

## Unit 1: What makes us human?



### Part 1: One per cent

When we talk about what makes us human, we're often trying to define what sets us apart from other animals.

It's easy for us to list the ways that we perceive ourselves, the human race, to be different, and possibly superior, to the rest of the natural world; we've developed full languages for communication, we appreciate music and art, and leave a legacy when we die.

But some of these definitions of what makes us human, and what distinguishes us from other animals, start to become slightly less clear-cut when we examine our closest non-human relatives – primates and, more particularly, the great apes.

Even to the unscientific eye, the similarities between young humans and young chimpanzees are blindingly obvious. Seeing a young chimp respond to tickling with giggles is uncannily familiar.

Throughout history primates have been used as human proxies. Not long ago it was still considered acceptable, and harmless, to dress chimps in clothing and have them pretend to be humans, invariably for comic effect. Primates have long been used for scientific research and technology development, in situations where we've been unwilling to risk human lives. Remarkably, since the late 1940s over 30 primates including monkeys and chimpanzees have been launched into space and, unsurprisingly, very few of them returned to earth alive. While acceptable at the time, many of these images are disturbing to us now.

The ethical perception of this treatment of primates has changed over time. And this change came about in large part due to the research into great ape communities in the wild conducted by groundbreaking scientists like Dr Jane Goodall.

Goodall began her research with wild chimpanzees in Tanzania in 1960. She was the first scientist to record the use of tools by primates, specifically chimpanzees making tools to extract termites from termite mounds.

Prior to this it was thought that making tools was a defining human characteristic, and it led to the grand pronouncement from the eminent anthropologist Louis Leakey, "*Now we must redefine tool, redefine Man, or accept chimpanzees as humans.*"

Through her 40 years of research Goodall revealed chimpanzees to be complex creatures capable of compassion and altruism, with complicated societies and familial relationships. This work offered not only insight into chimpanzee culture, but into our own as well.

Today, with modern DNA research, it has also been revealed that we share approximately 99% of our DNA with chimpanzees and bonobos.

All of which raises the question, what is it in that 1% that really makes us human?

## **Part 2: Chimps versus humans**

Anthropologist Professor Alice Roberts is fascinated by the similarities and differences between primate and human intelligence.

The Max Plank institute is at the forefront of some ground-breaking work comparing intelligence in humans and in chimps. For the past nine years Michael Tomisello has been closely studying this troop. And his work on ape intelligence is casting a fascinating new light on what it means to be human.

*And when you first started doing this work, were you surprised? Did you... did you find that they were more or less intelligent than you expected them to be?*

*Well, that's the, that's the great part is that they were in some ways more intelligent and in other ways maybe a little less so.*

*Yeah.*

*They will do some things that just absolutely surprise you and you just can't believe they're so clever and then they'll just turn around and do something that's just kind of thick!*

*We like to think we're the most intelligent species on the planet. But we have to be careful about what exactly we mean by intelligence.*

*The first thing we have to get rid of in thinking about animal intelligence is the idea that there's this ladder of intelligence that goes from low to high. And animals can just be placed on it. It's actually much more complicated than that. Different animals have different intelligences as it were. So the best memorisers in the world are squirrels and birds that hide their nuts in different locations, and can remember dozens and dozens and dozens of locations more than we can.*

*Oh, I was going to say so when you say best memorisers in the world that includes us...?*

*That includes us, absolutely.*

*In the case of apes, what we think is that they are especially good at cognizing things about the physical world, and understanding space and causal relations like when using tools, what causes something to move, and whatever. They're very good at that and basically they're not much different from human children in that kind of understanding.*

*Michael's colleague Daniel Hannas has invited me to try my hand at solving a problem that they regularly give to chimpanzees.*

*Just do whatever you want to achieve the peanut.*

*My task is to get the peanut out of the tube using anything that comes to hand.*

*I wonder if I could use the chain somehow? Now the teaspoon. That's going to be really difficult, I think. Yes, here it comes.*

*You'll never get it out again.*

*I don't think that's the right thing to do.*

*It may take me a while to figure it out, but the key to this puzzle is something that you may think chimps don't have: the ability to use a bit of lateral thinking.*

*Yes! Here it comes.*

*Excellent.*

*It took me more than four minutes to get my peanut. So now, let's see how a chimpanzee manages.*

*Oh look, he's doing it. It's just really clever, it really is. Watching this chimp doing that. And he doesn't have a bottle of water like I had. He's got to think about how to get the water in there. He takes some from his drinking bottle into his mouth, then he spits it out into the tube. Another mouthful of water gone in and it's just, it's almost there. It must be so frustrating.*

*He's done it, he's got it.*

*Somehow these huge brains that we've got encapsulate the main differences between ourselves and our closest cousins. Because look at these chimpanzees: they're naked and hairy and they're not wearing clothes, they're not talking about me, they're not sketching me. So there are some really massive differences between us and them which must come down in some ways to what is going on inside this huge organ in our heads.*

## Unit 2: Behind the scenes

### Part 1: A life in the theatre

From their first taste of treading the boards as a child in a school play, some people dream of a life working in the theatre.

For most people, if they are honest, it isn't studying the works of the great playwrights in the classroom that keeps this dream alive through the teenage years.

More often than not, it's the freedom, fun and excitement of drama classes that fan the flames. It's all about getting up from behind a desk, expressing yourself, becoming someone else for a while.

For many, it's living life in the spotlight that is most appealing. From performing street theatre in a park, to starring on Broadway, they live for the adulation and applause of the audience.

But for others, the dream is about making that magic happen, working, unseen, in the shadows behind the scenes.

This is the Theatre by the Lake in Keswick. Appropriately named, the theatre sits on the shores of tranquil Derwentwater, and is surrounded by the breathtakingly beautiful scenery of the Lake District National Park.

While it feels like a world away from the bright lights of the West End of London, the theatre is one of the most prestigious regional theatres in the UK.

And, most importantly, it actively works to help young people get their first break working as part of a highly-skilled backstage team. The team is led by experienced professionals who guide the young crew members starting out on their careers.

*I'm Ian Forrest and I'm Artistic Director at Theatre by the Lake.*

*Really my job is to be responsible for all the home-produced work that we produce in the theatre. That may be in any year up to eight productions. So I choose the plays, I cast them together with a Casting Director and my Associate Director, and then we audition for actors and we choose our companies, and then we rehearse the plays.*

*But I think what's great about this is it is a mix of people with different experience, and also the good thing is that we do positively try and give people opportunities early in their careers. And we've also got various apprenticeships on the technical and production side as well. So it's great, I think, actually being able to work with people who are really enthusiastic and keen and young. It's really enjoyable doing that.*

*My name's Andrew Lindsay and I'm the Technical Manager here at Theatre by the Lake. And I look after the sound, lighting, video and staging resources, technologies and the staff that implement those here at Theatre by the Lake.*

*I kind of fell into becoming a technical manager by accident. I didn't know whether to do music or visual arts at university when I left school, so I went to an institution which encompassed those areas; so working with music and working with visual arts in a theatre setting. And then I specialized in lighting design, sound design and the technical aspects of theatre.*

*And after leaving university I did as much professional work as possible to kind of broaden my horizons a little bit. And was fortunate enough to have a series of permanent full-time jobs, working my way up the ladder to become a technical manager.*

*We have a huge range of different technologies at our disposal. We have everything from the flying system, staging system. Flying is a term used for the movement of sets vertically on stage. We have technologies there which have been around for nearly 200 years that derive from when the sailors came off the ships and tied knots and used ropes and pulleys to move scenery and set around when they weren't working offshore.*

Today working behind the scenes in the theatre can be as much about computers as it is about curtains. And a high degree of technological expertise is required for many of the roles.

*The other side of the coin is we have highly complicated, but fantastic digital systems which allow us to work easily and more in-depth producing a whole range of different theatre in different styles. The vast range of technology now available to us means that there's very little that we can't do.*

*So, we have kind of both extremes: we have really hybrid digital technology, but then we have 200-year old technology as well, working hand in hand to produce what the audience see every night.*

## **Part 2: Working backstage**

So what is it like for the young crew working behind the scenes? What exactly goes on in the shadows while the audience is transfixed by the actors on stage?

Charlotte and Hayley are both assistant stage managers at the Theatre by the Lake.

*My name's Charlotte and I work at Theatre by the Lake as the resident Assistant Stage Manager.*

*So on this particular production I'm on the book calling the show, making sure all the lighting and sound cues happen at the right time in relation to what's happening on stage.*

*So in this particular case this book I had with me throughout the rehearsal period for the four weeks. The different columns: I've got like a cue column. I have a calls and information column, which is anything I need, any information, any little bits, or, when, especially when it's like a visual cue. But, my last column I use during rehearsals which is the blocking, which is every single movement that the cast member makes throughout the show I have to record and make a note of.*

*There's a camera right at the front of the auditorium that doesn't record, but just relays the show from there. And it also plays back in the green room as well backstage so the cast can see what's happening on stage as well. And it also, it's useful for me for various visual cues. For instance I've got various lighting cues simply happening: when someone turns on a light switch in one of the rooms I have to be able to see that happen.*

*I wear this cans set – we call it cans – and I’m talking to either the stage manager who’s on the floor, who’s Hayley tonight, and she’ll be at the beginning of the show on the cans set or she’ll also be on radio, if I do need her in an emergency. But I’m also talking to whoever is operating the show. So, when I say, when I call a cue for a lighting and sound cue to happen there’s someone in the box at the front of the auditorium, in this one, pressing go on the desk basically to make sure that happens.*

*My name’s Hayley and I’m the resident Assistant Stage Manager.*

*So I work as part of a team of three. There is a Company Stage Manager, a Deputy Stage Manager and I’m on the bottom of the ladder as the Assistant Stage Manager and so one of my main duties is to source, prop and borrow or buy props, furniture and set dressing for all the shows that we do here at Theatre by the Lake during the year*

*So when we get here, the stage is bare and we have to put all the furniture and props back together, back on the stage and then we do a shout check to make sure that everything is there so we have a list of where it should be and what it should entail, so what’s in the suitcase; it goes down to quite a lot of detail to make sure it’s there, and then as part of a show call we make sure the actors are here and I run, on this one, both wings, both stage left and stage right – we’re now stage left – and I make sure that the actors have all the props that they need to go on stage with.*

*I think the best thing about working on my job is that it is completely different every day; you can come in and it’s a different show. Because theatre is live, which is the best part about it, you have to deal with the issues really quickly. We had, on Saturday night one of the actor’s trousers fell down on stage, so you have to act really quickly and get the safety pins and make sure that you put his trousers back on ready for him to go back on stage, and there is always little bits and bobs that happen that makes it really interesting and different.*



## Unit 3: Information is beautiful

### Part 1: Data visualisation

We live in a world where we are constantly deluged with numbers, facts, figures and statistics. In a time of data overload the buzzword is now “data visualization”.

This is the Information is Beautiful Studio, and data visualization is their business.

*Data visualisation is big at the moment, largely because of the amount of data that is being recorded by lots of different organizations, I think that is a key part of the interest in data visualization - where people are amassing data, whether it's governments or health organizations or Google or Facebook - there are patterns and connections within that data that are very difficult to see or spot without using some kind of technique to visualize those patterns. And that's where we work, we look at masses of data, and occasionally it's smaller pieces of data, but largely it's about looking at the patterns and connections that exist within that data and making them apparent to people. And we have a particular niche within the small industry that already exists around data visualization.*

*The three partners who run the business are all journalists by trade, that's what our backgrounds are, and we have a very journalistic approach to the work that we do, so that's the difference between us and other studios that are out there: the story is at the heart of everything that we do, and the design and the research and all the data is pulled together to support that story.*

*We talk about two different types of visualizations: we have explanatory pieces and exploratory pieces. An explanatory piece is about getting a message across a bit more quickly, and we want people to be able to look at that and recognize what is going on fairly quickly. An exploratory piece is something where people need to spend a bit more time with it to start to extract their own stories from the data that's being presented to them, and usually there's a lot of different contextual information in there that might shine a light on another piece of information and give you a slightly different angle on it, but it is about spending a bit more time with that piece.*

The team use many different sources of data to create their pieces. Sometimes data is drawn from institutions like the United Nations or World Health Organization, and sometimes clients provide their own data.

*Most of the data that we source is openly available. We only really want to use open data in the pieces that we create, and we always link to our data sheets. We're very transparent about our process and we want people to be able to examine the data that we use so that if there is problems with it, or people suspect there may be something not quite right about our data, it's there for them to explore and look at themselves.*

*Things that we try and avoid through the process of visualization is this confusion, trying to present too much data can often be a problem, so it's walking the line between simplicity and complexity. It's how you tailor the piece to tell the story that you're trying to tell with the minimum of complexity, and we also try to avoid too many words. These are supposed to be visual pieces, so words play a much smaller part in the type of work that we do. So it's kind of paring back everything, to only keep the essentials, to get the message across.*

## **Part 2: The process**

*Our goal at the beginning of the process is to produce a high-quality piece of journalism that engages people and that people want to connect with.*

*All of our pieces start with a very considered nugget of an idea It has to have a hook to it, and that's typically how a journalist will start, is looking for the hook, the idea, that we think is compelling enough to create a visualization around. We then look for the data to support that idea, or not. You know, it maybe, maybe there isn't, maybe that data doesn't exist, but that journalistic hook is at the heart of everything that we do, and so journalism is the start point really, and then we are using design and editorial skills to support that idea.*

One of the earliest stages in the process is choosing the best graphical form, or device, for the presentation of the data. With hundreds of possible alternatives, it can be a challenging task. Each device has its advantages and disadvantages.

*For instance, bar charts work really, really well because the human eye is particularly good at picking up differences between rectilinear shapes. So the differences in height between bar charts, between the different segments of a bar chart, are really easy for your eye to pick up, so therefore you can pick up that message really, really simply and quickly, whereas if you were sitting there comparing numbers with each other, it's a much more demanding process.*

*Our process begins with this initial concept at the heart of the piece. We always write a thorough concept first that consists of pretty much a headline and a stand first that describes the idea very quickly and thoroughly to people, so we're pretty sure there's a hook in that and people can understand it quickly. From there, we start to move into research, looking for the data that might support that idea.*

*We use a variety of tools in the design process. We find the sketching to be really important. We start all projects by doing basic sketching. And it helps as a memory tool in that we can sometimes be flooded with ideas when we start a project, and it's important to get them down so we don't miss anything. It's also very important to have this record, a visual record of what we've done, because we can sometimes go down a wrong path and we have to back up a little bit and we've then got other options ready to go.*

*From then on, we'll move to the schematic stage. And that will be using digital mock-ups to make a one-to-one representation, usually in black and white, and so we'll strip out any of the visual styling so not to confuse anything and purely think of it as in a structural manner, and how things are positioned on the page and how they interact with each other.*

*From then on, we will start to introduce the aesthetics, so we'll think about colour palettes and we'll think about typography and how the whole visual tone of the piece fits with the actual content, so it's a combined piece of work.*

Ultimately, the completed visualizations still have to compete for attention in a crowded multimedia marketplace, with an audience being deluged with information presented via text, photos, audio and video. So, what is it that makes data visualization really stand out?

*We see visualization emerging as just another way of telling a story, but the way in which it tells it is that it has a way of short-cutting messages to a more primal part of your brain, if you like, so when your brain recognizes colours and shapes and patterns more easily or more quickly than if you have to read something or add up numbers, and that's what we rely on with visualization, it is short-cutting messages into the brain.*

## Unit 4: Eyewitness



### Part 1: Eyewitness research

We all hope that we will never find ourselves a victim of, or witness to, a crime. But if we were, how confident are we that we would correctly identify the perpetrator, or even remember accurately exactly what happened?

*My name is Graham Pike. I'm a professor of forensic cognition here at the Open University's Department of Psychology. I teach and research in the area of forensic psychology for particular expertise in eyewitness memory.*

*Eyewitness testimony is a particularly problematic area for several reasons. One of those reasons is the outcome of eyewitness testimony can be very important. If an eyewitness misidentifies someone then an innocent person can be sent to prison.*

*One of the other problems with it is the difference between everyday cognition, so how our brains work in everyday situations and how they work in the very special scenario of seeing the crime. So everyday experience for how our mind works is usually quite positive, we recognize our family and friends without any problems, we remember what we're supposed to be doing, our memories tend to work, it's only remembering quite difficult information we find problematic.*

*But when it comes to a situation where you've seen somebody who's unfamiliar, for only a few seconds maybe, in a very stressful situation, in a scenario that's very unfamiliar to you, then we're not so good at being able to recognize that person, in fact we're particularly bad and we find it very difficult to remember the events. Even the order that they happened in can be something that we really struggle with.*

*So eyewitnesses tend to make a lot of mistakes. But importantly they don't realize that they're making them.*

*Testing the reliability of eyewitness testimony is actually quite difficult. It's very hard to replicate exactly the situation that would happen in a court. For instance, what we can't do is commit really violent crimes in front of research participants because it would be unethical. We also can't introduce something called 'consequentiality'. Now that*

*refers to the consequences of a decision that's taken. So the consequences in a court are really profound. What an eyewitness says can lead to somebody being convicted, to somebody walking free who committed the crime. There's no way really of replicating that in a research setting.*

Graham worked with the Greater Manchester Police on a fascinating television series that explored the issues around eyewitness behaviour through experiments, and by staging convincing mock crimes in front of a group of volunteers. The series, called Eyewitness, revealed some intriguing insights into how our memories work, and some of the common errors that eyewitnesses can make.

*As a demonstration of human memory we actually showed a piece of, kind of, modern art to our eyewitnesses and asked them to describe it, asked them to say, kind of, what it reminded them of.*

*“You could say it was fan-like in its shape.”*

*“You got, like, the spokes. It could be like a bicycle wheel.”*

*A few weeks later we then got them to draw, from memory, that piece of art and what we found was that rather than replicate the piece of art, what the people tended to do was replicate what they'd said it looked like. So if the person had said, “Well it kind of reminds me of a bicycle wheel,” then what they drew was a bicycle wheel. So what they'd done was interpreted that piece of modern art as what it reminded them of, but then remembered it in terms of that, so not exactly how it looked, but what it reminded them of. And it was that that they reproduced.*

## Part 2: Putting research into practice

The research being done by Graham and his colleagues in this fascinating field of study, along with our growing knowledge of how our memories work, and the use of modern technologies, is starting to offer very practical help to those working in criminal investigation dealing with eyewitnesses.

*There were some really good examples of eyewitness errors that were made in the Eyewitness series. The second crime that we staged was an armed robbery with most of the people wearing ski masks, like balaclavas, so that you couldn't really see anything of their face, but there were eyeholes, and one of the eyewitnesses obviously remembered that the eye region of the face was somehow different and his brain constructed a story to try to explain that, but rather than say the person was wearing a ski mask, he thought they were wearing sunglasses, and it wasn't just the fact he said that they were wearing sunglasses, which was completely wrong, he went into great detail about what the sunglasses looked like. So he described the brand, he described the shape of the lenses, he described the colour of the bits that go over your ears, but all of that information was completely made up, his brain had constructed, and what was really, I guess, surprising and really illustrative of one of the problems about his testimony is he completely believed it. For him, the experience of remembering the sunglasses which didn't exist was exactly the same as the experience of remembering details that did exist.*

*“Pretty sure he was wearing sunglasses.”*

*My work and other research in psychology really I think has two things to offer. The first is that we can act as a warning to the criminal justice system so that if we find that an eyewitness, or eyewitnesses in general are unable to do something or are fairly inaccurate we can warn them not to rely on that information. The other thing we can do is by studying how the mind works and how investigative procedures and courtroom procedures kind of make the most of how the mind works we can change those procedures, improve them. So hopefully what we can do is improve the accuracy of the information you gain from an eyewitness to try and stop an eyewitness identifying the wrong person, to try and help them remember information more accurately and more completely.*

*One example of that are the video identification parades that are used in the UK. It used to be, prior to 2003, that the police officer would have to scour the streets trying to find about nine or ten people that looked just like the suspect and that's a very hard thing to do. And we know that those parades tended to be quite unfair on the suspect. With the video identification system there's a very large database of thousands of faces that can be searched and you can put together a parade based on that database. Technology is also helping in terms of what's known as facial composite images, so e-fits and photofits. The original systems such as the original photofit and identikit system were found by psychologists to be very inaccurate because they really didn't work in a way that kind of made the most of human cognition. So the way we remember faces is we remember the whole face, we remember it what's known as holistically which means the whole face, but the way those early systems worked was to try to get people to construct a face by picking out first of all the eyes and then the nose. You'd look through hundreds of eyes and try and pick the right one. Now memory just doesn't work like that, you find it very hard to pick out somebody, their eyes particularly if you don't know them well, so modern systems have been introduced, computer systems that are based on knowledge of*

*how human psychology operates so that now what you see is a whole face and you kind of create an image of the suspect by manipulating the whole face.*

*So forensic psychology is informing the criminal justice system and helping to improve police investigative procedures all the time.*

## Unit 5: Across cultures

### Part 1: Migration stories

Wherever you are in the world, migration is likely to be a hot topic. The influx into a country, region or even city, of people from other nations or cultures can cause anxiety, distrust and resentment in the communities where migrants choose to settle. And the outflow of the educated and the young to other regions or countries in search of better lives can have serious consequences for the homeland that they leave behind. And being that new arrival in a strange place is always challenging. Overcoming language barriers, bridging cultural gaps, learning new rules both written and unwritten, and just trying to fit in, can be an exhausting and often isolating experience.

But, whatever your views on the current politics of migration, there can be little doubt that the movement of people it is far from a new phenomenon. And the world as we know it today would, culturally, be a much poorer place if there had not been constant movement of individuals and groups of people between countries and cultures throughout history. Our languages, religion, food, music, art, attitudes, ideas and customs have been shaped and enriched by the mixing of cultures brought about through migration.

And ultimately migration is the sum total of millions of individual experiences. And migrants who have returned home often have unique perspectives on the similarities and differences between our cultures, and what we can learn from each other.

#### Stephanie

##### England to China

*I moved to China for a job and I lived there for about four years. In general I had a very good experience. I would say that my two main challenges were learning Mandarin and dealing with people's expectations of me.*

*Most people obviously thought that I was from China. And so they would just make natural assumptions, they would, you know, they would start speaking to me in Mandarin or things like that. So, loads of times I had to keep saying to people, "No, I'm not from China, I'm from Britain."*



*In terms of learning Mandarin, it was very difficult because it's a tonal language and if you don't get the exact tone, you could be saying something completely different. So sometimes, for example, often when I was speaking to taxi drivers and I would say my address, they wouldn't understand me because of the tone. So I would have to keep adjusting my tone all the time and so sometimes it would take at least four attempts to get my address right. In the end, though, I decided that the easiest thing to do would be to carry my address around with me written in Chinese characters so that I could just show it to the taxi driver. The other thing, of course, about Mandarin was, of course, reading and writing it. I couldn't read or write it, even though my parents, who are from Hong Kong, tried to teach me when I was very young. And that is one of my regrets, or that was one of my regrets when I was living in China, I kind of thought to myself a few times, I wish I'd paid more attention when I was younger when my parents were trying to teach me.*

## **Nin**

### **England to Turkey**

*I've lived in Turkey, I've lived in Colombia, in Bogota the capital, and I've also lived in Khazakstan as well, so I suppose very different regions completely geographically. But I don't think that really changed the people that were there. One thing I found was that actually, inherently, all people they are all the same. I don't want to make that sound very general, but their values are very similar. Their approach to life is very similar. How they work within a family is very, very similar. Small things maybe how they do things on a day-to-day basis - foods that they eat, what they do within their family, what their typical Friday night is, what their typical evening activities are - may of course differ. But inherently I think that they're actually really similar.*

*When I was in Turkey, my push was always to mix as much as possible with local people. I found I learned a lot more, I integrated a lot better, and actually that was the best way to pick up the language. So within two years in Turkey, for example, I was actually able to translate documents for colleagues from Turkish to English and vice versa.*

*One thing I found in Turkey, it doesn't matter when you're working, when you're free, it's important to sit down at least once a day, as a family, together and eat the same thing. So not one person has to have their diet, the other person has their diet, it's a collective, something communal which I really believe brings the families together. And that's something that I insist now when I am sitting with my family as well.*

**Maura****Ireland to Brazil**

*Moving to Brazil it was just, again, it was a complete culture shock. But the weather was incredible, people were very friendly, and the food was amazing, and I lived by the beach. It was like I had landed in heaven and I just didn't, I didn't know how it happened. And because I had Spanish, Portuguese was a little bit easier, it was more accessible, I could kind of get by and I just loved every minute of being in Brazil. I just loved the food, the lifestyle, the people, and it was an amazing experience.*

*I think that in Brazil what you learn to do is you learn to value the things that are good in your life right now. There's a lot of poverty in Brazil, and what I learned is that you'd look out the window sometimes and people are playing music in the street, and you see people dancing, and they haven't got a lot, but they were just enjoying the moment. So I guess for me, one of the biggest things that I learned is that you've just got to enjoy the moment and seize it.*

**Part 2: Far from home**

Some people who migrate never return to live in their homeland. What is the experience like for them?

**Anjana****India to England**

*I moved the UK in 2000, so about 15 years ago, from India. I was born and bred in South India in a place called Kerala. A lovely place. I came here to do my degree, and my grandmother lived on her own here, so to live with her as well.*

*When I was doing my degree, in the first year or so, when you're sort of integrating yourself and learning more about the culture, and all that, trying to understand the accents, I did feel a little bit foreign because in my first assignment - I did a Law degree - first assignment was to watch a trial in a courtroom and the guy had an Irish accent and I had to take notes. I came back with a blank page. And I was like, "I don't have anything, I'm sorry, I don't understand that!"*

*Indian culture is very conservative in the sense that you don't have as much freedom of expression. Everything is set in their ways, and there is a certain path you follow. So you go to school, you go to university, you get a degree, get a job, then you do your master's, then, it's all like that's the way it is. Most people do and you kind of tend to fall into it. Whereas what I found here was people were not afraid to choose a slightly different path. OK, what if I don't do a degree? Doesn't matter. I can go and work for five years and then go back into education, say 15 years later. It doesn't matter when you do it.*

*When I came to do my degree, my plan was always to go back in four years' time, you know, and get a good job and settle where my parents are, because they were back in India. And then I got married! After a while, not straight after, that would not be good. I got a job here in London, so I started working and then I met somebody and then he happened to be from here, and we got married, and that's, the rest is history now.*

*It's very hard when you are living in a different country, and if you have a different set of values and culture you grew up with, to keep it intact, it's very difficult. But I do strive to do that. In terms of, like, in Indian culture the family structure is very, family is very important. I'm sure family is important for everyone. But when your parents age, it is considered your responsibility to look after them. And I think that is a nice sort of thing to keep. And there are elements like that that I do miss, sometimes. I don't get to do as much as I would like to, but I do, as much as I can, I try to think about it in my everyday actions and try to sort of bring it into my life.*

*I do still think of India as home. I think that's because 16 years is a long time, and where you grew up, where you have your childhood, all that, that kind of comes to be the home. So I do think of it as home, although, if I am away from here for more than two weeks, I get homesick So I can say I have two homes maybe?*

**Diarmuid****Ireland to England**

*For me it is interesting because I was born in England, and my mother was Irish, so she did exactly what I am doing now, in that she moved to England in 1984, always intended to move back, but didn't move back until 1997. So stayed there for quite a long time, but did make the move back. Personally, I always imagined that I would move back. It's home, I suppose. But the reason I moved was mainly economic. It's very difficult to get the kind of job I have now in Ireland. So, the reality is that Ireland can't offer the same variety that a bigger country can offer. And no matter how economically successful it is, that will always be the case. It's a country of four and a half million people.*

*Emigration is a part of Irish culture. It's in our literature, in our famous songs and it's something people talk about a lot. There's a famous quote about, you know, 'no longer shall our children be raised like our cattle, for export'. That's a paraphrase. But that is essentially what has happened for the last century, at least.*

*Being Irish is a strange one, because it's a small country that has a big brand. A lot of people know something about Ireland, even if they know very little about the actual country. The first thing you'll hear is usually the Irish pub. Then you might hear something about singing. And then you might hear footballers like Roy Keane or Robbie Keane. So, when an Irish person goes abroad they're usually met with this brand and in a way it's a good thing. People tend to warm to you quickly. But that can also be difficult because people have a cartoonish view of Ireland which has little or nothing to do with the reality. So often you're, you have to break through the cartoon-like identity to actually communicate what being Irish is.*

## Unit 6: Bletchley Park

### Part 1: Breaking the code

In any conflict, knowledge is power. Being able to communicate effectively and secretly with allies is always a challenge, and codes, ciphers and codebreakers have played a vital role in every conflict in history.

It's unsurprising to know, therefore, that during World War II some of the greatest minds of a generation were engaged in cracking the codes of enemy communications being transmitted around the world. But it's the lasting legacy of some of this work that is surprising.

This is Bletchley Park in the centre of England. Today, it's open to the public and is very popular with visitors, but during the Second World War this was one of the most secretive places in the country, and the base of the Government Code and Cipher School.

*The people who worked here broadly came from virtually everywhere, but more specifically, many of them came from the major universities.*

*They had them on standby and the idea was that they would come in for courses and that sort of thing. One of the earliest people approached would have been Alan Turing who was freshly back from the USA where he'd just spent two years at Princeton University, and the courses would generally be timed for the university vacations so then they could still do their university work, but train as potential codebreakers.*

This is the Enigma machine, the most famous wartime cipher machine in history. Using mechanical wheel settings to encrypt messages that were then sent via Morse code, the machine was first developed in Germany at the end of the First World War.

At Bletchley Park, mathematicians Alan Turing and Gordon Welchman developed the Bombe. This electromechanical device enabled the testing of all the possible settings of the Enigma machine to be done mechanically, in high

volumes, and quickly. By 1941 there were rooms full of these machines, standing nearly two metres tall and two metres wide.

*And whilst Alan Turing was the man who was an absolute genius in coming up with the technical ideas, it was Gordon Welchman who said, “We need to mechanize, not just that bit, but the whole process overall and have a complete production line for intelligence.” And so the Typex was designed. It was a bigger machine, it was a better machine than Enigma. It had five rota wheels, Enigma only had three. It could produce a paper tape from the side, far easier to use. And so they took these Typex machines and they effectively reverse-engineered them and they made them as clones of Enigma. So having got the settings, the next machine you use now is the Typex machine to effectively type the message out. You put in the gobbledegook and the tape on the side produces the German.*

The deciphered messages were sent between huts at Bletchley for translation and analysis, and then turned into intelligence reports. For security reasons the huts were only known by their numbers, and no-one spoke of the work they were doing inside their hut.

*The conditions here were, by modern office standards, rudimentary. I think there was a high degree of camaraderie, lots of friends were made but at the same time overall and overriding was security. So your best friend could work in the next-door office to you, but you wouldn't dream of talking to him or her about what they were doing.*

## **Part 2: Colossus**

Breaking Enigma is one of the most famous achievements of the team at Bletchley, but it was the work done on another cipher machine, the Lorenz, that really laid the groundwork for modern-day computing. Some of the machines that were created to decipher Lorenz have been rebuilt and can be seen working to this day at the National Museum of Computing at Bletchley Park.

Enigma machines were used in the field to create secure everyday communications, but the Lorenz was a much more complex cipher machine which was used for high-level strategic communications. British intelligence had no idea what the Lorenz machine looked like, or how it worked, and knew that the intelligence value of breaking this code would be immense. And some of Bletchley's most brilliant minds were dedicated to the task. Bill Tutte was perhaps the most brilliant of them all.

All Tutte needed was a simple mistake to be made by a Lorenz operator.

*In August 1941, messages, test messages sent by the Germans setting up a new link between Vienna and Athens were intercepted. It was due to operator error that the message was sent twice, both copies were received by Bletchley. Because of operator error the copies were different and the head of the military section, Colonel Tiltman, over a few days broke the message. Well, breaking one message sent twice is not the answer to the solution. So he then passed it to the research section and said, "This is what I've done so far, now tell me how the machine works." And they kicked it around for a couple of weeks and then one day Captain Gerry Morgan called in Bill Tutte, hands him a sheaf of paper and gives him some really comprehensive instructions - see what you can do with this. And Tutte then took it away and over a period of a few weeks analysed the complete architecture of the machine.*

*Tutte's feat was said to be the single biggest intellectual feat of the Second World War.*

With Tutte's plans, and the help of another great mathematician, Max Newman, the Heath Robinson machine was built to find the settings for the Lorenz machines. The Heath Robinson was an electronic machine, but required teleprint paper tapes to run simultaneously, one for input and one for output. The paper stretched and snapped and the process was inefficient. Breaking the Lorenz messages still took weeks.

Improvements needed to be made, and Tommy Flowers was the man to help. Flowers was an electronics engineer who worked for the Post Office. His genius was finding a way to replace the paper tape input with electronic valves. The end result of this innovation was Colossus, the world's first large-scale electronic digital computer. While extremely limited by modern-day standards, this was a monumental breakthrough, and reduced the time taken to break Lorenz messages from weeks to hours.

The sheer size of Colossus is incredible. By the end of the war there were ten Colossus machines at Bletchley, all being operated by female staff. And the intelligence gathered using these machines was absolutely pivotal in the war effort.

So why don't more people know about Colossus, and about the genius of Max Newman, Bill Tutte and Tommy Flowers?

So much of the progress made in the area of computing during the 1940s was simply lost at the end of the war. With the Cold War looming, the British never revealed that Enigma and Lorenz had been broken. People never spoke of their time at Bletchley. Papers and plans were burnt, machines destroyed and progress stalled for many years. The great minds who had worked together at Bletchley were scattered back to universities in the UK and around the world, and Tommy Flowers returned to the Post Office. For decades this groundbreaking work remained secret and unrecognized. It wasn't until 1975 that the first information emerged about the existence of Colossus, and it took another 30 years before the machine could be rebuilt.

It's impossible now to imagine how different the history of computing might have been if the veil of secrecy had been lifted in 1945, and these great minds had continued to work together.



## Unit 7: Graffiti Life

### Part 1: Graffiti is art

Graffiti gets a bad rap, but in some areas this negative perception is being turned on its head. Graffiti and street art is bringing communities back to life. It's turning dull and uninteresting streets into exciting, vibrant places to live and work. Graffiti is providing a creative outlet for young and old alike. It's opening eyes, creating new opportunities and making people happier.

David Speed is a graffiti artist and the director of Graffiti Life, an organization whose work shows that you don't have to sell a Banksy to have graffiti change your life.

*Graffiti Life is a collective of artists. We offer a range of services to our clients. So, as well as having our little gallery here where we sell prints and original paintings we also do team building where we teach people how to paint, they can learn how to do graffiti. We do murals. We've worked for some really big companies. We do advertising. And we paint interiors, exteriors, murals all over the world, which is great. And we also do live art, so where we're painting at an event and everyone can watch the artwork coming together.*

David is well aware of the negative attitudes towards some graffiti.

*The vandalism side of graffiti certainly does still exist, and there are people that their sole aim is to become famous through their peers really. It's not really on a wider scale, just within the graffiti community they want to become well known. So they will then paint their name on as many surfaces as possible – that's kind of their goal. And that still very much exists.*

*It's kind of funny how there are two different worlds within it: there are a lot of people who just are strictly just painting legally, there are people who are painting legally and illegally, and there are the people who are strictly painting illegally. The two worlds both still exist.*

*The reason that I'm allowed to work professionally as a graffiti artist nowadays comes down to the fact that there is an understanding from the general public of the artistic side of graffiti. I think a lot of that can be attributed to Banksy, and these really clever messages that he was saying, and quite ironic and satirical and things like that. And I think that was the catalyst for people to understand this art form a little bit more. And that was maybe the easy way in way to "okay, I've seen this guy Banksy, but let me see who else is out there". And I don't think there would be a Graffiti Life if there hadn't been a Banksy beforehand because it sort of opened a lot of doors because people are now a lot more understanding of the artwork that we make.*

The Graffiti Life gallery is in the heart of the East End, an area that is now internationally famous for its street art.

*For me I just love the fact that, I live in East London, so every day when I walk to work I get to go to an art gallery completely for free. I'm walking past new pieces, it's forever changing, it's constantly updating itself. Every time I go past a wall there's something new on it. I love that kind of freshness.*

*People come from across the world to come to East London just to see the street art. We run street art tours where we take them around this area and tell them bits about the artists that have created this work. In the same way, artists, international artists, this would be their first stop, is to come to London to create artwork here just because this is the hub, this is the central place where all the artwork happens, certainly within street art.*

## **Part 2: Bringing communities together**

So what is it about graffiti that David loves and wants to share with others?

*So, for me it's more about I just enjoy seeing people expressing themselves. Like when we do workshops with people you can see that when it kind of grabs them and people get to do this themselves, and the pride that they have when they've created something amazing on this huge scale, much bigger than they've ever painted before, because maybe the biggest they've ever painted before is sort of on a canvas, or a piece of A4 paper or something like that, and then all of a sudden you're painting a huge wall and you just have this sense of achievement of what you've created. And I love that. I love the expression and the fact that there really are no rules. I mean, you can paint whatever you like.*

*There are so many people just painting what appeals to them. And I think if you just paint what appeals to you then you will find a lot of people that it appeals to as well.*

*A lot of times when we work with young people you find you get – I mean in every group, no matter what age they are – you always get someone who says, “Oh, I can’t even draw a stick man”. And they’re the people that I really love working with because I only need 90 minutes and with a person who says, “I can’t draw. I have no artistic talent.” Give me 90 minutes with that person and they’ll be so proud of what they’ve created at the end of it and I love that, and we can really sort of turn that on its head.*

*And a lot of young people that we work with maybe they’re not that confident. We’ve worked with a lot of people who are kind of not in education or training, so they’re unemployed, they’ve kind of maybe not been given a lot of opportunities or they’ve kind of been passed by by society, or in school kind of they weren’t really working well at academic subjects and that wasn’t what they were strongest at. I often find when I’m working with young people I’ll give them a compliment on what they’re doing and you’ll go, “That’s wicked what you’ve just done! That’s really cool what you’ve just created!” And they sort of look at you like they’ve never heard a compliment before. And I just think there are so many young people who are not being encouraged enough, and maybe their schoolwork and stuff they find it really hard, or they find maths hard or something like that, but if you give them something artistic where it’s kind of an open playing field, if I’ve got a group of young people who have never painted before, they’re all roughly at the same skill level so they can produce something they can really be proud of, and you just see that transformation in people.*

*I think graffiti is a really powerful tool and I think it can bring communities together. I think that when a community is involved in creating a piece of artwork then they have ownership of that work and they become fiercely proud of it and protective of it.*

*I mean, sometimes in the past, not so much over more recent years, but sometimes in the past we’d be going up to a wall and get our spray cans out and lay them out on the floor just ready to paint, and you’d have people muttering under their breath something about graffiti or messy or you’re about to ruin this wall or what not. But then as soon as you’ve started painting those same people are walking by and the amount of older people, the older generation who maybe you would expect to not be interested in what we’re doing or particularly inspired by what we’re doing, I was amazed initially by how many of those people were coming over and going, “What you are doing is fantastic and we love it.” I mean, that has happened so many times. I think that is just so amazing that people are sort of walking by and they are getting involved and they’re saying, “We really approve of what you’re doing”.*

*For me, my goal and Graffiti Life's goal on the whole is to create artwork everywhere. So we're happiest when we can walk down the street and we can see amazing artwork everywhere. And I think that as I'm travelling I would much rather see creative stuff on the walls wherever I go rather than just plain, blank, painted by the council, grey walls. I think that's kind of stifling, and I think people should be encouraged to be creative.*

## Unit 8: Ruth Shackleton: A life less ordinary

### Part 1: The Red Arrows

*My name is Squadron Leader Ruth Shackleton and I'm presently the team manager of the Royal Air Force Aerobatic Team, the Red Arrows.*

*The Red Arrows is the most famous display team in the world. Their full title is the Royal Air Force Aerobatic Team. It was founded in 1964 and it was a culmination of three different display teams.*

*The team as a whole it consists of 120 personnel and that is made up of nine display pilots, a commentator, photographers, logisticians, engineers, administrators, and we are fairly self-contained in order so that we can perform in over ten countries around the world each year.*

*Our display season begins in May and it continues until October. Predominantly our displays are in the United Kingdom, however we do do tours abroad and in 2013 we toured ten countries throughout the Middle East in a period of 35 days.*

*The displays are a series of formations and manoeuvres that last in the region of 20 minutes. The first half of a display is sweeping formations made up of nine aircraft. The second half of the display is a lot more dynamic and a lot more fast-paced, and that's where you'll get the Synchro Pair and the mid-air manoeuvres that you'll almost think they're going to touch and we are famous for the display. People try and replicate us throughout the world.*

*The pilots are indeed the very finest pilots that the Royal Air Force have. There is very few people that could fly in such close proximity at such high speeds and so they are extremely professional in what they do and it takes an awful lot of practice and dedication to get to that level. They've generally been in the Air Force up to 11 to 12 years. They have had to have flown 1,500 fast-jet flying hours. They have to be above average, which sounds very ordinary, but I can assure you that it's the very best we have.*

*My role in the Red Arrows is that I'm the team manager. That involves me being responsible for everything non-flying related. So, if you can envisage moving a display team of this size around both the UK and abroad it takes an awful lot of logistics and coordination. That is one of my roles. I am also responsible for the marketing and PR aspects of the team, and I also am the corporate liaison for all our corporate sponsors. It is a very broad role, no two days are the same. Some days I might be speaking to the Royal household, other days I'm speaking to schoolchildren. It is from the strategic to the operations and tactical levels and it's a huge, very, very demanding role and I'm very privileged to be able to do it.*

*Many people would want to be in the role I'm in, I take it extremely seriously and I think it's a great honour to both represent my country, the Royal Air Force, and to be part of such a famous team that is renowned throughout the world, and no matter what gender, what race, what nationality, people have heard of the Red Arrows. And it's rather like a red London bus or it's rather like the Queen, we're a British institution and to be the team manager for that institution is a once in a lifetime.*

## **Part 2: An unusual career path**

*I suppose my career to date has been quite unusual in terms of my gender because I've normally taken on roles normally associated with men. However, it's not precluded me from doing anything. My first role was as a flight attendant with an airline, which of course is very female orientated. But I decided at the age of 24 that I'd like to join the Royal Air Force. It's about 10% of the Air Force is female and you are included in everything. And so despite people's thoughts on the military, it's a very equal and fair employer, and as such I've done many roles that men normally do.*

*I suppose I was a bit of a tomboy whilst growing up. I liked cars, I liked Lego, I like everything associated with boys, but no, I joined the Combined Cadet Force when I was 16 as part of the Royal Air Force Cadets and that was pretty unusual. I was the first female cadet at my school to do that and it was a really interesting, exciting challenge. Not only did we get to fly and do aerobatics, but we did a lot of fieldcraft, too, and that really exposed me to the military for the first time.*

*I became a flight attendant really truly because I wanted to travel and explore the world and get into the world of work. My friends had all gone to university intent on pursuing further academic study; I knew that was not for me and I wanted to explore and do something very different. So I ended up working for a Middle Eastern airline which*

*exposed me to an extremely different culture, of course very different between the genders in that part of the world, and I absolutely loved it and I had a marvellous time exploring over 2,000 hours flying in over three years.*

*And my lifestyle differs from that of my friends and colleagues in that by my age normally you're settling down to have a family, you're maybe becoming a bit more stable, you're settling in the one region and area. Of course, my job, I've moved 13 times in as many years and each job has been very different in a different part of the country or the world and so you're rather like a hobo. You're like a rolling stone and you never quite know where your next role is going to be. This is particularly prevalent in this role because we do a lot of displays all around the country and all around the world and it necessitates me being the team manager to arrange that for the team so I end up on the road a great deal. I go to a lot of meetings all over the country, and when we go on tour I'm in the thick of it arranging that, too. So you sleep in a lot of different beds and hotels, you meet an awful lot of different people and I guess it's very much career-orientated my lifestyle as opposed to some who have chosen to stay at home.*

*I don't really feel that there should be gender orientation in the job role you choose. I believe male and females have equally as many strengths and weaknesses. I feel if you're determined enough and you work hard enough and you set your mind to something bad enough, I think you can achieve almost anything. I never dreamt that when I started as a flight attendant with an airline that I'd end up being the team manager for the most famous display team in the world.*

*I've never experienced any negative attitudes towards me in the roles I've chosen. I've always been taken as an equal. It is a male-orientated world, certainly in the military, but that's only spurred me on and challenged me further because I believe that women are equally talented and can perform equally well in these roles, but you have to want it bad enough and you've really got to do the business. And it's not always easy because sometimes you face challenges, it's uncomfortable, your private life suffers, your home life, you know, it's tiring, you're in dangerous situations potentially, but you've only got one shot at life and you've got to live it and that's always been the way I've tried to live my life.*

## Unit 9: Silent film music

### Part 1: The silent film era

On a summer's evening in London, a crowd is gathering for an unusual cinematic experience. This is the Kennington Bioscope, a unique monthly event that takes place in the historic old Lambeth Workhouse, where Charlie Chaplin lived and worked before he went on to become cinema's first international superstar. It is now the location of the Cinema Museum.

The Bioscope gives its audience the chance to travel back to a time before multiplex cinemas, IMAX, 3D and ear-splitting surround sound, to experience long-forgotten silent films shown with live piano accompaniment, just as they would have been enjoyed a hundred years ago. John Sweeney is a world-renowned silent film accompanist, co-founder of the event, and expert on the silent film era.

*The characteristic of silent film is that there is no real sound on the picture. You might have a soundtrack put on it at some point, either at the time or later, but there is no real sound. You don't hear the sound of talking, you don't hear the sound of dogs barking, or doors closing, or cars revving up or anything like that.*

Of course, calling it 'silent film' is a misnomer. Right from the beginning of cinema in 1895, people used music to fill the gaps left by not having 'real' sound.

*By the 20s quite often productions would have a score which was written. If it was a particularly big budget, sort of, production number, they would have commissioned a score which they would possibly expect to be played everywhere, but whether it was, I don't know. Other times the musical director of the production company would produce what's known as cue sheets, which is a list of popular tunes or tunes from big books of music for silent film, and they would say for this scene play this number, for this scene play another piece, and so on and so on.*

*There are some people who think you should watch silent film in silence to get the purest cinematic experience. Which is all very well except the vast majority of silent films in my opinion don't work in silence, and certainly the vast majority of silent films were never made to be seen in silence. The directors didn't expect them to be seen in silence either. So there is a space for the music, the music is essential.*



*It's very interesting, with someone like Alfred Hitchcock whose nine surviving silent films have recently been restored beautifully by the British Film Institute, if you look at his silent films and then you look at the sound films, you can see that he grew up being a silent film director because there are so many scenes in Hitchcock which aren't about dialogue at all and where the music, there's action happening and the music is happening. Or in the case of for example the crop duster scene in North by Northwest, there isn't even any music, you have real sound, but there's no dialogue, and you can see that he grew up making film by image. He said "show, don't tell", that was one of his catchphrases.*

The release of the first official talking picture, *The Jazz Singer* in 1927, signalled the beginning of the end of the silent film era. Hollywood only continued making silent films for another couple of years, but in other countries the tradition persisted.

*In other countries, in Japan for example, they were making silent films as late as 1935/36, and also in Russia, so it varies. But basically the end of the 20s was the end of the silent era. So when talkies came in, it took a while for all the cinemas to switch over to sound, but the writing was on the wall for silent film.*

*I can't remember the figure, but I think at least two-thirds of the films made in the silent era were lost, either through neglect because when sound came in people thought nobody would be interested anymore. Silent films were also made on a film stock made out of silver nitrate, so they were often boiled up to get the silver content. And the film is fragile, so lots of films just decayed.*

## **Part 2: The music**

*People always say that silent film music goes... Or... And of course sometimes it does. But I think people's image of silent film is so much derived from two things: one is from slapstick comedy, from the Buster Keaton and the Harold Lloyd and the Charlie Chaplin shorts which we're familiar with; and the other thing is from German expressionism. Silent film was so, so much broader than this. When I got into silent film I had the same sort of thought, that that was basically silent film, but then I discovered this huge range of material.*

Music can do a number of things for the audience. Sometimes it reflects the speed of the action. But more often it helps the audience to see inside the heads of the characters. It allows them to understand what a character is feeling. Music can shape our emotional response to the scene and character.

*The most simple way of putting it is a major key is a happy key, and a minor is a sad key. But of course that's simplifying it to a ridiculous extent. You can have very sad music which is in a major key, you can have very wistful music in a major key. So other factors like the rhythm, all that sort of thing, where the music is going, how it's building, how it's shaping, have a huge influence on the mood that you're creating.*

*When I play for a film my ideal of what I'm trying to achieve is summed up by a great composer of music for sound film actually, Elmer Bernstein, who said he tried to find the heartbeat of the film. Quite often I'm playing for a film I haven't seen, probably more than 50% of the time, I think. And that's hard. You spend the first part of the film – even if you know a little bit about it because you read up as much as you can to find out about it – but you spend the first bit of a film feeling for the characters and what's going on. Then if you're lucky, you can kind of lock in on what the director and the actors are trying to achieve in the film and what the characters are feeling, and then it somehow becomes easier and you get into the swing of the film and the rhythm of the film makes sense to you. Other times you feel like you can't quite get in there and you're sort of on the outside, and you can be doing the right sort of music, but you somehow haven't got the rhythm of the film and the shaping it in terms of where it's building up to and so forth.*

*In an ideal world when I'm playing for a silent film, I shouldn't really be aware of what I am playing at all. It's happened sometimes when I've got so swept in a film that the music has kind of poured out of me as a response to what I'm seeing on the screen, and I haven't had to think about it.*

*I mean, one thing I say when I'm teaching a masterclass is, it's not always the case, but something that's worth thinking about when you're playing for a scene is what are people's heartbeats doing in this scene? Are they, is it a scene where the tension is building up? Or are they? And so on, you know. There's a whole range of how you respond to what's happening on screen. But in a way you have to kind of be inside the characters, I feel. That's my approach and that's how I feel it works, when I can inside the characters.*

Most people assume that the audiences at silent film screenings today will be filled with older people and film buffs. But, increasingly, the audiences are filling with younger people with a new-found interest in the artistry of these early films.

*And I feel like silent film has gone beyond that phase where something is old-fashioned to where it's become almost timeless, and people are recognizing that it's a unique way of telling a story, it's also a unique picture into the past.*

## Unit 10: The science of sport

### Part 1: All about the money?

There is absolutely no doubt that professional sport is big business around the world. It's estimated that the global sports market is worth in excess of \$140 billion a year.

While football, or soccer, is still the dominant sport in Europe, Africa and Latin America, cricket dominates the Indian subcontinent, and American football, baseball and basketball lead the North American sports market. But no matter what the sport, and where it's being played, the financial rewards of elite level sport cannot be underestimated.

Sports team coffers are filled with income from ticket sales, or gate revenues. Ticket prices vary widely from country to country and sport to sport, but can be astonishing. The cheapest matchday ticket to see Chelsea Football club play in the English Premier League, the wealthiest football league in the world, costs £50, or around 80 US dollars.

Huge sums of money are generated from television and media rights, with millions of fans watching live coverage of matches and tournaments from their homes around the world, and increasingly on the move on their smartphones, too.

Merchandising is vital to the teams as well, with fans eager to snap up the latest kit to show their team loyalty, and many teams' logos now appearing on ever more diverse items.

But it is reported that the single biggest financial contribution to global sports revenue is made by sponsorship - payments made by companies to have their brand name associated with successful sports teams and tournaments.

And there aren't just corporate riches on offer. Ultimately, it's the performance of individual athletes that these global sporting brands are built upon. And there's little doubt that the elite few are handsomely rewarded for their sporting prowess, by their club salaries and competition winnings, and by personal multi-million dollar sponsorship deals.

So the allure of such a lucrative, albeit often short-lived, professional sporting career is obvious. These days, it would be fair to assume that as much as any young athlete may strive for the glory of playing for their favourite team, or the honour of representing their country, they are also driven by the potential financial rewards on offer.

And more than ever, raw talent and innate ability alone are not going to get you into the echelon of the elite athletes. It requires starting young, training relentlessly, having a dedicated team behind you, and most importantly of all, it now takes science to make it to the top of sport. As world-beating teams like British Cycling know, victory today is all about 'marginal gains'. The team breaks down the sport into its tiniest individual elements, from the design of the helmets, to the type of pillow the athletes sleep on, and how they wash their hands. Then, using science to help them, they find ways to improve each and every element by just 1%. The resulting combined improvement in performance can mean the difference between the silver and gold medals. And when your team wins seven out of a possible ten Olympic Gold medals in your sport, like the British Cycling track team did in 2012, you know it's a system that works.

## **Part 2: The science**

The role that science plays in the development of elite athletes is multidisciplinary, but it can be broken down into three core areas: biomechanics, physiology and psychology.

Biomechanics looks at the mechanics of human movement.

The discipline often includes the study of the interaction between an athlete and their equipment and environment, with the aim of enhancing performance and avoiding injury.

The design of sporting equipment is constantly evolving and sometimes changes to their kit, whether it be footwear, rackets or clubs, can make or break an athlete.

Physiology, the study of how exercise changes the function and structure of the body, is one of the most obvious ways that science is integrated into the sporting development of athletes.

Scientific methods, and technology, are used to assess and monitor how athletes' bodies respond to training both physically and chemically.

This data enables coaches to evaluate an athlete's potential and allows specific training programmes to be developed to ensure optimal performance is achieved.

A simple scientific test like VO<sub>2</sub> max, which measures the maximum rate at which the heart, lungs and muscles can use oxygen during exercise, is now a standard training tool for any professional athlete. Participants wear a mask on a treadmill or cycle. Their exercise intensity is gradually increased and the levels of oxygen and carbon dioxide are monitored. With analysis of the data gathered, this test can accurately measure fitness levels. The test, repeated regularly, can gauge the effect of any training on the athlete's fitness.

Athletes who take part in sports that require endurance, such as long distance running or rowing, often have the highest VO<sub>2</sub> scores.

In recent years, more efficient ways of improving fitness have been developed through the use of this type of scientific data. A good example of this is high-intensity interval training – often referred to as HIIT. It has been proved that athletes can improve their fitness level much more effectively by exercising in repeated short bursts of very intense activity. Some research has suggested that it might only take three minutes of high intensity exercise a week to considerably improve the fitness of the average person!

Psychology is perhaps the most challenging discipline of sports science. While it's easy to quantify how a physical training programme can improve an athlete's performance, it's much more difficult to assess the role that psychology plays. But there's no doubt that a positive mental attitude is absolutely essential for success in high-level sport.

Professional athletes work with sports psychologists who help them to achieve and maintain high levels of self-confidence, motivation and concentration during training and competition. And perhaps most importantly of all, psychologists will also help them to control their emotions, and deal with adversity when things aren't going their way.

Because every professional athlete knows that, even with the best coaches and scientists in the world on your side, victory will ultimately boil down to you versus your opponent, and who wants it more.

## Unit 11: The skills to survive

### Part 1: In the wild

It goes without saying that technology plays a pivotal role in our lives. Even if you don't consider yourself a techno-geek, it's more than likely that you'll find it hard to imagine life without a mobile phone, or access to the Internet.

We already live in a world where it's possible to create 3D objects with a printer, where we are constantly tracked and monitored, self-drive cars and artificial intelligence are a reality, and experts promise the imminent arrival of the 'Internet of Things' that will control our homes and lives.

But hand in hand with this increasing reliance on technology and electricity, there is a corresponding risk that we will find ourselves completely unable to function as a society without it. The spectre of a lack of electricity and cyberterrorism already loom large. And on a more practical level, our dependence on technology is already having quite serious consequences on our abilities and skill sets.

What would happen if you found yourself without a phone, without power, without a GPS signal, alone and lost in the wilderness? How many of us would be able to cope? How many of us even have the basic skills to survive?

Jason Ingamells is an expert in wilderness survival skills, and drawing on a wealth of personal experience, he teaches these skills to others, and can offer life-saving advice.

*So my name is Jason Ingamells and I'm the director for Woodland Ways Bushcraft and Survival. And what we do is we take groups out to various locations, throughout the UK and overseas, and we practise bushcraft and survival skills and wilderness-living skills.*

*Survival skills for me are about trying to get yourself out of a situation that you've not necessarily chosen to find yourself in. And that is overcoming those four principles of survival: fire, food, shelter and water.*



*I teach on the rules of three, OK, and those are: three minutes without oxygen, three hours without shelter, three days without water, and three weeks without food.*

*Now I'm going to presume that everybody has the ability to be able to breathe, so my pure focus is on shelter immediately. We need to regulate how our body gains and loses body heat, so we need to maintain our core temperature. And clothing is an extension of that, but also the ability to get yourself into an area which is waterproof and windproof, shelter is always the highest priority.*

*Now three weeks without food may sound like a very, very long time, and indeed it is. And again, I'm not suggesting that you should leave it for three weeks and then go out and acquire food, but it's certainly a lower priority for you. If you're ingesting food, your body needs water to ingest it. So if water is of a concern, you've got limited supplies, you're better off not eating.*

*And so we build on that skillset: we get people learning how to create fire from natural materials, how to construct shelters that will be completely waterproof and windproof, again out of natural materials, how to get their water and make that water safe to drink, and also how to acquire their own food, whether that's from animal or plant.*

## **Part 2: A life changing experience**

The Woodlands Way weekend is one of Jason's most popular courses. And just two days in the woods can prove life changing.

*So I cater for a large range of different age groups, everything from eight years old up to 80 years old. A family course is going to be very different from an adults-only weekend course. However the vast majority of the customers are coming out of the city, they're young professionals, you know, 30/40-year-olds, who maybe want to de-complicate their lives just a little bit.*

*We live in a society now where we have complete reliance on other people, and the skills that we teach are more about self-reliance. You know, we can't come out here and flick a switch and have light and turn a dial and have heat, you've got to provide it for yourself. And I think that connection with being responsible for your own safety and your own welfare really connects with people that have been removed from it for so long.*

*People don't use knives on a daily basis now as a tool, people don't prepare their own food, there's a reliance on other people to do things for us. And so therefore what I'm doing is I'm almost rebuilding their knowledge base of how to look after themselves, so it can be quite shocking sometimes.*

*And I think we can see that technology is having a major input into the lack of those skills now, we can press a button and we've got access to a wealth of questionable information sometimes, but certainly information. And I don't think technology is necessarily a bad thing, but we shouldn't use technology to turn our back on these old skills. At the end of the day, if we lose these skills and then technology fails, where does that leave us?*

*It's strange, because I see people going on a journey as they come through with us, so for the first 24 hours or so, they're in an unusual environment, it's alien to them, and the thing that they miss the most is actually the technology. They miss being in contact with other human beings, their social networks.*

*They're not able to nip on to Facebook and do an update status, they can't communicate with their normal social network through technology, and so they go through a journey of almost having to release themselves from that.*

*But as the time progresses and they realize that actually the world is around them here, it's not on the screen in front of them, you get a transformation, they relax more and they really tune into the environment. And then 24 hours later, they're completely different, they're noticing things that they would have never noticed before because they would have been looking like that. And then you start to get a connection with the real world that you're in, rather than the cyberworld which is on a tablet.*

*So getting back to basics, getting people out there, you can see, I see a transformation: they arrive on the Friday night, they leave on the Sunday a different person completely.*

## Unit 12: The Human Genome Project



### Part 1: The discovery of the 'secret of life'

On the evening of 28th Feb 1953, two scientists, Francis Crick and James Watson walked into The Eagle Pub to celebrate a good day's work at the nearby University of Cambridge Cavendish Laboratory. Crick boldly announced that they had just discovered the 'secret of life'. As hyperbolic as it sounded, a few months later the pair published a paper in the scientific journal *Nature*, where they revealed that they had discovered the structure of DNA, 'the stuff of life' – the iconic Double Helix. In their words 'This structure has novel features which are of considerable biological interest.' It explained how genetic information is stored, copied and passed on through the generations.

The same journal also contained papers by Maurice Wilkins and Rosalind Franklin, who had been responsible for the research and the defining image that enabled Crick and Watson to create their structural model.

The elucidation of the structure of DNA was a turning point in molecular biology. It started a scientific revolution, and ushered in the era of genetic and genomic research that would change medicine as we know it.

*So to build a human body you need to know what proteins to use, you need to know what processes to activate, and when and where in the body and the DNA both gives the information to build the proteins and contains the information, the programming language if you like, of when and where to switch those proteins on.*

*So DNA is a very simple molecule in some ways. It consists of a string of bases, we represent those bases by four letters: a, c, g and t.*

Professor Julian Parkhill works at the Wellcome Trust Genome Campus outside Cambridge. Scientists here have always been at the forefront of genomic research, and they were part of the global team that undertook the biological equivalent of travelling to the moon, the Human Genome Project. Work started on the project in 1990 and it was one of the most ambitious scientific ventures in history.

*The human genome has around three billion base pairs. There are two copies of every gene so in total around six billion base pairs, but most of those are identical. So the original project aimed to sequence that haploid genome, the single copy, the three billion base pairs.*

*So the Human Genome Project was a massive undertaking. It involved very large numbers of different people from different countries, different institutes, working at different times, so it's difficult to be exact about the numbers, but the estimate, people estimated that it cost probably around \$3bn. It involved at one stage or other at least 5,000 people from 20 different institutes around the world. We produced a third of the finished sequence, which is the largest single contribution from any institute around the world.*

The Human Genome Project was completed in April 2003. The reference genome determined the exact order of base pairs in a human being and is presented as page after page of text with just four letters – a, c, g and t. Each gene appears as bold text on the page.

*They have printed it out in a set of books and it's a bookshelf around three feet wide and six feet high and it contains 40 or 50 books of very large hardback size, so it's a substantial amount of text.*

## **Part 2: Putting the genome to use**

Today, the scientists working with the Human Genome in laboratories around the world are fundamentally changing medicine as we know it.

*My name is Elli Papaemmanuil and I'm a postdoctoral research fellow at the Cancer Genome Project at the Wellcome Trust Sanger Institute. So the Human Genome Project was completed around the time that I was finishing school, and it was a very exciting time and I came to the UK to pursue studies in Human Genetics, and that then has taken me into cancer research for my PhD in postdoctoral research.*

*The completion of the human reference sequence has been fundamental in strengthening our understanding around both: how the genome sequence is organised, but most importantly, how this correlates to disease.*

Once the reference human genome was completed, it became possible to study groups of patients who shared the same disease to look for shared genetic markers or gene mutations.

*Specifically, we now know that the human genome contains approximately 23,000 genes, of which 5,000, with certainty, and more likely up to 10,000 of those genes, have been correlated with common diseases, such as cardiovascular disease, arthritis, as well as more rare diseases and developmental disorders, such as autism. Our understanding of cancer has been revolutionized through the attainment of the reference genome sequence, with at least 400 genes known to be implicated in cancer today.*

*So by having a very well-annotated list of correlation of gene mutations with different disease entities, and the great opportunity of having now these technologies incorporated within clinical laboratories, it is now possible to test a patient's DNA alongside all the routine diagnostic tests for those common genetic markers that can inform us not only on the specific disease entity that a patient may be associated with, but also provide quite a lot of important insight on potential new therapies that would be effective for that specific patient, taking into account the genomic profile.*

While there is still a long way to go in translating research into clinical practice, progress so far has been very promising.

*In the same way where we currently think a blood test does routine, in the future, a DNA test should inform what the patient suffers from, what the most effective treatment is, potential adverse reactions to specific treatments, or combination of treatments, that one should be mindful of, and expected outcomes, so that patients are not over treated or undertreated, and rather receive the best possible care that they can. And all of this with a very simple and easy-to-conduct, as well as interpret, DNA test that's going to be routine across clinics, and why not GP practices.*

We made it from the discovery of DNA's structure to the completion of the Human Genome project in just 50 years. We now live in a world of genomic medicine and it's a world of endless possibilities.

