

From Cave to Cloud

This is the transcript of a keynote lecture given by Professor Bruce Brown at the *Designs on e-Learning* conference at the University of the Arts London, 6th September, 2012.

I'm very grateful for this opportunity to say a few words at your important conference. We're now at one of those rare moments in time when the effects of a new technology can be described as genuinely revolutionary. And there have been very few moments like this in recent history. One was the emergence of book-learning after Gutenberg's invention of printing from movable type. Since then we've continued to evolve these mechanical technologies through a slow, and almost invisible, process of incremental development. But, now, we're being catapulted out of this mechanical age of book-learning by a new generation of disruptive digital technologies that are game-changing. We are being forced out of our comfort-zone of incremental development into one of radical innovation. And this is a shift with which we have no choice but to engage.

Today, we have to recognise the fact that a new generation of technology is once again reshaping the ways in which we learn, study, generate knowledge, and shape our institutions. I would also say that these new digital technologies are returning us to more important concerns about individual learning and creative development—fundamental concerns from which we have been distracted by an obsession with the preceding generation of mechanical technologies.

And what's-more, we really have no option but to move with the massive change that confronts us. Moreover, to simply rely on the habits and practices derived from a previous phase of mechanical technology will be of no value. Indeed, it often seems that we talk of the future yet we act in the past without realizing that our long-standing comfort zone of incremental development is being overtaken by radical innovation.

So, I would like to put these shifts into some kind of perspective that will illustrate the disruptive effects of new digital technologies on the way that we educate and govern ourselves. I'd also like to show how this change is, paradoxically, and finally, returning us to some of the fundamental principles of education. Moreover I would like to suggest that the changes being brought to an older, and broken, educational model that we have grown up with (and yet have still to shed) are social changes based on social learning. This will not only change what we know, and how we learn it, but the ways we behave, collectively and individually, in the world. The English philosopher, Herbert Spencer, described this in saying "The great aim of education is not knowledge but action."

I would like to focus on one, seemingly simple, reversal that's lies behind these major changes — and illustrate how the development of successive technologies has brought us to this point of revolution. We still are soaked in a model of teaching inherited from an age of mechanized industry where one person will seek to influence the thoughts and actions of many other people. This old model depends on the effective transmission of approved content. The Digital Age has reversed all of this through technologies that now allow many people to interact with many other people. From this new process of many-to-many interactions will emerge a single body of knowledge that may challenge approved, or official, sources?

My generation grew up in an educational environment shaped by the Industrial Revolution. One of its primary objectives was the development of successive technologies (such as printing) that could control content and would conquer distance. The purpose of developing technologies that could support distance teaching was to enable a few people to influence the behaviour of many people. This was often, but not always, done in the interests of greater social cohesion and, at other times, for the exploitation of labour. It's what the 19th century thinker John Stuart Mill described as a tyranny of the few over many. It was an educational system in which the demands of a rapidly industrializing society meant that utility and conformity were more important than creativity and innovation.

I attended Liverpool School of Art in the mid 1960's then went on to Canterbury and the Royal College of Art. Throughout this education I had the good fortune of meeting, and being taught by, creative practitioners like John Heartfield (the great political photomontagist), Richard Hamilton (an intellectual giant of British Modern Art) and Herbert Spencer (whose creation of *Typographica* reinvigorated the UK tradition of typographic visual language). Here I experienced the very best of what, on the surface, may seem to our contemporary eyes to have been a very informal, unmanaged, learning environment. I don't believe the phrase "learning outcomes" would have been understood if it had ever been used and the distinction between research and teaching was never made. Everything in my experience of being a student, at that time, was focused on what we now, in various ways, would either call student-centred, project-based, enquiry-driven, or, independent learning (or all of these things mashed up together). But, at the time, it was simply seen as the student-centred experience of learning through making. What was being changed, though, was a shift from knowledge transmission to knowledge construction through collaborative learning. Though the digital technologies needed to support this model had not yet been invented three elements seemed to underpin the human process of learning. They were:

- visual imagination
- embodied knowledge
- social networks

Let me just touch on the link between learning-through-making and embodied knowledge before going on to discuss the question of social networks. By embodied knowledge I mean something that is not just taught but also has been caught—not information going over the head but knowledge that gets inside the mind to change behaviour. Indeed, the definition of learning (as opposed to teaching) that underlies my talk is: the embodiment of knowledge or experience to create permanent changes in behavior.

The following example shows how drawing can be used to stimulate visual imagination so that the knowledge and experience gained becomes part of second-nature. The university I work in has a Medical School having close links with our art and design disciplines. Recently the students in this Medical School undertook a photography project in which they simply used the camera as a means to more closely investigate their clinical environments. As part of this project a prominent heart surgeon also came to talk about the sketchbooks he kept. In the event this surgeon showed us a very beautiful series of anatomical drawings for which his explanation was both illuminating and fascinating. He explained that, for him, the drawings were not simply representations but were rehearsals.

He explained that, when operating on a patient there were times when the balance of life could depend on his split-second decisions. In such circumstances book-learning by rote was of no use. What he needed was a second-nature experience that supported rapid decision making. And, in this example, the act of rehearsing scenarios in visual imagination, through drawing, enabled the knowledge to be embodied so it shaped his future behaviour.

Though an example drawn from clinical practice it was this kind of learning-through-making that was typical of a 1960's art school. Through it I learned how to reason and reflect by engaging with the struggle to make things—to shape abstract things (like ideas and feelings) in visual imagination and then draw them into the material world for wider social interaction. But the 1960's art school also had another mission. It set out to replace a broken model of regimented, factory-driven, transmission teaching that had dominated education until then. In this model the role of a teacher was (and often still is) to transmit content into the supposedly empty heads of eagerly awaiting students.

Here I would like to illustrate how transmission teaching evolved through a series of technologies that were all designed to control content and conquer distance. And I'd like to do this by identifying just four points of radical change in the production and distribution of content. They were all aimed at the development of means for distant teaching (rather than distance learning). Each of these changes also appeared, very suddenly, almost out of nowhere, after long periods of hardly noticeable, incremental, development. They are:

- Image making
- Typographic printing
- Electronic transmission
- Cloud Computing

Of these four shifts Image Making and Electronic Transmission were intermediary stages that helped to bridge the transition from one Age to the next. The invention of printing from movable type heralded the start of a Mechanical Age where technologies were designed to facilitate one-to-many transmissions. This has now been overthrown by the many-to-many interactions made possible by cloud computing and the Digital Age.

So let me begin with the first stirrings of this process as images suddenly exploded, about 20,000 years ago, onto cave walls across Europe. Though early humans had, for millennia before this, possessed the brain-power to make such images it never was harnessed to this purpose. So, what caused this sudden shift in behavior to image-making? If not the consequence of some change in human biology was it simply the accidental discovery of a new mark-making tool or was it some other insight that stimulated the shift?

I've already mentioned the heart surgeon who used drawing to rehearse acts that shaped his own behavior. Following on from this, try now to think of pre-historic cave drawings in a similar way. Firstly, see these drawings not as representations but as rehearsals. And, secondly, think of the caves not as art galleries but as learning spaces. Indeed, images such as these not only had a value to those who produced them but also to those who later came and consumed them.

Just like our surgeon — who had to cope with important split-second decisions — the producers of these images may have needed to find safe ways of rehearsing complex and dangerous hunting

practices. They may have needed to prepare for such events by rehearsing them in visual imagination – to then be carried around in memory as part of second nature. The simple process of making such images made sure that the knowledge they generated was embodied. Once this purpose had been fulfilled the same images then had a later, perhaps unintended, effect on those who came to see them. It must have become evident that when, many people consumed the same images, then social learning began to take shape. This helped to increase the survival chances of many, isolated, individuals through the orchestration and shaping of their collective behavior. The important discovery is that images stimulated the social learning through which many people could learn to act as one.

It must not have been long, however, before this process began to reverse itself. A shift from collaboration to transmission meant that ruling authorities could then direct social behavior towards prescribed ends. It was here that teachers and leaders began to emerge along with the tools and technologies needed to spread their influence. Their specific objective was to create official content then get it to as many people as could be reached, wherever they were. So, if official content could be made portable on, say, the surfaces of skin, clay or parchment this would extend the range of influence of one person over many people. So the first person to walk out of a cave with official content tattooed on their skin began this process of distance teaching.

Some of you may know of Harold Innis' seminal work, 'Empire and Communications' in which he defined a society's capacity to transport official content to distant places as the key to their success. But he also pointed out that a major limitation of physical media such as stone, clay or parchment was their resistance to mass reproduction and, hence, their limited range of influence.

This limitation was overcome by Gutenberg's invention of printing from movable type which heralded the start of the Mechanical Age. His technological innovation can be genuinely described as revolutionary — for it changed the shape of human society. For the first time books made possible the production of official content that would be identical in every detail, in every reproduction, that was ever to be produced and distributed. It also stimulated the ability of people to make and decode symbols (in this case the alphabet). Hence it caused an increase in textual literacy throughout the population. And, as this stimulated a growing demand for content the production capacity of hand-operated printing presses could no longer keep up. It was this escalating appetite for content, combined with the Industrial Revolution's invention of mass reproduction, that finally enabled fixed content to conquer distance and flow to people in every corner of the globe.

Indeed, Gutenberg's technical revolution created the first mass distribution of official content from one person to many people. So the advent of book-learning completely changed the way people were educated. Though it seemed that this technology could control content and conquer distance it nonetheless had two limitations — time and language. Though books could conquer distance their physical rate of transportation was slow. And, though textual literacy had increased, what came with it was a demise of visual language. Now people went to libraries rather than to their memories for knowledge. Now that information could be bound into books the effort needed to embody knowledge in minds was redundant.

At this point, technology delivered one more radical shift with the invention of electronic transmission. About 150 years ago the discovery that content could be transmitted through the ether by electromagnetism again reshaped human society. This expanded the range of content available by

allowing, not just texts, but sounds and images to be transmitted and received via radio speakers and television screens. Not only did electronic transmission conquer distance it also vanquished time.

Now texts, images, movies and sounds could be transmitted and received instantaneously. Not just from every corner of our globe but also from the moon.

All of these earlier technologies had one thing in common. They were all designed as one-to-many systems of communication. That is, they were very good at enabling one person to transmit official content to many people - so influencing mass behaviour. They were strong on talks and weak at conversations.

Again, as Harold Innis makes clear in *Empire and Communications*, those technologies designed to conquer distance (such as stone, clay, parchment or skin) will have a bias towards permanent content. In contrast, those technologies designed to conquer time (such as radio and television) will transmit content that becomes more fluid. What electronic transmission introduced was a weakening of institutional control over content. So, out of this previous phase of mechanical technologies, the invention of electronic transmission provided an important bridge into the borderless knowledge of our Digital Age.

The Digital Age emerged in the 1980's through the twin inventions of personal computing and the world-wide-web. This new generation of digital technologies revolutionised the production and distribution of content. It enabled everyone to be a content producer and everyone to be connected to everyone else. This shifted the process from one-directional transmission to multi-channel interaction. Let me give you an example of the effect this had on collective social behavior and authority.

This is Gene Sharp pictured in the study of his Boston home. He's a nice, sage-looking, Professor with an Oxford PhD and retired from Massachusetts and Harvard Universities. He now spends his days in this room with one assistant, and a dog. What Gene seeks to produce in this space are the sparks of ideas that will catch fire then spread with an energy of their own. Here is a recent BBC News report about him. The bottom line in this report is intriguing. It says 'This is Gene Sharp, the man now credited with toppling the Egyptian Government'. Indeed, Professor,Sharp, sparked ideas that helped to ignite popular resistance to regimes in Burma, Serbia, Ukraine, Russia, China, Thailand, Indonesia, Iran and South America. Putting the social and political dimensions of these events to one side, what were the elements or processes that caused widely dispersed individuals to shape their collective behavior into that of a purposeful community.

Firstly, Gene Sharp is a content producer and that's where it stops. He makes content available for those who may benefit and makes clear this is its primary purpose. He is not a content transmitter and does not profess to offer instruction on how his content should be used or applied. Instead, Gene Sharp provides a framework of tactical ideas around which individuals can link with each other so that group action may be created and orchestrated through collaboration. And, famously, the way this many-to-many interaction was achieved in Egypt, Iran and other countries was through the use of digital social networks like Facebook and Twitter.

A first step in this process was the extension of Gene Sharp's intellectual space (his room) into a digital space where anyone could enter. It's called the Albert Einstein Institute and has a mission for "the defense of freedom, democracy, and the reduction of political violence through the use of nonviolent action". One of the site's most used and infamous texts is "From Dictatorship to

Democracy". You can see it listed down towards the bottom of this website. Anyone, anywhere in the world with access to the world-wide-web, can download it free of charge. Within the pages of this book is a framework of 198 strategies for non-violent protest. Interestingly, the majority of these strategies are based on symbolic images and performed rituals rather than words. The ways in which they were applied is clearly evident, for example, in the Green Revolution of Iran. The key, however, to the use of these strategies was the way in which social networks such as Facebook and Twitter got them into the respective bloodstreams of communities so that many disparate individuals could be transformed into one purposeful (and powerful) community. And once formed this community gathered a momentum that was unstoppable.

If you have not heard of Gene Sharp before, or the influence of his ideas on movements such as the Arab Spring, then you can see more of this in a film that's just been made by the Scottish film-maker Ruaridh Arrow. The point of this example is to illustrate the real power of a new technology to transform many isolated individuals into one purposeful, and powerful, community. One that will harness digital content and social networking to shape and direct its own behavior. Though more technologically advanced than the charred wood used to make pre-historic cave drawings these new digital technologies have similar effects. Though both technologies were thousands of years apart they were similar in trying to link many individuals into one cohesive group. The main difference between them, however, is one of scale. Technologies of the Digital Age now operate on a massive scale that conquers both distance and time in a way that cave drawings never could.

And here is the revolution. Whereas earlier mechanical technologies enabled one person to transmit official content to many people, Digital technologies now enable many people to work on the co-production of a single body of knowledge. It is a radical inversion of one-to-many systems into many-to-one. It is a shift from one-directional transmission to multi-channel interaction. Put another way it transforms John Stuart Mill's tyranny of one over many into the authority of many over one. So it brings another revolution to the ways we educate and govern ourselves.

Interestingly, though, some of the key ideas behind this revolution were first voiced before the emergence of the Digital Age. Douglas Engelbart (in Stanford) and Ivan Illich (whose time was divided between the US, South America and Germany) supplied some of the key ideas. In 1962 Douglas Engelbart proposed that computers around the world be personalised then linked to each other to provide a massive collaborative tool. A global learning web in which many people could interact with many others to enhance human learning. Ivan Illich built on this idea in his book "De-Schooling Society". First published in 1971 Illich's efforts, to reform a "broken educational system", are considered to be as radical now as they were when published. In De-Schooling Society Illich proposed a more open and interactive educational process built on computing technology. Indeed, his early vision of a learning web that could link many people to many other people has turned out to be surprisingly accurate. He described it this way:

"The operation of a peer-matching network would be simple. The user would identify himself by name and address and describe the activity for which he sought a peer. A computer would send him back the names and addresses of all those who had inserted the same description. It is amazing that such a simple utility has never been used on a broad scale for publicly valued activity."

And behind Illich's ideas was a conviction that institutionalised education created an institutionalised society built on utility and conformity. He saw this as a broken educational system in need of reform.

So, in response, he proposed a more open and self-directed model that was grounded in social networks and learning webs. In his view this new education should:

- "provide all who want to learn with access to available resources at any time in their lives;
- empower all who want to share what they know to find those who want to learn it from them;
- furnish all who want to present an issue to the public with the opportunity to make their challenge known."

All of these ideas emerged around the same time, in the mid 1960's, when UK art schools were also challenging the accepted models of education based on the transmission teaching of approved content. Indeed, at this time, there seemed to be a general will in the world to replace this tired system with something better. But these brave visions emerged too soon in the transitional space between old and new technologies. What they did not yet have access to were two technologies essential to making this aim real and sustainable — they were personal computing and the world-wide-web. They had not yet completed the journey from cave to cloud.

With the creation of these new technologies earlier visions of a more open system of education based on global learning webs and social networks becomes a possibility. And these ideas have recently re-emerged in the US in the form of Massive Open Online Courses. Commonly referred to as MOOC's these can be freely accessed, as their name suggests, by a massive number of participants. One such MOOC is edX offered by Harvard, Stanford and Berkley. The edX website recognises that a next generation of students will expect to be connected 24/7 and so be likely to adopt a more nomadic style of learning. They will expect to study anywhere, anytime.

MOOC's have two underlying principles. Firstly, that curriculum and content are not prescribed but will emerge from the many-to-many interactions of massive numbers registered on the global learning web. Secondly, that all the material produced through collaboration will be aggregated into one knowledge base. The first MOOC's to launch this many-to-one learning experience seem to have had a mixed success. Though it is too early to see how they will, or will not, evolve there is some evidence that MOOC's are still delivered from a top-down perspective — they are being driven by a previous model of distance learning from one-to-many. Though the practice remains one of transmission teaching it is, this time, writ large on a massive scale.

In this respect it often happens that any new, upstart, technology will have a transitional phase through which to free itself from past habits and traditions. The first automobiles, for example, continued to look like an earlier form of transport — in this case a horse and carriage — until the distinctive characteristics of these new machines emerged. But the pace of change between an age of mechanical technologies and this Digital Age now has gathered a momentum of its own. The shift from one Age into the next is no longer incremental but radical. This may be due to the low-cost ubiquity of personal computing and mass access to the world-wide-web and cloud data. It may also be that a business model which monopolized the production and distribution of content has now been busted by Digital Age technologies. With the demise of these monopolies over content many people can now produce, co-produce and consume content through massive webs of learning.

In this Digital Age the iPad is no longer a computer but a site of co-ordination. It is a space where materials, tools and content can be assembled, created then put in the cloud for all to share. This re-integration of the production process is already reversing the fragmentation of skills and labour that mechanized industry forced society, and education, into as a consequence of the Industrial

Revolution. Now the iPad will re-integrate all of the means needed to create and distribute content. And this introduces the potential for a new form of digital Craft whereby one person may co-ordinate all stages in the cycle of making something from the sourcing of materials, to assembling tools then applying image, text and sound to the design of interactive content. This shift also serves to revive our command of visual language after the decline it went into after the invention of printing from movable type.

Though we now have technologies that allow us to do anything we wish to do what seems missing in all of this is the power of imagination needed to find innovative responses to the major challenges facing society . And this is largely the inheritance of an educational system in which utility and conformity have been valued over creativity and innovation.

This second revolution now emerging from our Digital Age will have an immense effect on the life of institutions and the shape of those communities of practice we still call universities. This shift will, finally, take us away from an obsession with technology and the control of content to focus on the things that really matter in life. How we educate ourselves, make sense of the world and deal with major social challenges. I would also say this shift has come at a critical moment in time. As we continue to struggle with environmental and financial crises we face a third crisis more pressing. We face a poverty of imagination. But it is only through the power of imagination, not technology, that we will be able to make the world better.

We are now at the point where our ties with a one-to-many model of education are being shaken by the new Digital Age. The world-wide-web has vanquished both space and time, personal computing in the clouds has deregulated content. Up until now universities have been able to define themselves through an ability to control content. But for next-generation of universities this grip will be weakened as we move into an Age of increasingly borderless knowledge and open distribution. No longer will universities be able to define themselves through the content they offer. In this context institutionalized education will have to deliver something else – something more fundamental. Universities will have to move from a long-standing focus on the controlled transmission of content to a more open, and flexible, model for the co-production of knowledge. The fundamental aim of this will be to help each learner create their own intellectual scaffolding through which to make sense of the world and to sustain a lifetime's endeavor.

So, sense-making will eclipse content transmission as the key distinguishing feature of tomorrow's universities. What this demands is a radical overhaul of the teaching and learning strategies we have inherited so we can re-establish a focus on the innovative and creative potential of brain-power and visual imagination—in doing this we need to be much less preoccupied with technology or teaching and give much more focus to creative learning through making.

And here I would like to introduce one final thought. It is the notion of trust. In this new world of deregulated content where many people will interact with many other people to construct knowledge then getting access to trusted sources, and institutions that can be trusted will, be a primary incentive. How to establish and maintain trust relationships, therefore, will be a significant challenge for universities in the future. If successful this will be one of their most valuable assets and distinguishing characteristics.