Sudoku, numbers can be repeated on a line as long as they are in different blocks. Also, unlike Sudoku, you aren't given any starting numbers, just a blank grid.

Where does logic come into it? Take the following fragment:



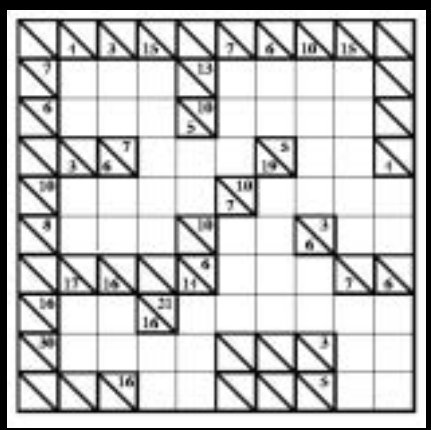
There is a horizontal block of two cells that must add up to 16. Ways that could be done using digits 1 to 9 are 9+7, 8+8 or 7+9. But it can't be 8+8 as that needs two 8s in a block which is not allowed so we are left with just two possibilities: 9+7 or 7+9. Now look at the vertical blocks. One of them consists of two cells that add up to 17. That can only be 9+8 or 8+9. That doesn't seem to have got us very far as we still don't know any numbers for sure. But now think about the top left hand corner. We know from across that it is definitely 9 or 7 and from down that it is definitely 9 or 8. That means it must be 9 as that is the only way to satisfy both restrictions.

Here is a full Kakuro to try.

Check you got it right on the cs4fn website (www.dcs.qmul.ac.uk/cs4fn/) when you are done.

Being able to think logically is important because computer programming is about coming up with precise solutions that even a dumb computer can follow. To do that you have to make sure all the possibilities have been covered. Reasoning very much like in a Kakuro is needed to convince yourself and others that a program does do what it is supposed to. An ongoing challenge is in developing programs that can do that kind of reasoning and so be able to tell us whether other programs are correct or not.

For more logic puzzles go to the cs4fn webzine (www.dcs.qmul.ac.uk/cs4fn/).



Taking a RISC from the logic piano

William Stanley Jevons was born in Liverpool in 1835. He was famous in his day as an economist and his smash hit book 'The Coal Question' called the nation's attention to the reduction in Britain's coal supplies. Jevons had other strings to his bow though and one of the strangest was his "logic piano". Jevrons was fascinated with logic and reasoning. He believed you could start with one thing (a premis) and from this work through a chain of reasoning to the conclusion, and that this could be done for everything. So he set about building his wooden Logic Piano, where you could put in the premises, play the keys to mechanically apply his reasoning rules, and discover the conclusion. Amazingly it did work and is similar in idea to modern day theorem provers used to verify properties of computer designs. Of course, being small and woody, it couldn't solve every thing but then it turns out that was always an impossible dream (see page 18).

RISC chips are everywhere; in Play-stations, iPods, mobile phones...

As the years passed others took on his idea, thankfully turning from wood as the material of choice, till finally the silicon microchip was developed. No longer timbered, it could take the electronic signals (we can think of these as the premises) and output the conclusion by following lots of instructions on the chip, like the piano did. As the chips got bigger it turned out that lots of the memory space on the chips wasn't being used well. Chips were designed for storing big numbers but most applications used smaller numbers, so the space for storing these on the chip, the registers, were often not completely filled, and too much time was being spent on importing data from outside memory onto the big empty spaces on the chip. Worse still the instructions just became too big and slow to carry out sensibly. Economic madness as Jevons would no doubt have said!

Enter RISC (Reduced Instruction Set Computers): economical and not a piano key in sight. It uses the memory on the chips economically, and rather than use complicated instructions it instead uses many simple instructions. Musically it's like moving away from trying to orchestrate a concerto when it was easier to simply pluck the notes. Today RISC chips are everywhere; in play-stations, iPods, mobile phones…You name it it's probably got a RISC chip in it computing efficiently away. RISC chips are one of the key reasons behind the spread of computers away from offices and into our everyday lives. The fine-tuning still isn't over yet though. Multinational companies like ARM still work to find the best way to play the most efficient logical tunes on their RISC machines. It's a good guess that this constructive use of time and resources would be music to Jevons' ears.

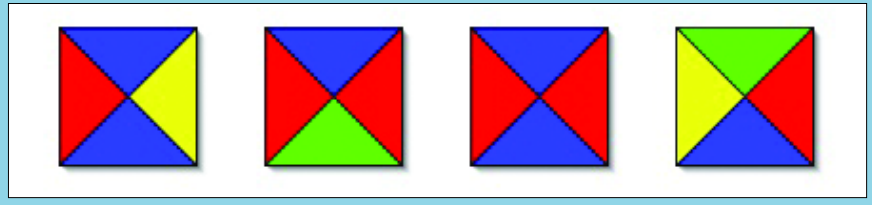
The Uncomputable Jigsaw Puzzle

Your missions should you choose to accept them...

1) First a simple jigsaw puzzle…Can you work out how to put the following square tiles into a 5x3 rectangle so that touching sides of tiles match. You can use as many of each tile as you like but no different ones.

2) Now a little harder. Can you say whether or not it's possible to tile a rectangle of any size (with dimensions a multiple of tiles of course) with those 4 tile patterns using any number of each? Touching sides must always match.

3) Finally, the tough bit, can you write a set of instructions that give a way, if followed blindly of solving the above problem for any tile set…Whatever tile patterns you start with, your instructions must say whether they can tile any sized floor or not.



Have we set you a Mission Impossible? Read page 18 to find out.

Mission:Impossible

In each episode of Mission:Impossible, the M:I team have a seemingly impossible task to perform, which of course they duly do. They achieve these feats using not only Tom Cruise/Ethan Hunt heroics and clever plans but also hi-tech gadgets that help make the impossible mundane. Is there nothing that hi-tech coupled with smart people can't overcome once we set our minds to it?

The massive progress being made as computer science rapidly changes the way we live makes it seem anything is possible. Computers can now fly a plane across the Atlantic, including taking off and landing, with no human intervention. They can beat the best human at chess. They can store my whole music collection in my pocket. Computers can recognize faces, tell me which way to drive to get home ... When in the past people have made predictions about future technology things that would never happen they have tended to end up looking foolish. With a bit of ingenuity in the future computers will solve any problem we want them to ... won't they?

Lots of problems, are 'uncomputable' – they can never be solved even by hyper-intelligent beings from the planet Vorg

It turns out though that some missions really are impossible for computers and even Tom Cruise wouldn't be able to make a difference even if he was given unlimited time. Not now, not ever...and just to hammer it home, this is a fact that was proven mathematically way back in the 1930s before any one had even created an actual working computer...

Computer Science is not just about what computers can do, but also about what they can never do, which is where the bad news for the Mission:Impossible team comes in. Computer scientists have shown that lots of problems that must have solutions are 'uncomputable' - they can never be solved using computers however powerful. Uncomputable problems are not just ones that computers can't solve either, humans can never know the answers, nor can hyper-intelligent beings from the planet Vorg.

What kinds of problems? You might hope that they would be ones that sound impossible from the outset, like cracking the Dr Who Skasis Paradigm that will give you power over the whole of time perhaps? It turns out that even some innocuous problems will never be solved (see page 17 for one to do with Jigsaws)...and in some cases they go to the heart of what we would like computers to be able to do for us like guaranteeing the programs we write do what they are supposed to, or proving mathematical facts from premises (see page 17).

...impossible even if he was given unlimited time...

So remember, if you ever join the Mission:Impossible Team, there are some missions that, once that tape has self-destructed, the only thing to do is just say "cop that for a lark" and go home. The good news is there are still lots of exciting computer science missions that aren't impossible...should you choose to accept them.

It's a secret Deal or No Deal

A hit TV gameshow with 22 sealed boxes and just one question: Deal or No Deal? Enough money to buy a mansion? Or just a jelly baby? How is your nerve? Does your friend Ross really know what's in his box? Will you take the money on offer from the Banker, or wait to see what finally is in your box? With the limited information you have of what prizes have gone and advice from the other colourful players, do you make the deal or not?

The rules of TV show 'Deal or No Deal' are simple; the game is addictive viewing. It is the hidden information of the boxes combined with the other players' personalities that make it compelling. In fact the show's producers put all that week's players in the same hotel so they can get to know each other before the game. They get to know each other's personalities.

Computer Science or No Computer Science

So what does it have to do with computer science? The most obvious link is that the game play is just like a computer program, it follows rules…but another link is in the hidden information and the way that participants can makes guesses on the contents of the boxes depending on the players' personalities. It's like the boxes and the personalities are the same thing at times.

Noel or No Noel?

Noel Edmonds runs the show, but he isn't allowed to do anything. He just has to make sure the game follows the format: follows the rules. To create an actual run of the show you need more than just the rules of course. You need props and personalities… resources to manipulate…boxes and contestants. In computer programs the equivalent are variables. Variables have names to refer to in place of the hidden values within, just like the boxes have numbers 1 – 22 so you can refer to a given box, its cash value inside unknown. Variables store the information that the program manipulates as it runs, just as Noel, following the rules, manipulates the contestants and the boxes. The rules say boxes can only be opened at specific points and with conditions attached about what happens to the money within. Just like repeatedly running a computer program, every show plays out differently even though the steps followed are always the same.

Crash or No Crash

Following the intended rules is critical. If a box is accidentally opened at the wrong time everything goes haywire. That happened in April 2006 when a contestant called Tom dropped his box, revealing the contents when they should have been hidden. The whole show had to be interrupted to sort out the mess. Dropping the box was like a maverick rule no one had noticed suddenly being followed – a bit like a previously unknown bug in a running program crashing it. It would have to be fixed on the fly with new code added and the program restarted. In Tom's case the new "code" added was a rule that if a box is dropped all are reshuffled with their values redistributed. Keeping the information hidden was everything.

Dropping the box was like a maverick rule no one had noticed suddenly being followed

Group or No Group

There is more to the boxes than their hidden money values though, and that is where a different kind of information hiding comes in: "encapsulation"…grouping things and temporarily hiding the details of what has been grouped. Deal or No Deal boxes are more than just a number they have personalities too. Each box is linked to a contestant. Even though the people and the boxes are completely different things, you don't really think of them like that but as a single entwined thing. Why pick a particular box to be opened? Because its contestant has been lucky in the past. If Ryan's box has a low value in, then you remember that about Ryan in future shows. When you think of Ryan you mean his box too even though you don't spell it out.

Toby or Not Toby

This idea of grouping different things in our minds as single animate objects is a very natural thing we do and it's helpful to programmers too. This idea of encapsulation is one of the key things about the style of programming know as "Object-oriented programming". That is all an "object' is to a programmer. A bunch of related resources with their own properties and abilities, glued together, to be thought of as one thing. Why is it useful? Because it is easier to keep track of just one thing than lots of related ones, and it's a natural way for us to think about both the world and the programs we write. Talk about Toby and, without spelling it out, you mean his personality, his history over the previous weeks, his current box and the value in it. When Toby moves, his box moves with him. You only think about the separate parts when you need them. When it's time to open Toby's box, then you can focus on the box alone rather than the personality. In a game show it makes the game captivating. In programming it makes the program easier to write. With millions of lines of rules to write that's serious.

Back (page) in fashion

Clothes and accessories make up the fashion conscious world we live in today. Computing devices already form part of the wardrobe of many. Being seen with the right mobile phone, or the stylish white iPod headphones makes a statement about you. But what does the future hold for fashion? We take a stylish peak into the wardrobe of the future at the clothes and accessories to come.

Wearable Computers: a fashion statement?

You can actually wear a computer today if you want to. You can buy a pair of eyeglasses that look like ski goggles and act as a monitor and a hard disk drive. They have a wireless connection to the eyeglasses that you can strap on your wrist. It's been suggested that using these sorts of technologies can record everything we see. Sort of like your own personal aeroplane black box, so you'll never forget those fascinating memories of a rainy day at the shops. Whether we would want to do this is another matter! We also might not want to wander around with 'bits of computers' visibly hanging on us. Of course for some it will be a cool look but for others it would be a 'bolt on' fashion no-no.

Catwalk comment: a little too much bulky Borg this year.

A new meaning for smart clothes

We are used to saying that someone is a smart dresser, but when technology comes into fashion the words 'smart clothes' take on a whole new meaning. Smart in the technology sense means intelligent, and new fabrics and clothing are being developed which have the ability to sense and change depending on the world around them.

Catwalk comment: clever calculating clothes can create crazy combinations.

Smart to be Safe

An example of where this smart technology can go are a new generation of hazard suits that are equipped with sensors that keep an eye on your position and measure your vital signals, such as temperature and heart beat. Applications would be for teams of people who brave disaster areas. The information from the suits can be sent via a wireless link to a central control where the health of the rescuers can be monitored. The information can also be passed to other people in the team and combined with useful bits of data such as maps or weather reports, to ensure the team have the best chance to work together effectively, efficiently and safely.

Catwalk comment: clothes that know where you are going take a fashion lead.

Electronics that wear well

Carrying your mobile phone, laptop or PDA's may become a thing of the past when technology goes into your clothes. A Germany company already sell a jogging outfit, which has an MP3 player in the sleeve, activated by your voice command through a microphone in the collar. There are also new washable fabrics that have electronic circuits woven into them so in effect the design on your coat could become a keyboard, and all the other electronic parts could miniaturise and vanish into pockets, in effect you are wearing your phone, iPod or computer… perhaps even all of them at the same time.

Catwalk comment: this collection may be music to your ears.

A phone with your finger-tips

In the future when you are being phoned, you may simply feel a tickle in the phone band on your arm. Click your fingers then stuff your finger in your ear to talk to friends! Strange as it seems a Japanese company are developing a system that sends vibrations from your phone armband down your arm and through your fingers to provide the sound to act as an earpiece.

Catwalk comment: using your finger to phone gives a whole new meaning to digital phones.

Sick of clothes?

There are plans to develop biometric bodysuits that will measure your vital signs and where appropriate dispense medicine to you; it will be like wearing a Doctor 24/7. As with all new technology we need to decide if this is something we would be happy with. Is it right that a smart suit decides your prescription, or would you feel happier to have human doctors making these important health decisions?

Catwalk comment: the smart way to get better.

Weaving our future with computers

Over the next decades billions of interacting microscopic computers will vanish into the background, becoming part of the weave of modern life. Clothes will get smarter, cool new technologies will change the way we live our lives and designers, artists and computer scientists will work together to fashion a brighter future for us all.

See the webzine's Magazine+ www.dcs.qmul.ac.uk/cs4fn for extended versions of this and other articles

cs4fn Paul Curzon, Peter McOwan and Gabriella Kazai of the Department of Computer Science, Queen Mary, University of London. Sudoku photo by Ferenc Kazai. Proof reading by Sue White.

EPSRC Engineering and Physical Sciences Research Council

Sodarace and the Human Error Modelling Project are funded by EPSRC

Microsoft and ARM provided support for printing.

Microsoft ARM

Queen Mary University of London

Passionate about computer science?
www.dcs.qmul.ac.uk/cs4fn/