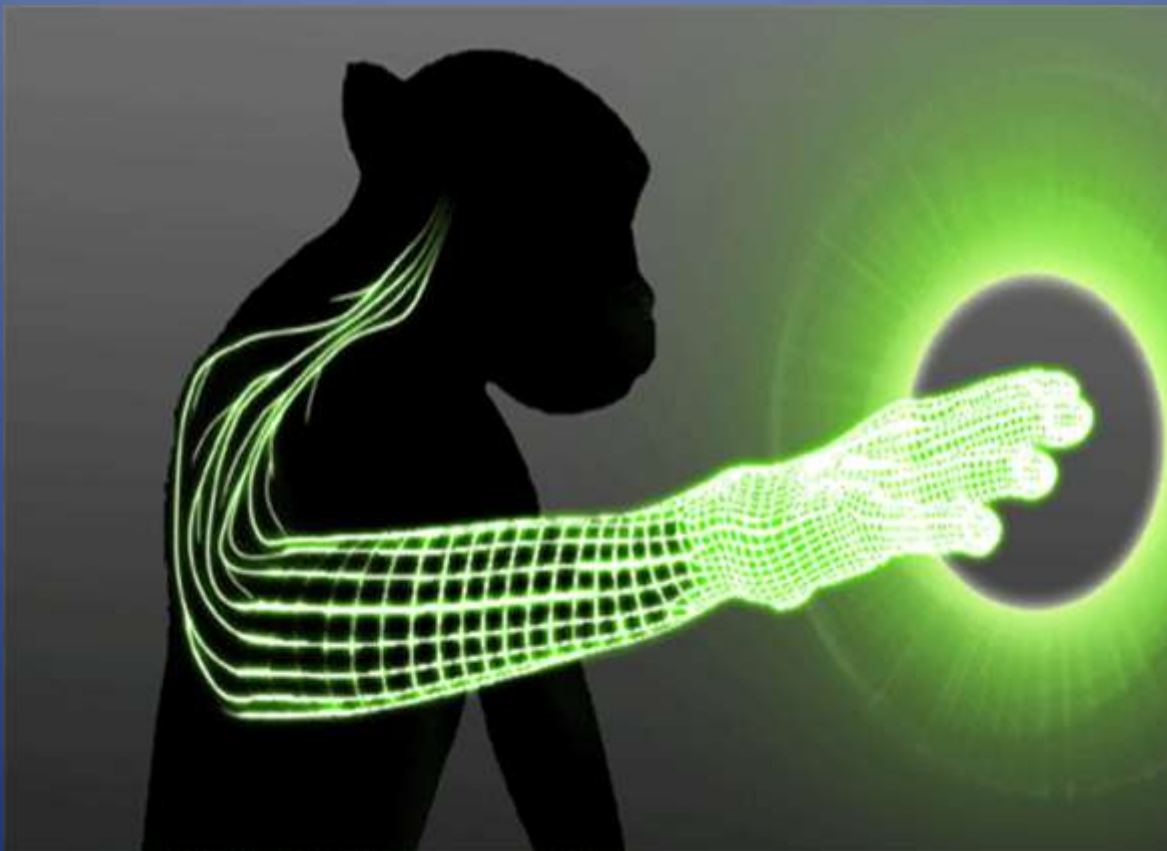# The Virtual Ape

Ray Hammond

Chapter extracted from:
SCARY-WONDERFUL: THE NEXT 50 YEARS

'We are such stuff as dreams are made of…'

William Shakespeare

The Tempest, 1610

You may worry that your children spend too much time talking, texting and web surfing on their mobile phones, sitting at their computers or staring at TV. You may think that you yourself also spend too much time on these activities.

You may urge your kids to 'get out more', to 'be more physical', 'to meet more real people' and to 'get into the real world'. You may very well wonder what will become of youngsters who seem to spend all of their disposable time in some form of cryptic electronic intercourse. What will their adult lives be like? Will they grow out of their obsession with technology?

The answer to that last question is a resounding 'NO'.

Virtual habitats in all of their manifestations – social networking and messaging sites like Twitter, Facebook, WhatsApp, Bebo, MySpace, etc., multi-player network games, virtual worlds, fantasy spaces and augmented reality – **will form a natural and inseparable part of the future habitat for human beings.**

The more youngsters prepare for such a life, the better equipped they will be to live in what will certainly be a 'virtual' future.

Although all of the electronic spaces I have just described *are* artificial and created by humans, I am going to argue in this chapter that our happy immersion in virtual environments is not some distraction from the 'real reality' of life or from the 'normal' healthy course of human development, but is the logical end destination for our species. It's where we've been heading ever since we first began to speak.

To understand why I feel so certain that the virtual worlds created in computer memories and the global networks will be an important part of our future habitat it is important to recall the essence of what makes human beings different from all other animals that have evolved on Earth. The distinction is, of course, the qualities of the human mind and, centrally, I argue that the higher functions of the human brain are wholly 'virtual'.

In current usage we understand the word 'virtual' to mean either 'almost' (as in something that is 'virtually the same') or 'computer generated' as in 'virtual reality'. But the word virtual stems from the medieval Latin word *virtualis* which originally meant something that has force, essence and effect

but which does not necessarily have any physical form. Because we always lack a language for the technological future, rather than inventing a new word to describe the myriad electronic creations and environments that are growing out of the human imagination I am restoring the full meaning of the word 'virtual' to embrace all of these creations – and the human mind itself.

The essence of what it is to be a human being (compared to all other creatures) is 'virtuality' – which can also be thought of as higher levels of consciousness, imagination and language.

LANGUAGE IS THE PARENT OF REASON

Somewhere around four million years ago those ape-species that were our evolutionary forebears did something very strange in their hot homelands of Southern Africa. They began to stand up on their hind legs and walk in a semi-erect fashion.

We do not know how long it took for these proto-humans, these *Homo Habilis* (tool users) as they have been called, to perfect the skill of walking on two limbs only, but the changes could only have occurred over thousands of generations and through multiple sub-species. Neither do we know why this change in locomotive technique took place; perhaps a change in the climate demanded an adaptation, perhaps the rise of new predators with new ways of hunting prompted the switch, perhaps new ways of hunting with weapons that these hominids themselves developed was responsible. Whatever the cause, what we do know is that as a direct result of their gradual switch to an upright walking position two physiological changes

occurred to the pre-human frame which were to lead directly to the emergence of a capability we now see as uniquely human.

The first physical change produced in the pre-human form by a switch to bipedalism was a downwards movement in the parietal and occipital plates of the cranium. Under the force of gravity these bone plates, which are located at the back of the skull, were drawn downwards over countless generations and this provided increased space in which the pre-human brain could grow larger. By the time *Homo Habilis* appeared (between 2.4 and 1.5 million years ago) the brain in our forebears had become the size of a softball – about 500cc in volume. By the time *homo erectus*, our immediate predecessor, appeared (between 1.8 million and 300,000 years ago) the brain size was over twice as large – up to 1,100cc (the average size of a modern human brain is 1,200cc)[1].

The second physical alteration was also caused by the reorientation of gravitational forces on the human skeleton. As the hominid head was raised to an upright position over thousands of generations, the spine straightened to support the head and this allowed the larynx, the voice box of the bipeds, to fall downwards and find a larger space in the elongated neck in which to grow. Today, humans have the largest and most complex descended voice box of all animal species – except for one species of red reindeer stag which, for an unexplained reason (but perhaps for extra-loud bellowing), has an even larger, but less complex larynx[2].

As a direct result of these two changes – the larger brain and the larger larynx – proto-humans gradually developed their cries and grunts into a clear

language. Eventually, complex spoken communication emerged.
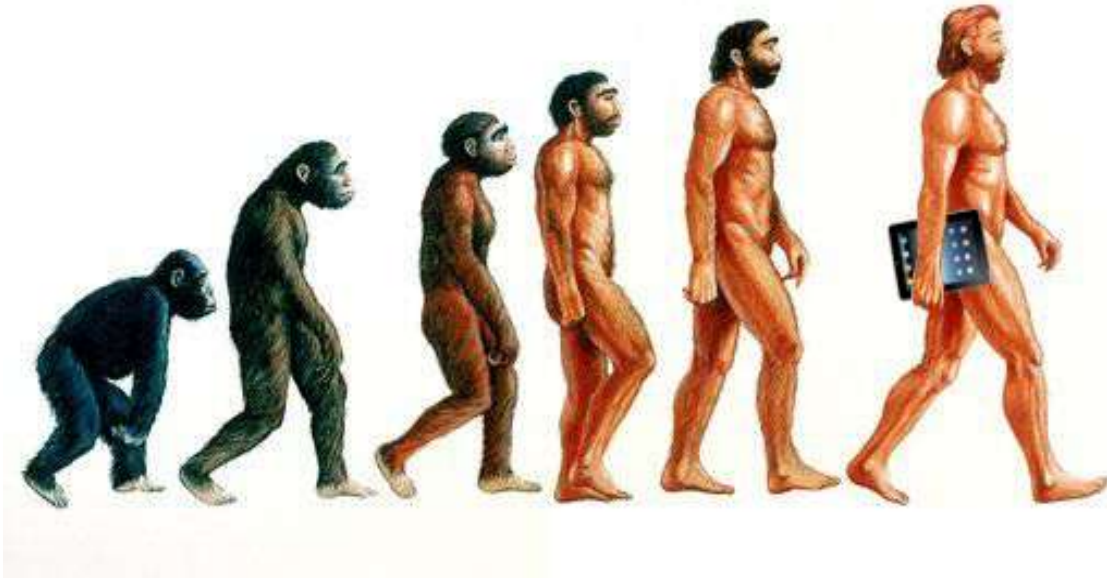
This explanation about the origins of human language was first popularised by cognitive scientist and evolutionary biologist Steven Pinker in his 1994 book *The Language Instinct*[i] and has now become widely accepted amongst cognitive scientists and evolutionary biologists.

   Using sounds that initially were entirely arbitrary but which gradually became understood as symbols, these human forerunners named each other and the things around them for the first time. But human language is wholly virtual, in our expanded meaning of the word. It only works because two or more minds in a group share a common concept of what a particular oral symbol, or set of oral symbols, means.   'Tree' only means 'Tree' to another

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[i] http://en.wikipedia.org/wiki/The_Language_Instinct

member of the tribe who has learned what meaning has been given to the unique grouping of sounds in that particular word.

This concept of applying meaning to specific symbolic sounds is the 'virtual' element of human memory and is one of the key distinguishing features that separated the mammal that was to become *homo sapiens* from all of the other creatures on this planet.

Oscar Wilde famously claimed that 'Language is the parent, not the child, of thought' but it seems obvious that humans are capable of some types of thought which do not require language[3]. The human mind can use its virtual powers to create visual simulations of complex scenes in its imagination – perhaps a fantasy sexual encounter or a longed-for meal – without the use of language and such imaginings must count as 'thought' even if only at a simplistic level.

And the occurrence of dreams during sleep – a mental activity shared widely with other species – also testifies to the brain's power to create virtual, wholly imaginary scenes, situations and narrative, sometimes without spoken language. No one is certain about the purpose of dreams (if they have any) but everybody who recalls their dreams will have been amazed by the sleeping brain's lightening ability to create imaginary scenes – cityscapes, geographies, crowds of people – and 'render' them (i.e. adding colour, texture and depth to the scenes) so rapidly that imaginary events feel as if they are external and real. (The current thinking amongst psychologists is that there is no 'purpose' to dreaming and the 'narratives' formed during

sleep are just random 'thinking' and 'processing' actions of the brain that occur whilst its higher levels of consciousness are subdued.[4])

Although no one can prove at what point dreaming emerged in the pre-human mind, the evidence for dreaming in other species suggests that the power of dream and its virtual creations certainly pre-dates the development of spoken symbolic language.

Perhaps Wilde's observation could be recast more accurately as 'Language is the parent, not the child, of *reason*' as simple forms of thought certainly appear to pre-date symbolic language. Either way, the human pictorial imagination and the symbolic word are both wholly virtual.

But our virtual nature runs even more deeply. All that we know of our surroundings, the outside world and of each other is 'virtual', in my enhanced and extended meaning of the word. Every piece of information that enters your mind does so in virtual (i.e. encoded) form. When you feel a touch upon your skin, your nerves are translating that pressure into electrical signals and then sending the information to your brain to be processed in a chemical soup. It is a processed 'representation' of touch that you feel, not the actual touch. That caress, pinch or punch that you feel is wholly virtual.

THERE IS NO COLOUR IN THE WORLD

Some of our senses are even more startlingly 'virtual' in nature. When you look at a beautiful sunset, or the dazzling hues of a tropical fish, the colours

that appear in your mind (like the shapes themselves) are wholly virtual representations. Your optic nerves convert the inverted monochrome images captured on the retinas of your eyes into electrical signals which are sent into your brain's chemistry for processing. Here, your clever large chemical processor converts this information into what you think of as vision (turning the images the right way up in the process and turning flat 2D images into a full three dimensions with full volume, depth and perspective) and adds all of the lovely colours that you believe exist in the external world to the result[ii]. There are no actual colours in the external world – only different wavelengths of greyscale light; your mind manufactures colours dependent on the wavelength information received. That red apple is not red at all; you make it so.

[ii] http://en.wikipedia.org/wiki/Color_vision

The evolutionary advantage of colour manufacturing within our brains – or the reason that we developed such an extraordinary ability to add virtual colour to enhance our perception of the world – was the improved discrimination of surfaces provided by this addition to visual processing. Other species of ape and monkey also create some colours in their brains (although few are as rich as the human colour creation machine) and many other mammals and birds create some simplified forms of colour, whilst others detect and encode 'colours' from the ultra-violet range of frequencies[5]. However, many animals, birds and fish see only the tones of black, grey and white – which is what the world really looks like.

The evolutionary biologist and cognitive scientist Pascal Boyer explains human perception of the external world as follows:

> When we see things we just believe we see them and we believe they really are out there. (I am not talking about exceptional circumstances, but banal scenes. You are at the zoo and there is a tree out there and an elephant next to the tree.) However, the visual system does not present the rest of brain with a scene. It takes apart chunks of information coming from the optic nerves and handles them separately. One system transforms the two-dimensional information on the retina into a possible three-dimensional representation of volumes, another one evaluates their respective distances, a third handles their colour , a fourth sends information to a database of common shapes for identification, etc[6].

It will follow that all the information from the rest of our senses also arrives in our minds virtually, arising from electrical signals sent to the brain, rather than by any form of 'direct' perception (as is the case in most, if not all, other animal, bird and fishes species).

There are, of course, far more than the classic five human senses first identified by Aristotle. In addition to sight, hearing, taste, touch and smell there are also senses for feelings and conditions such as balance, tiredness, hunger, thirst, fear of heights, pain, sexual arousal, and heat sensing. But all are produced by information processes in our brains which create them as virtual sensations.

So my argument is that the 'real' world as we perceive it is, in fact, a virtual representation of the outside world created by our brains in a way that can be compared to a computer processor constructing a virtual world (and, of course, dreams are a perfect example of such artificial construction). It is also true that our 'internal' feelings are virtual and are the result of representations created from electrical data.

In his 2012 book "How To Create A Mind" futurist and inventor (and Google's current Director of Engineering) Ray Kurzweil wrote:

> Although we experience the illusion of receiving high-resolution images from our eyes, what the optic nerve actually sends to the brain is just a series of outlines and clues about points of interest in our visual field. We then essentially hallucinate the world from cortical memories that interpret a series of movies with very low data rates that arrive in parallel channels.

It is for these basic reasons of human biology that we are so at home in the new virtual worlds we are now creating in computer memories and in networks. The human mind is the original virtual environment and these new computer-generated places seem as 'natural' to us as our own senses and thought processes. We are, indeed, part of the matrix.

CAVE PAINTINGS ARE VIRTUAL

In addition to evolving very complex mental simulations and spoken language (both virtual) we know that our hominid ancestors also developed tools for practical, non-virtual, purposes. But it is also possible that pre-humans may have created some physical objects for symbolic, ritualistic or artistic purposes; perhaps primitive sculptures and artwork, which might count as virtual representations of their world. But the evidence for this is scant and uncertain.

The oldest 'art' we can be sure was created deliberately was made by modern humans, *homo sapiens*, and can still be seen on the walls of caves in South Western France.   These cave paintings were created over a long period between 16,000 and 32,000 years ago. By this time *homo erectus* had long since migrated out of Africa and had spread deeply into Europe and parts of Asia. The climate in the various areas where these hominids settled caused specific racial characteristics the develop – different skin colours, eye shapes, nostril shapes, etc. – and somewhere between 500,000 and 200,000 years ago *homo erectus* evolved into *homo sapiens*, modern humans.

Anthropologists are unsure why the stone-age cave dwellers in France drew beautiful images on their underground walls. It wasn't 'art' in the modern decorative sense as archaeologists have been able to determine that the 'artists' of the time chose to create their work in caves that weren't used for residential purposes. Some of these caves are quite inaccessible and while it is possible that these creations were artistic in the purest sense of the word, they may also have had symbolic and religious purposes or even educational

aims[7]. There is even some evidence that many of these "paintings" were created while the artists were under the influence of hallucinogenic herbs[8].

   The drawings are mostly of animals that lived in the region at the time – antelopes, reindeer (during an ice age), bison, horses, etc. – but there are also some depictions of mountains and the local landscape and even outlines of human forms (although it is suspected that these were kept deliberately simplified because of religious taboos about the realistic depiction of humans). My favourite theory is that the artworks were created by distant ancestors of Bill Gates who were desperate to invent PowerPoint presentations.

But whatever the real reason behind the creation of these stunning images, it is important to understand that they were, and are, *wholly virtual*. Paintings on a cave wall may not seem at all virtual but they are, of course, entirely virtual representations of the world that the cave dwellers saw all around them. The stone wall is the storage medium that contains the information that these people (perhaps unwittingly) forwarded to the future in virtual form.

AND, OF COURSE, ALL RELIGIONS ARE VIRTUAL

At the risk of being contentious I suggest that all forms of religion (and superstition) are products of the human ability for thought and virtual simulations and projections within the imagination. Religion may be a by-product of humans' ability to think about the future (however reluctantly). In the absence of knowledge, a religious belief is a wholly rational response to the anticipation of death.

From today's perspective there is no objective scientific evidence for the existence of any god or for the veracity of any superstition (other than a possible negative placebo effect caused by superstitious fear).

But the concept of 'proof' regarding religious and superstitious ideas would have been very different in pre-scientific times and many 'truths' would have seemed self-evident even when they were incorrect – such as the illusion that the Earth is flat or the observation that the sun circled the Earth.

Early humans' almost complete lack of knowledge about themselves, their surroundings and the Earth provided fertile territory for virtual creations such

as gods, demons and the spirits of ancestors. (Why never the spirits of those yet to be born? Surely they have a bigger stake in the present than those whose lives are over? Perhaps it is because humans were conditioned by evolution to discount the future, as I discussed in Part One - The Introduction.)

Religion and symbolic ritual seem to be almost innate to the proto-human and human species and religious behavior is thought to pre-date *homo erectus'* migration out of East Africa 50,000 years ago[9]. Many anthropologists suggest that religion emerged from general group morality as proto-human tribes sought to find ways to reinforce the codes of behaviour that maintained and protected group cohesion.

For example, psychologist Matt J. Rossano[iii] argues that religion emerged after morality and built upon morality by expanding the social scrutiny of individual behavior to include supernatural agents. By including ever-watchful ancestors, spirits and gods into the social realm, early humans discovered an effective strategy for restraining selfishness and building more cooperative groups[iv].

The adaptive value of religion would have enhanced the chances of group survival – a very powerful evolutionary selector. Those groups with a 'religion' to control their behaviour survived to send their genes down to the present day while the genes in the non-believing groups were wiped out

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[iii] http://www2.selu.edu/Academics/Faculty/mrossano/
[iv] A senior government figure in a large Middle-Eastern Islamic nation that is both very rich and ultra-conservative admitted to me recently that his government tolerates the existence and influence of extreme Muslim clerics in order to maintain social order in rural areas where the government itself has no instruments of control.

(which, perversely, might lead those groups with religions to consider themselves to be the 'chosen people').

If superstitious fear were not reason enough for the invention of religion, the flowering of virtual mental simulations, the development of complex language and the understanding of causality allowed human beings to imagine purposeful agents behind many observations that could not readily be explained otherwise; for example, accidents, thunder, lightning, earthquakes, the movement of planets, the complexity of life, etc.

But anthropologist Pascal Boyer argues that the most usual reasons cited for the development of religious belief in humans – superstition, fear, the need for explanations, social cohesion, etc. – are not adequate on their own to explain how religious notions grew spontaneously and in very similar ways in many separate groups of humans. He suggests that religious concepts and norms can be explained better as a by-product of standard cognitive architecture.

Today, the truths behind many of the once seemingly inexplicable curiosities of life have been revealed by modern science, a discipline based on objectivity, testability and repeatability. Most of the really big questions about life have now been answered beyond doubt (if not the very biggest question) – and those answers do not include any type of god or supernatural entity.

Human religious instinct (sometimes called 'The God gene') is very powerful, particularly so when a child is indoctrinated from an early age with

a rigid set of religious beliefs. These beliefs become emotionally embedded in the child's psyche. This sort of childhood indoctrination is common to many of the world's major religions and the process is sometimes described as 'hereditary religion'.

Childhood emotional attachment to religious ideas becomes so strong that in adulthood any results from objective science that seem to contradict the religious beliefs are often dismissed without proper examination in order to protect the emotional and psychic wellbeing of the believer. Literally, many of those indoctrinated with rigid religious beliefs in early childhood are *unable* to undo their beliefs. The biologist and campaigning atheist Richard Dawkins describes this sort of religious indoctrination of children as 'child abuse'[v].

Religious faith can bring enormous comfort to those who are either ignorant of scientific explanations or who choose to reject objective reason for deep emotional reasons of self protection. But organized religion is generally anti-progressive and divisive of peoples and it misleads billions of humans about the truth of their condition and their responsibility to each other and our shared environment.

Religion is at once the most powerful, the most irrational and the most destructive product of human virtuality. I would like to think that religion will die out as reason and education spreads around the world but the power of the human instinct for religion seems to suggest this will not happen for a very long time.

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[v] http://richarddawkins.net/articles/118

FOUR VIRTUAL INVENTIONS THAT CREATED THE MODERN WORLD

Humans made their first truly great breakthroughs in virtual innovation ten thousand years after the last people who dwelt and painted in the caves of South West France either died out or moved on. The agricultural revolution was the driver that was to produce a flurry of virtual innovation and, as a consequence, lay the building blocks of the modern civilized world.

The change from a nomadic hunter-gatherer lifestyle to a settled farming existence took place over a long period starting about 10,000 years ago.   The gradual change in the way humans lived began around the edges of the Mediterranean and in some of the extremely fertile inland areas of the Middle East. The process of learning how to grow plants instead of foraging for them, and husbanding animals instead of hunting them may have been driven by drought which denied nomads the chance to move on to unexploited regions[10]. Whatever the cause, the switch took thousands of years to complete but as this process evolved it produced abundance and plenty and, for a lucky few, even some spare time. As humans benefited for the first time from reliable and regular meals in a settled location, so education, learning and innovation began.

The first centres of learning and civilization to emerge were the towns and cities of the Sumerian people who, for over 3,000 years, lived in the large fertile valley between the Tigress and Euphrates rivers, at the centre of a region known as Mesopotamia.

The cities of Sumer were the first to practice intensive, year-round agriculture (from around 5300 BC).   By perhaps 5000 BC, the Sumerians had developed core agricultural techniques including large-scale intensive cultivation of land, mono-cropping, organized irrigation, and the use of a specialised labour force, particularly along the waterway now known as the Shatt al-Arab, from its Persian Gulf delta to the confluence of the Tigris and Euphrates rivers. The surplus of storable food created by this economy allowed the population to settle in one place instead of migrating after crops and grazing land. It also allowed for a much greater population density, and in turn required an extensive labor force and division of labor[11].

The apex of the Sumerian civilization, which is now regarded as the cradle of all civilization, was the great city of Babylon which was situated in today's Iraq, about 85 kilometres south of Baghdad.

This period of immense change and innovation produced many vitally important physical inventions – irrigation, the wheel, the building arch and the plough – but it also produced the four virtual technologies that have since created the modern world.

The first vital virtual innovation of the Babylonian/Sumerian civilization was the invention of date and time. 'Periodicity' is a natural product of the Earth's rotation and solar orbit, but the division of the planet's rotation into named hours and minutes, and the division of the solar year into quarters, months and hours of the day were both wholly virtual innovations.

Other cultures, some earlier, some more contemporary, were also keen to measure time and date; Ice-age hunters in Europe over 20,000 years ago scratched lines and gouged holes in sticks and bones, possibly counting the days between phases of the moon or, perhaps, female menstrual cycles. And although there are no written records about Stonehenge, the circle of giant stones built over 4,000 years ago in England, its alignments show its purposes apparently included the determination of seasonal or celestial events, such as lunar eclipses, solstices, etc[12].

But the well-fed Sumerians did the job properly. Then invented a calendar that divided the year into 30-day months, divided the day into 12 periods (each corresponding to two modern hours), and divided these periods into 30 parts (each like four of our minutes)[13]. All of a sudden the future was calibrated and agreements to meet, to make a payment or to marry could be made for an approximate time on a specific date in the future.

The second all-important Sumerian virtual innovation was the invention of alphabetic cuneiform writing which was to develop into the phonetic, alphabetic writing of the sort we use today. In previous cultures information in simplified form had been recorded using hieroglyphs, pictograms, ideograms and other image-based forms of 'writing', but these did not allow complex and narrative forms of information to be stored[14].

Developing a flexible, alphabetic written language based on the components of speech, with rules of grammar, allowed very complex information and ideas to be recorded for the benefit of other contemporaries and stored for reference by future generations. For the first time human

society could capture its complex knowledge and social records in virtual form and store it in a way that could be forwarded to the future. Writing replaced the tribal memory and oral methods of knowledge transmission (storytelling, songs, etc.) which were of very limited durability and subject to considerable temporal distortion.

The third vital innovation of the immensely creative Sumerian culture was the development of Babylonian mathematics which became the first ever formal and universal (spoken-language independent) system of measuring by virtual means the world around us, and then calculating any required values, also by virtual number manipulation. The modern practice of dividing a circle into 360 degrees, of 60 minutes each, began with the Sumerians and this astonishing culture also founded astronomy as it is practised today.

Babylonian mathematics later merged with Greek and Egyptian mathematics but today's maths is still grounded in the understandings that were first achieved 5,000 years ago. All modern astronomical, engineering and technological achievement is founded on Babylonian virtual mathematics[15].

Finally, the fourth of the vital virtual innovations was the invention of 'money'. Modern money (and most ancient money) is essentially a token – in other words, an abstraction, or a virtual symbol that can be exchanged for goods. The limitations of previous physical barter systems was that sellers (say of chickens) had to be matched to exchangers (say of building materials), which was often difficult or impossible to achieve in a useful time frame.

But the Sumerian concept of money suddenly eliminated this need to match buyers and sellers and freed the Sumerian economy to soar, as it has freed all other economies to do ever since. The Mesopotamian civilization quickly developed a large scale economy built on money as the exchange intermediary. The Babylonians and their neighboring city states later developed the earliest system of economics as we think of it today, in terms of rules on debt, legal contracts and law codes relating to business practices and private property[16].

As a 'symbol' money itself has no intrinsic value. There are only a few *absolute* 'values' in the world – food (plants and livestock), shelter (building materials and land), water, energy, weaponry, clothing, labour and, perhaps, some limited forms of transport. Some human cultures have also assigned values to commodities that are naturally rare, such as gold or diamonds, and these commodities have sometimes doubled up as forms on money (known as 'commodity money' because the tokens themselves had a value attributed to them) but such attributed value only holds for societies familiar with such notions of value. Offer a gold bar to a stranger from a culture which has never heard of gold and he won't give you a cup of water for it.

All forms of portable 'value' other than the absolute values and those assigned to rare commodities are facilitated by the use of symbolic money tokens as an intermediary. The concept of money is 'virtual' and it doesn't exist independently of a collective social agreement that a given 'token' – a coin, a piece of printed paper or a credit or debit in a computerized bank account – does have value.

The value of national currencies in today's world rises and falls directly according to national and international confidence in a particular currency – a widespread lack of belief in a currency leads to rampant inflation and ultimately the collapse of the 'token' of value.

The invention of money was also to lead to the development of banking, which is itself a virtualization of money, which is virtual in itself (you can see how we drifted into the problems of virtual highly abstracted financial instruments in the 2008-09 financial crisis). The extent of banks' virtualization of money has increased considerably in recent history. In the late 19th century a typical American or British bank had an equity buffer – i.e., core capital – equivalent to 15-25% of its assets. As recently as the 1960s British banks held more than a quarter of their assets in low-risk, liquid form, such as cash or government bonds. But going into the 2008-09 credit crunch, confidence in banks' virtual powers had grown to such an extent that some Western banks' core capital was 3% of their assets or less, and less than a tenth of those assets were liquid[17]. This was the main cause of the financial crash – we pushed virtualization too far.

As the face value of the financial tokens, symbols and instruments circulating in global society is very much greater than the value of the world's fungible products of absolute value (i.e. goods or products of absolute value available immediately to be sold or exchanged) it is not unreasonable to see national and international financial systems as wholly virtual. The value in the global economy exists only because we believe that it does (and, in some instances such as the USA, because national armed

forces have the power to insist that other nations respect the value of their 'tokens').

Banking – the storage and lending of money – also began during the Babylonian period but religious prohibitions on the earning of interest ('usury') delayed development of mainstream banking until the middle ages. The Italian Lombards of the 14th Century were adept financiers but modern banking in which a relatively small pool of deposits can be virtualized into much larger pools of loans was not invented until the 16th and 17th Centuries when the activity was developed mainly in London and Amsterdam.

But before we get too far ahead of ourselves, it is right to record some other important virtual inventions that have contributed to creating the fast-changing world of today.

The German invention of printing with moveable type in the 15th Century (the further virtualization of the virtual technology of alphabetic writing) is one of the most commonly cited drivers of the Renaissance and the flowering of European learning which followed, and which finally led to The Enlightenment. The act of repeatedly impressing inky words onto paper pages and then binding them together may not seem to be at all virtual but books are, of course, wholly virtual forms of information transmission and distribution. Once printing was developed complex knowledge and information could, for the first time, be widely disseminated allowing humans, in the famous quotation, to 'stand on the shoulders of giants'[vi].

[vi] The phrase is often attributed to Isaac Newton, but seems to have originated in the 12th Century to refer to those learning from the great minds of the past.

Modern oceanic navigation was another crucial invention which was wholly virtual and which allowed sailors to cross the seas with increasing accuracy and safety. Developed from astronomical navigation and the discovery of the magnetic north, the dissection of the globe into virtual lines of latitude and horizontal lines of longitude allowed progress across the oceans to be measured using two earlier virtual inventions; mathematics and time. A sextant measured the sun's position to ascertain the latitude and chronographs of increasing precision were developed for the measurement longitude. And maps are, of course, graphic but wholly virtual, representations of locations and features.

By the 19th Century the pace of technological innovation was increasing rapidly as the dissemination of education and knowledge through printing and the establishment of global trade started to produce nation states which grew to become empires. Notable innovations during this period were the telegraph, radio and moving pictures (which were all virtual) and the development of powered ships, locomotives and flying machines (which were not).

Technological innovation which had been progressing at a slow but exponential pace since before the Agricultural revolution 10,000 years ago, now entered that part of the exponential curve at which it first became noticeable to most people in advanced societies.

The 20th Century produced X-rays (invented in 1895, actually, but developed in the early 20th Century), television, computers, data networks,

ultra-sound scans, MRI scans, meteorological and financial modeling systems and mobile phones (which are all virtual innovations) and passenger planes, bomber planes, fighter planes, missiles, rockets, satellites and spacecraft (which are not virtual in themselves but which were developed using virtual information, technologies and techniques). There were, of course, many other innovations and inventions, but I merely wish to set the virtual components in context.

In my introductory chapter I pointed out that a lack of language with which to describe and discuss the properties of most new technology often hinders our ability to understand its potential. Just as phrases like 'magic lantern', 'iron horse' and 'horseless carriage' now seem archaic and to miss the point of the invention they described, so I suggest that the phrases 'smart phone', 'mobile phone' and 'cell phone' will come to seem equally archaic. These names mislead us and do not indicate how these devices are likely to develop.

We are now building a vast virtual habitat which is connecting components of the external, physical world to the simulations and processing power of virtual environments. The services and networks we think of today as television, cell-phones, the internet, broadcast radio, data networks, etc., are all converging to become part of a giant virtual universe of electronic information which will grow to be larger than its host planet and far more complex.

In time, the majority of humans will be permanently connected to this parallel virtual environment and they will enact their lives in the physical world largely through the medium of the virtual realm.

In 2010 a thorough nation-wide U.S. survey conducted by the Kaiser Family Foundation reported:

> The amount of time young people spend with entertainment media has risen dramatically, especially among minority youth. Today, 8-18 year-olds devote an average of 7 hours and 38 minutes to using entertainment media across a typical day (more than 53 hours a week). And because they spend so much of that time 'media multitasking' (using more than one medium at a time), they actually manage to pack a total of 10 hours and 45 minutes worth of media content into those 7½ hours.[18]

Young people and other heavy users of electronic virtuality already feel a sense of loss and deprivation when connection is interrupted or withdrawn. In future, as more and more elements in the physical world become connected to the virtual world, it will seem impossible to live a full life without permanent electronic access.

And it's not just the young, as 'Cellular News' recently reported:

> Global market intelligence firm, Synovate, today released data from a global study on media and advertising that showed seven in ten people across 11 markets cannot live without the internet or would miss it a great deal if it were not there.
>
> Whose digital love affair is the greatest? Ninety-two percent of Brits, 91% of Spaniards, 90% of Australians and 89% of both Dutch and American respondents rate the internet as completely necessary to their lives.[19]

The revolution is unstoppable. A restaurant that does not publish its menus, reservations system, special offers, independent dining reviews and location map in the virtual world will lose out in the physical world to those that do. A road bridge that does not have sensors embedded in its fabric which are

constantly reporting the strains and loads on the structure, will be retro-fitted to include such reporting systems. Bridges without such sensors will be regarded as suspect and unless retro-fitted will be closed.

Every street light, every pipe network (domestic, industrial and municipal), every pump, every mousetrap, every power cable, every car, every fridge, every train and train seat, every front door, every school room, every hospital bed will be connected to the virtual electronic universe we are creating. After connection the capabilities of these 'nodes' will continue to increase. A street lamp that merely reports that it is either 'on' or 'off' at the point of connection will start to talk about its energy consumption, its ambient conditions and the climate. The hospital bed that initially only reports whether it is occupied or not will go on to provide full diagnostic information and monitoring services for its occupant.

The virtualization of our lives and our world is proceeding at a very rapid rate and although all exponential curves are unsustainable in the long run, in the second decade of the 21st Century we are nowhere near running out of steam in our headlong flight into a life of synthetic virtuality.

<div align="center">Ends</div>

I appreciate hearing from readers so if you agree, disagree of have a point to make about any of my arguments in this essay, please write to me at ray@rayhammond.com. You'll find more chapters at www.rayhammond.com and daily research postings on Twitter @rayhammond2030

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