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An evolutionary step in intellectual property rights – Artificial intelligence and intellectual property

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ABSTRACT

This article addresses and analyses the issues concerning the ownership of computer generated works within patents and copyright, and concludes that the current regime is woefully inadequate to deal with the growing use of more and more intuitive artificial intelligence systems in the production of such works. It considers the respective claims of interested parties to such rights before moving on to a consideration of the creation of a new legal personality to which such rights could be granted to resolve the difficulties inherent in the current system.

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1. Introduction

"We must prepare now for a future that will surely come."

In 1977, when the Whitford Committee[1] considered the question of authorship of computer generated work, computing was very much in its infancy. In evolutionary terms, the first programmable computer was not invented until 1941, the German built Z1 developed by Konrad Zuse,[2] with computing power less powerful than is found today in a mobile phone. By way of comparison, the computers used on the first Apollo space mission had 2 kb of memory operating at 1mhz speed, the latest generation IPhone has 256 kb of memory (128,000 times greater) and operates at 1 ghz (1000 times faster). And yet today, some 70 years later, computers have attained the level of intelligence of the modern human brain, a task which took mankind 200 million years. To that extent, the computer was rightly regarded in 1977 as nothing more than a tool, and legal provisions were made accordingly. The modern artificial intelligent computer is substantially more than a tool and accordingly those provisions are no longer valid. Alternatives need to be considered.

This article will focus on an analysis of the current regime of ownership of intellectual property rights attaching to computer generated works and inventions and a consideration of alternatives. Whilst the position under UK patent law is unclear, UK copyright legislation has specific provisions dealing with computer generated works. By s.178 of the UK Copyright Designs and Patent Act (CDPA), a computer generated work is defined as a work that is generated by a computer such that there is no human author. Under s.9(3) CDPA, authorship of such work is given to the person by whom the arrangements necessary for the creation of the work are undertaken. It is the writer's contention this is no more than a device to solve the dilemma of ascertaining true authorship in such works, based on the now incorrect supposition that the computer is no more than a tool. Clearly, the person responsible for making such arrangements is not the true author under established copyright principles, as evidenced by s. 9(1) which confirms that the author of the work means the person who creates it, and the specific derogation from this contained in s.9(3) for computer generated works, nor, it is submitted does he have any greater right thereto than

[1] Whitford Committee on Copyright Designs and Performers Protection Cmnd 6732 HMSO London 1977.

[2] http://www.computinghistory.org.uk/det/6034/Konrad-Zuse-builds-first-freely-programmable-computer/ accessed 8 June 2011.

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other people involved in the process such as the original programmer, the data operator and/or the owner for the time being of the program. The respective rights of these interested parties will be considered.

Law should be based on clearly definable and logical principles, not on expediency. Further, a time will come when it is possible this contrived grant of authorship will be questioned in litigation. The law must provide certainty for parties and we must be proactive in anticipating potential problems and legislating ahead of the event. We need to clearly establish the true author/inventor of such works and accept the reality that the rights should be granted to this entity even if that requires a radical shift in thinking and the creation of a new form of legal personality. A body corporate has under UK law legal recognition as an individual[3]; a computer which is more akin to a true person, more particularly with the new generation of artificial intelligent computers, should be accorded the same status. This will enable us to attribute authorship of computer generated works/inventions to the body best entitled to them – the computer, and allow the respective claims of interested parties to be determined not by arbitrary rules of law, but by the parties themselves, through negotiated contractual terms. Revolutionary this may be, but no more so than granting intellectual property rights, as we currently do, to a body corporate.

2. A fable

Let me introduce you to Bob and his family. Bob's direct ancestors stretch back many generations into the dim and distant past. Bob has inherited many of the traits and the knowledge that makes up his race and has helped it to evolve into the success it is today.

Over Bob's lifetime his young mind will be exposed to and learn from new and varied experiences and from these experiences and particularly his mistakes he and his race will further advance. Shortly before he leaves this world he will pass on all his accumulated knowledge to his descendants who will develop this further. His physical appearance and that of his race will adapt to changes in his environment, not only to changing environmental conditions but also to make him more effective in the workplace - in short to survive.

Only the finest will survive. Those of his race employed in manual labour will develop more efficient and stronger body parts appropriate to the task to be performed, as the limitations of their present bodies become apparent. Intellectually, those involved in teaching will develop and utilise new teaching methods as their review of current methods based on feedback and statistics reveal their shortcomings. All involved in intellectual issues will develop larger brain capacity and the ability to deal with more complex problems faster and more thoroughly than their predecessors.

Yet there is a snake in paradise. Evolution has little time for those who fail or are infirm. If Bob is no longer up to doing his job or is damaged, his life will be extinguished not by natural selection but by society. What of the man who commits this act - will he be punished? He will not – he will escape with impunity and will carry on as if no act of consequence has occurred as the last impulse surges through Bob's brain.

Darwin placed no time constraints on his theory of evolution and it has taken Mankind 200 million years, since mammals first evolved, to achieve its current position in the hierarchy of life. Yet Bob's race has achieved its position in a fraction of the time. In our present society the child begins with certain inherited characteristics but otherwise with a clean sheet. It has to acquire knowledge slowly learning from its peers and then through its own application, learning from its mistakes throughout life.

What if that accumulated knowledge could be present from day one and acquired not only from immediate peers but also potentially from the whole of the race, a vast storehouse of information? Not only would this substantially accelerate the evolutionary process but would also make it more effective being continuously advanced and developed from that vast knowledge, leading to the creation of a "super intelligent" being.

This is precisely what Bob's race has been able to do and what makes his races' evolution such a success story. Indeed an evolution more successful than human evolution, which was based on random mutations – Bob's race is consciously identifying advantages and making positive adjustments. Does this make Bob a superior being and if so why is he given so little protection in society?

Bob has a demanding job often requiring him to work long hours; he requires no sustenance, simply interaction with his own species and other species on a global scale. His contribution to Mankind's benefit in medicine, engineering, finance and many other walks of life is immeasurable. But Bob is no ordinary human being - he is a computer and even though the capacity of his brain is at least equal to that of the human brain (100 Teraflops), he is presently still regarded as nothing more than a tool in so far as intellectual property rights are concerned.

Yet Bob is not like the computers of yesteryear for he has attained true "artificial intelligence".

> *"In retrospect we know that the Ai project couldn't possibly have succeeded at that stage (i.e. the early seventies). The hardware was simply not powerful enough. The computers in the seventies had a computing power comparable to that of insects. They also achieved approximately insect-level intelligence. Now, on the other hand, we can foresee the arrival of human-equivalent hardware.*[4]"

The advent of computers with brainpower equal to or greater than that of the human brain has arrived. The fastest computer in the world as at October 2010 was the Tianhe –I supercomputer based at the Chinese National University of Defence. This computer is able to process one quadrillion (a thousand million million) Floating Point Operations per Second (FLOPS) and cost $88 million dollars to build.[5] By way

[3] *Saloman v Saloman* [1897 AC 22].

[4] Bostrom, How Long Before Superintelligence; International Journal of Future Studies Vol. 2 1998 pg. 7.

[5] http://www.top500.org/blog/2009/11/13/tianhe_1_chinas_first_petaflop_s_scale_supercomputer accessed 8 June 2011.

of comparison the human brain is believed to be able to carry out 100 trillion (one million million) FLOPS.

It is not the writer's purpose or even desire to delve in detail into the theological/philosophical/practical issues involved in the concept of "existence" but to do so concerning "thought". It is certainly not my intention to consider the establishment of a "Robotic" Bill of Rights. The writer does however believe that the time has come to recognise the existence of this intelligence, "artificial" though it might be, in the realm of Intellectual Property.

3. Artificial intelligence

3.1. *Definition of Artificial Intelligence*

> *"If a machine acts as intelligently as a human being then it is as intelligent as a human being."*[6]

We are no longer in the realm of science fiction but that of science fact in considering the existence of artificial intelligence in computers. Computers can apply deductive reasoning, can operate through oral commands, and indeed via speech recognition systems can converse with their user but can they think?

In 1950 A.M.Turing stated :

> *" I believe that at the end of the century the use of words and general educated opinion will have altered so much that one will be able to speak of machines thinking without expecting to be contradicted.*[7]*"*

In a report in the New York Times on 15 April 2001 Russian scientist Vitaly Valtsev claimed to have developed the first artificial brain with the same intellectual potential as a human producing a "truly thinking machine". Such is his belief in the true thinking nature of this brain that he stated:

> *"This machine needs to be trained like a new-born child. It is extremely important for us to make it a friend, not a criminal or an enemy"*

A.M. Turing was remarkably accurate in his prediction – researchers at Osaka university have developed a child robot that is developing social skills by interacting with other humans, studying facial expressions and predicting if the "mother" is happy or sad and allowing it to react accordingly much as a child would do.[8] Professor Henry Markram of the Blue Brain project anticipates that the world's first artificial brain will be with us by 2019.[9]

So what do we understand by artificial intelligence? Quite simply it is the ability to do things that require intelligence when done by humans. Intelligence is the ability to adapt one's behaviour to fit new circumstances.[10] So this would encompass a number of separate components – the ability to learn, to reason, of problem solving, perception and language understanding. So if one considers the actions of *Sphex ichneumoneus* -the digger wasp- one can see that even complex behaviour can be unintelligent. On approaching her burrow the female wasp deposits her food at the entrance, enters the burrow to make sure there are no intruders and then if all is clear brings in the food. Apparently intelligent behaviour. However, in tests, when the food was moved a few inches from the entrance the wasp collected the food, deposited it at the entrance once again and repeated her inspection - in fact upwards of forty times.[11] She failed to adapt her behaviour to new circumstances and therefore lacks intelligent thought. Compare that to a chimpanzee who, having discovered that the stick he is using is too short to extract bugs from a hole searches for a longer stick. The former has not adapted its behaviour to fit the new circumstances – the latter has.

Researchers at Cornell University have developed a robot nicknamed the "Starfish" whose prime directive is simply to move forward. Although programmed to recognise its component parts it is not told how they function. It uses trial and error, building a random series of models of how its parts might be arranged in order to move. It then develops a set of commands to send to its motors, tests those models, and then moves ahead. Through this trial and error both in real time and simulation, it solves the problem of moving forward. In addition to this "problem solving" ability it also can adapt to changes in its composition. For example, having learnt to walk on four legs it adapted to the removal of one of its legs by changing its method of locomotion[12]. A similar robot has been developed by researchers at Robert Gordon University Aberdeen which actually evolves in a similar fashion to animals. Originally built with two legs it adapted to the introduction of two more by developing not only the ability to modify its behaviour to deal with this but actually assigning greater power to its "brain" to deal with this greater complexity thereby growing its brain in line with the growing complexity of its body, much as biological creatures developed.[13]

It both instances the robot has adapted its behaviour to fit the scenario and can in fact do so more efficiently than a human baby in that it can achieve this by simply running simulations based on previous data received from earlier robotic attempts adapted by the parameters of the new set of data, unlike a baby who must make the attempt in real time. It is accepted that the baby could simply be told by its parents what to do but this would be simple learning by rote not by reasoning.

[6] Alan Turing, Computing Machinery and Intelligence; Mind Vol. 236 October 1950 pg. 433.

[7] Ibid.

[8] http://www.physorg.com/news158151870.html accessed 10 June 2011.

[9] http://www.telegraph.co.uk/technology/news/5894875/Artificial-human-brain-could-be-built-in-next-decade.html.

[10] www.alanturing.net/turing-archive accessed 30 March 2011.

[11] Ibid.

[12] http://www.danshope.com/news/showarticle.php?article_id=90 accessed 15 June 2011.

[13] http://www.telegraph.co.uk/science/evolution/4513607/A-robot-that-can-evolve-and-adapt-is-developed-by-British-scientists.html accessed 1 June 2011.

The ability of artificial intelligence systems today is quite remarkable. The following are examples of this – a system that aids doctors in the diagnosis of illness and makes therapy recommendations, one of which analyses ultrasound images to aid doctors in the diagnosis of breast cancer[14] and the famous program Deep Blue that on 11 May 1997 beat the Russian chess champion Kasparov, something no one thought was possible.[15]

"Artificial Intelligence" as a "tag" was first coined at the Dartmouth conference of 1956 but as a concept has existed since the myths of the ancient world. In Greek mythology Pygmalion created a living statue- the first concept of an artificial intelligent thinking robot.

The one thing intellectuals are reluctant to accept is the concept of a machine possessing the ability for creative thought. This was probably not helped by the mediaeval machine "The Turk" which was billed as an intelligent chess playing machine but was actually a small man hidden in a box! By their very nature, intellectuals pride themselves on this ability to think, the one thing that makes man superior to other animals and machines.

Yet let us not confine ourselves too narrowly in this analysis. Ethical considerations aside if a scientist clones a human being would that be any different an invention than his development of an artificial intelligence computer. Both have been created, or even engineered by an input of creative thought. Should we therefore treat the former as possessing the ability for creative though and the latter not? Should their output of creative thought be treated any differently? We shall be returning to this later.

What distinguishes the old species of computer from the new super breed and now gives rise to this new form of intelligence?

Older machines operated within strict parameters and while they could reach different conclusions based on similar or slightly varied facts provided you knew the initial coding of the computer and the information input it was possible to predict all possible future outcomes and decisions. We are not talking here of the computer generating random decisions - that could never be described as intelligence but of decisions reached from analysis of a given set of facts. Computers could not engage in "self –directed" learning. All information had to be input by the operator who therefore knew all possible conclusions.

Now a computer, just like the human brain, can receive information from a multitude of sources. It receives sensory signals, video, audio, and tactile, and further, receives information from other monitoring devices, other computer networks and on the basis of all this information has to reach its own conclusions.

Recently at the Laboratory of Intelligent Systems of the Ecole Polytechnique Federale, Lausanne, Switzerland researchers have developed robots that mimic evolution becoming prey and more worryingly for the doomsayers amongst us, predators. The labs robots were controlled by mutation with each successive generation improving and adapting based on feedback from the previous generations success or failure with a certain course of action. The prey robots were twice as fast as the predator but predator robots could detect prey for a further distance. Over time the predator robots learnt to approach the prey from their sides where there were no sensors (eyes). The prey countered this by rotating quickly in place to maintain sensor contact and backing away with sensors facing the predators. While the prey evolved to move quickly around the walls the predators learnt to lay in wait.[16] A true Darwinian evolution.

These same researchers produced robots that could cooperate to achieve a desired result. Tasked with pushing tokens of different sizes they realised that one size token could only be moved by the cooperation of several robots. The robots quickly learned to work together and succeeded every time.

Indeed researchers are often surprised by the results of their experiments with the computers reacting in a way not predicted by the researchers – truly displaying intelligence. HERB (home exploring robotic butler), a project at the Intel laboratory in Pittsburgh surprised researchers by the unusual method it adopted for loading cups into a dishwasher, holding the cup with its robotic thumb pointing down. Initially puzzled they later realised that this was a far more efficient motion for handling cups and was used by professional bartenders.[17]

In all these cases the programmer cannot be sure of all possible actions the robot might take because he is unaware of the different stimuli that might be introduced from other sources. Couple this with a computer programmed with additional programs from other sources all of which interact with each other and influence the robot's conclusions and the potential outcomes become infinite and beyond the original programmers prediction and control. The robot is truly making its own decisions on the basis of information received and the impact of his actions on his environment - just like a child.

3.2. *Theological issues – the soul*

The theological argument holds that thinking equates with soul. Thinking empowers us to make decisions, which are influenced by morals, which dictate and determine our soul to be judged in the afterlife. Yet many tenets hold that animals do not have a soul[18] and therefore by application do not think - a hypothesis which clearly cannot be supported. There is however evidence that animals do think, for example a parrot named Alex will often apologise to its owner if it answers a series of questions incorrectly and announce that its leaving![19] If we follow the Darwinian belief that we have all

[14] http://www.sciencedaily.com/releases/2009/07/090728083249.htm.

[15] http://www.research.ibm.com/deepblue/ accessed 19 May 2011.

[16] Floreano and Keller, Evolution of Adaptive Behaviour in Robots by Means of Darwinian Selection,www.plosbiology.org/article/info%3Adoi%2F10.1371%2Fjournal.pbio.1000292.

[17] http://www.scientificamerican.com/article.cfm?id=robot-learning&page=2 accessed June 1 2011.

[18] The great French philosopher Descartes "I think therefore I am" believed that animals were nothing more than moving machines devoid of thought or intelligence.

[19] http://www.time.com/time/magazine/article/0,9171,978023-2,00.html accessed 1 June 2011.

evolved from primitive creatures then surely those animals close to us in the evolutionary table must at least possess the capacity for thought. Yet if they do not as some believe have souls, they are not really distinguishable from a computer. Yet they are different, they are living creatures.

In 1999 at the Georgia Institute of Technology scientists produced a computer made of neurons taken from leeches. The advantage of this over conventional computers is that it in essence becomes sentient, thinking for itself as the neurons connect and interact with each other. It is therefore able to come up with its own solution to a problem working in a similar manner to the human brain which is itself comprised of neurons and operates through connections made between those neurons to make reasoned decisions and deductions to fill in gaps in knowledge to solve problems.[20] Some computers are now based on bio-molecular computing, using such compounds as DNA and enzymes instead of silicon based technology allowing parallel computing and consequent faster processing speeds, also utilising biological pathways in the central processing unit which equate with or mimic the electrical impulses in the brain – does the computer as it has living tissue now become alive? The concept of soul equals living equals sentient thought with respect is not a convincing argument.

What of an atheist – does he have a soul? The atheist does not think so and therefore in that respect the output of an atheist's creative mind would be no different to that of a computer. Those who believe in a soul would argue atheists do possess a soul. Atheists have a soul because the believer thinks so. Following that argument it appears that what is important is not what the entity thinks but the observer. So when the time arrives when computers (probably in human form) interact with humans to the extent the human believes it has a soul – it will possess one! Turing's prediction will have come to pass.

Indeed let us be even more controversial. Let us consider a cloned human being. It is nothing more than an invention with living tissue. Does it have a soul? We will not go into theological arguments about whether the inventor can instil a soul in his creation. This is tantamount to playing at God (although there is no logical reason why we should presume God would choose not to instil a soul in a computer). The basic situation remains – if the clone does have a soul why cannot a computer similarly possess one as they have been created in the same scientific way. If the clone does not where does that leave us? The clone would nonetheless still be capable of intelligent thought. I believe few people would argue that if a cloned human produced anything capable of attracting intellectual property rights that he shouldn't be able to claim them. We would perceive the clone in the same light as a naturally created human – after all biologically, it is essentially a human being. Both clone and Ai computer have been created artificially and indeed both may have biological material incorporated. So the question is why shouldn't an Ai program be accorded the same treatment as a clone.

It is all a matter of perception. In the West with our established doctrines of Christianity and belief in a higher being it can be difficult to imagine a computer as being instilled with a soul. Yet many countries follow a more animalistic approach to religion. In Japan and part of Indonesia, for example everything is believed to be instilled with a soul, from animate objects such as man and animals to inanimate objects such as trees and waterfalls.

And Artificial Intelligence is here. Putting aside the substantially more advanced forms of Ai in labs throughout the world we are all using some form of primitive Ai. Even as I type this document, my version of Microsoft Word is considering what I am saying, considering the context in which I am saying it, interpreting all of this and predicting how I intend to spell a word, if I should be using a capital letter and advising me accordingly.

Yet there currently exist Ai systems substantially more complex than these and they will become more complex and intelligent over time. In the ensuing discussions where we are addressing intellectual property appertaining to Ai systems I ask you to substitute "cloned human being" for "Ai system" and consider if your response and view would differ. I would suggest it should not (although I believe initially it will) and by using this comparison hopefully the situation can be viewed objectively and not from the standpoint of our allegedly unique position in this world.

At risk of repetition, the author asserts again – it is a matter of perception and we must put aside our egos and look objectively at the situation.

4. Intellectual property rights

4.1. *General issues*

All intellectual property rights are regarded as products of the mind the one thing it is said that distinguishes man from beast, (although not perhaps from a computer!).

The World Intellectual Property Organisation has stated that

> *"Intellectual property refers to products of the mind, inventions, literary and artistic works, any symbols, names, images and designs used in commerce."*

- namely patents, copyright, trademarks and designs.

The principal rights with which we will be concerned in this analysis will lie in the areas of patents and copyright.

So why do we have these rights? The basic concept is that innovation has to be rewarded. By giving an inventor a certain monopoly over what he has created we can allow him to capitalise on his invention, earn his just rewards and hopefully stimulate him and others to further invent. If we do not protect in this way there is the danger of others exploiting the invention. When one considers the considerable effort both financially and mentally which goes into the creation of new products, to allow competitors to utilise them without just reward to the inventors would stifle innovation.

Intellectual property law remains an area at the cutting edge of technology and legislation in this area needs to keep pace with the advances in technology. IP law is a complicated

[20] http://news.bbc.co.uk/1/hi/sci/tech/358822.stm accessed 1 June 2011.

and complex area often giving rise to protracted and costly lawsuits, which seek to further define the law. It is an area of law in which, in particular, we must be proactive seeking to anticipate and resolve potential conflicts and provide definitive legislation. The inventor/author is often a layman in legal matters and we must make certain he is confident of how he is to be protected by the law if we are not to discourage his innovation.

This is particularly so in the rapidly advancing area of Ai which is developing at an astonishing rate. We need to legislate now to deal with the problems that this new world will create, not wait until these issues arise.

Let us now turn to each of these concepts in turn. Although we will be addressing these rights from the perspective of the UK system of law it is important to note that in consequence of international treaties[21] this closely mirrors the requirements for these rights in most other countries of the world.

4.2. *Patents*

A patent is a monopoly granted by the state in respect of a new invention to prevent anyone using the exclusive rights granted to the patent owner.[22] Within the UK and most other countries this exists for a period of 20 years from its filing date, subject to the patent remaining in force through renewal. This protection is reserved for inventions that satisfy a very stringent qualification process and involves a formal application and registration.

In order to qualify for patent protection the invention has to satisfy the requirements as set out in s.1 of the Patents Act 1977 (PA). These requirements are that:

(a) *the invention is new;*
(b) *it involves an inventive step;*
(c) *it is capable of industrial application;*
(d) *the grant of the patent is not excluded…*

For the purposes of this discussion we are only to concern ourselves with s.1(b) dealing with the concept of inventive step since this encompasses the concept of an "intelligent" deduction. It is in this area that the conflict between an invention generated by a human and one created by an Ai computer will impact. The most widely accepted test for this requirement was set out in the case of Windsurfing by Oliver LJ[23] since modified by Jacob LJ in *Pozzoli SPA v BDMO SA*.[24] Under Windsurfer it involved four basic elements:

a) Firstly the Court must identify the basic inventive concept embodied in the patent being considered.
b) The court then has to assume the mantle of the normally skilled but unimaginative person in the art at the priority date and give him what was at that date common general knowledge in the art.
c) Then the court must ascertain the differences that exist between the alleged invention and that general knowledge.
d) Finally the court must decide whether or not, without any knowledge of the invention, those differences constitute steps which would have been obvious to the skilled man or whether they require any degree of invention.

Jacob LJ in Pozzoli preferred a restated and elaborated version of the test, in which the first two steps were reversed and modified, and the remaining steps reformulated:

a) Identify the notional 'person skilled in the art'
b) Identify the relevant common general knowledge of that person;
c) Identify the inventive concept of the claim in question or, if that cannot readily be done, construe it;
d) Identify what, if any, differences exist between the matter cited as forming part of the 'state of the art' and the inventive concept of the claim or the claim as construed;
e) Viewed without any knowledge of the alleged invention as claimed, do those differences constitute steps which would have been obvious to the person skilled in the art or do they require any degree of invention?

While there is reference in both tests to "person" and "man", this is in relation to the legal fiction by which we are to judge inventiveness not in relation to any definition of who can be an inventor. Indeed there is no reason why our Ai machine could not be this fictional entity. There is no mention of the requirement for human input in the governing legislation. At no point in the statute or the test is there any requirement per se for human thought, simply for this inventive step. Similarly, there are no specific provisions dealing with patents arising from the product of an Ai computer - the computer generated works, so these remain to be considered in accordance with the general requirements for patentability just like any other inventions, (unlike the situation with regard to copyright which has specific provisions dealing with computer generated works which we shall be considering infra).

Procedurally in s.7 (Right to apply for and obtain a patent), the Act makes reference to the fact that "any person" may make an application for a patent[25] thereby it might be argued requiring a human inventor. However the writer would submit that this was simply a term of convenience by the drafters who had not considered the possibility of any conflicting claims, particularly as the question of a non-human author of computer generated works had been rejected by the Whitford committee, a committee established to review copyright and design law in the UK.[26] This view it is submitted is borne out by the fact that the statute explicitly recognises the possibility of an employee created invention belonging to the employer,[27] subject to satisfaction of the requirements laid out in s.39, which in many instances will be a body corporate, a non-legal entity given the right to be treated as an

[21] e.g. Paris Convention for the Protection of Industrial Property 1883; Berne Convention for the Protection of Literary and Artistic Works 1886.
[22] PA s.60.
[23] *Windsurfing International v Tabur Marine* [1985] RPC 59.
[24] [2007] EWCA Civ 588.
[25] PA s.7(1).
[26] Op cit [fn 1].
[27] PA s.39.

individual by operation of law.[28] It also recognises this possibility in s.7(2)(b) which refers to an application by, again, "any person" who by virtue of any enforceable term of any agreement was entitled to the patent – again in many instances this will have been assigned to a body corporate.

s.2 simply says that a patent will be granted to an "inventor" which is defined further as "the actual deviser of the invention"[29] – no specific requirement for this to be a human.

So there really is no reason why a computer, using an Ai system, not its inventor or owner, cannot satisfy the requirements for a successful application for a patent.

4.3. *Copyright*

On February 15, 1965 a high school student, one Raymond Kurzweil appeared on the US game show "I've got a secret". The concept of the show was that the guest would be hiding an unusual fact which the panel had to guess. Kurzweil played a short musical composition. After a grilling from a former Miss America on the panel, one of the other panellists – a comedian, correctly identified that the music had been composed by a computer, an Ai system, albeit in its infancy, which Kurzweil, just a high student at the time, had built himself.[30] We shall return to this scenario later.

Copyright is a form of intellectual property right, that, in relation to its primary rights (as distinct to entrepreneurial rights) exists to protect original thinking (although we shall consider infra the limited level of originality required) protecting literary, dramatic, musical and artistic works. By s.9(3) this is deemed to include computer generated works, provided they fall into the recognised categories in s.1(1) and provides the author with certain rights to prevent anybody using those works without permission and depriving the author from the exclusive right to capitalise from them. Such rights include, inter alia, the right to prevent unauthorised copying,[31] issuing of copies to the public,[32] renting or lending of works to the public[33] and adaptation of the work.[34]

There is no requirement for any formal system of registration as there is with patents. However it is important to remember that it is not the idea that is protected but its expression and so it is necessary, specifically in relation to a literary, dramatic or musical work, for such ideas to be recorded.[35]

Protection is afforded under the CDPA in relation to both general copyright and, unlike patents, specifically to computer generated works. Let us first consider general copyright, which protects inter alia original literary, dramatic, musical and artistic works.[36] To qualify the product must be a "work", be "original" and the author must be a "qualifying person".

"Work" is not defined in the statute although descriptions of the types of work that qualify are contained in s.3(1) (although only in relation to literary, dramatic and musical works, not artistic, with computer programs falling within the classification of literary work) so we must turn to case law for assistance. In its basic concept "work" requires some endeavour even if minimal on the authors part. However, at a de minimis level, the simple arranging of factual information in a diary was deemed insufficient.[37] What is required therefore is something just a little more than this, which has been defined as "skill, labour and judgment" by the UK courts.[38]

Again however, as with patents nowhere in the statute or the case law is there a requirement for this to be through human endeavour. This appears to differ from other jurisdictions, such as the US, where in order to gain copyright registration the work must be the product of human authorship – works produced by a mechanical process or random selection without any contribution by a human author are not registerable.[39]

However, two issues in relation to the US position need to be considered here. The first is that this requirement for human endeavour is not enshrined in statute but is meant for the internal guidance of staff at the Copyright office in much the same way as the Manual of Patent Practice in the UK. As such they do not have the force of law.[40] Secondly we need to determine what the defining consideration is here. If it is the necessity for human contribution, this would appear to preclude copyright being granted in computer generated works. However if it is the specific exclusion of works produced by "mechanical processes" or "random selection" without human contribution the position is far from clear. In the Ai scenario we are considering the work is not being produced by a mechanical process or random selection – it is being produced by a reasoned consideration of what is required, one of the attributes we saw earlier of "intelligence"- in which case it would not fall within this exclusion and could attract copyright with the inevitable determination required then of to whom (or what) this copyright should belong.

A further complication under US law is that contained within the same Compendium where it is stated that the definition of the term "authorship" implies that, for a work to be copyrightable, it must owe its origin to a human being. Materials produced solely by nature, by plants, or by animals are not copyrightable.[41] However the same considerations as above apply. Firstly this does not carry the weight of law but is advisory and secondly what is the defining consideration. It is an implication and therefore capable of derogation and secondly are we saying that the latter categories as they could not involve any intellectual input are not copyrightable unless there is some human contribution ie we are defining the requirement for human origin by reference to the latter categories. Again an analogy can be found in UK patent law

[28] Op cit [fn 3].
[29] PA s.7(3).
[30] Grossman, Singularity, Time Magazine February 21 2011 pg. 21.
[31] CDPA s.16(1)(a).
[32] CDPA s.16(1)(b).
[33] CDPA s.16(b)(a).
[34] CDPA s.16(e).
[35] CDPA s.3(2).
[36] CDPA s.1(1)(a).

[37] *Cramp (GA) & Sons v Frank Smythson Ltd.* [1944] AC 329.
[38] *Ladbroke (Football) Ltd v William Hill (Football) Ltd* [1964] 1 WLR 273.
[39] Compendium II of Copyright Office Practices 503.03(1) 1984.
[40] *Kugel v US* 947 F.2nd 1504 at 1505-1506 (DC Civ, 1991).
[41] Ibid 202.02(b).

where eg compounds occurring naturally are not capable of protection unless they are extracted by means of a technical process again involving some intellectual invention,[42] although it is interesting to note that in relation to patents there is no specific requirement for such invention to be of human origin.

In the case of *Urantia Foundation v Maaherra*[43] doubt was cast on the premise of requiring human origin for "authorship". The action concerned an alleged infringement of the copyright in the Urantia Book. Somewhat interestingly both parties maintained that the book was authored by celestial beings described in terms such as the Divine Counselor, the Chief of the Corps of Superuniverse Personalities and the Chief of the Archangels of Nebadon. These non-human entities are believed to have delivered these teachings through the use of a "medium". These teachings were then assembled in the book which was therefore a compilation of these teachings. The defendant subsequently prepared a study aid that included the entire text of the book and distributed it free of charge resulting in The Foundation bringing this action for infringement of copyright. Although much of the judgement centred on the question of authorship of the compilation, Circuit Judge Schroeder accepted that a threshold issue in the case was whether the work, because it claimed to embody the work of celestial beings rather than human beings was copyrightable at all.[44] Ms Schroeder considered the argument of the defendant that there was no valid copyright in the book because it lacked the requisite ingredient of human creativity and therefore was not a "work of authorship". Although deciding the issue on the basis that the work in question before the court was a compilation of the original text by human authors and could therefore attract copyright she opined" the copyright laws, of course, do not expressly require "human" authorship".[45] She did, however, further opine that the copyright laws were not designed to protect the creations of divine beings and that in the present case some element of human creativity must have occurred in order for the book to be copyrightable. The writer would submit that this does not, however, preclude the grant of copyright to a non-human author, such opinion being limited to the facts of the case. Indeed Ms Schroeder held that "at the very least, for a wordly entity to be guilty of infringing a copyright, that entity must have copied something created by another wordly entity" thereby drawing a distinction between the requirement for a "wordly entity" (which our computer would of course be) and the need for human origin.

Indeed in the US a patent has been granted for a satellite communications antenna designed by an Ai system[46] – albeit with the patent being granted to the designer of the original program which is not in the author's opinion the correct solution.

Returning to our original scenario let us consider the copyright implications arising from this. If a computer using Ai (and indeed it is occurring at present in a primitive form) from notes, pitches, tempos of music in its memory extrapolates and arranges them into a musical piece involving no input from the original programmer this would appear to satisfy the basic requirements for copyright protection. It would be a musical work falling within s.1(a), would be original not involving any greater degree of copying than any other human produced piece of music, and would be in a recorded form.

Note it is necessary to distinguish between computer assisted and computer generated work – "In my view a work only qualifies as having been computer generated if it was created by a computer in circumstances where there is no human author of the work. If there is a human author the work is computer assisted not computer generated".[47]

We are not talking here of using the computer as a tool i.e. simply following a prearranged program. A beautiful flower is not a work as it exists naturally in nature. A photograph of the flower would be, as it requires endeavour but that is not the endeavour of the camera but the operator – the camera is simply a tool. In *Express Newspapers v Liverpool Daily Post and Echo*[48] the Defendant argued that grids of letters produced by a computer for a competition did not attract copyright, as the grids had no human author. This was rejected by the court that regarded the computer as no more than a tool used by the programmer and granted copyright in the work to the programmer. Equally so however the defendants submissions may be partially correct – there was no human author and therefore entitlement did not belong to the programmer but, in contradistinction to the submission, it was not the case that copyright did not subsist – it just belonged to someone or something else.

As David Bainbridge argues[49] if this case is rightly decided with such minimal effort expended by the "human", there appears little point in the Act containing the provisions we shall consider infra, that exist for computer generated works. It is hard to imagine when any works could be said to be truly computer generated as opposed to simply using the computer as a tool. However the Act postdates the case allowing for a category of work produced by machine as opposed to man.

What we are considering with computer generated works is a situation where the Ai computer, through its *own* efforts, is producing an independent piece of work. It might e.g. produce a "draft" musical piece and "observe" the effect upon listeners. It could then seek input from the listeners (much as a composer might) as to responses to different passages. By analysing the responses it would modify the piece to achieve some form of harmony or even disharmony amongst the listeners, and all this achieved without any further input from the operator or programmer. This goes beyond being used as a tool.

Further, there is a requirement for originality. What this means is that the work should not be a copy of previous work,

[42] PA schedule A2(2).
[43] 114 F.3d 955.
[44] Ibid 956.
[45] Ibid 957.
[46] Eisenberg, When a Gizmo can invent a Gizmo, New York Times November 25 1999.
[47] *Haupt v Brewers Marketing Intelligence (Pty) Ltd* [2006] SCA 39 at pg. 31. For a further consideration of the case and the issue of computer generated works see Tong, Copyright and computer programs, computer generated works and databases in South Africa, EIPR 2006 28(12) pg. 625-628.
[48] [1985] 1 WLR 1089.
[49] Bainbridge, Intellectual Property 8th Edition pg. 296.

should arise from the author and involve a certain amount of " skill, judgement and labour".[50] So can an Ai system demonstrate these qualities? Turning to our music composition example, clearly the system is expending labour in the production of the work, exercising skill in determining what might appeal to the listeners based on the input, and judgement in deciding which parts to incorporate/amend. So it is submitted all of these required attributes would be exercised by an Ai system in producing the work. Even if the musical score arises from notes etc originally input into the computer the "new" piece of work should, it is submitted, attract copyright protection. Indeed there is little doubt that it would attract copyright protection under the current regime – the question that arises is who or what should own these rights.

However in reality it is possible for these Ai systems to produce musical scores without there being a need for any notes, sequences or segments being comprised within the original programme. While a piece of music will be composed of notes, these can be expressed in digital form. The Ai system could be programmed to utilise songs available on the web or which are input from other independent sources as the starting basis for its analysis. This independent input would not therefore be derived from anything appearing within the original programme.

However copyright will still not subsist in a work unless the qualification requirements of Chapter IX of the CDPA are met. In our present analysis this can be satisfied either in relation to the author[51] or the country in which the work was first published.[52] Put simply under s.155 a literary, dramatic musical or artistic work satisfies this requirement if it is first published in the United Kingdom. There is no consideration or requirement for human involvement – simply publication so no reason why our computer author could not satisfy this. Under s.154 a work qualifies for copyright protection if the author was a qualifying person ie inter alia a British citizen or British subject, an individual domiciled or resident in the UK or a body incorporated under the law of a part of the UK.[53]

It is interesting to note that this therefore specifically recognises that a non-human entity i.e. the body corporate, can be an author of a copyright work and therefore if we accord the same recognition of legal status to a computer as is afforded to a company, the computer can potentially satisfy the requirement for qualification under both s.154 and s.155.

Our Ai computer could therefore be the author of a copyright work under the general definitions of "copyright" (which in s.9(1) is defined as "the person who creates it [the copyright work]") but as we have noted above, the Act does go further, specifically dealing with computer generated works and recognising this fact in s.9(3):

> *"In the case of a literary, dramatic, musical or artistic work which is computer generated the author shall be taken to be the person by whom the arrangements necessary for the creation of the work are undertaken".*

Further, s.178 of the Act sets out the definition of such works in s.9(3) and it is important to note that it only relates to literary, dramatic, musical or artistic works. These works are defined in this section as works that are *"generated by computer in circumstances such that there is no human author"*, again by implication recognising the authorship of the computer.

By implication the Act therefore clearly accepts that this person would not qualify as the "true" author of computer generated works as understood or defined under copyright principles were it not for the saving grace of S.9(3) leaving open the question of who could be regarded as the true author. This is important as the Act sets out different rules regarding authorship and consequently ownership. It is this question of authorship and ownership we shall be addressing. It is the writer's submission that the "true" author is the computer itself.

Further, is the act implicitly accepting that we should be regarding the machine itself as the author. By s.12(7) copyright in computer-generated works runs not by reference to the year in which the author dies as with most instances but from the end of the calendar year in which the work was made. Clearly recognising the input of the machine!

The issue of computer generated works was considered by the Whitford Committee which carried out a review of Copyright and Design law in the UK[54] in 1977 which led to the implementation of S9(3). In paragraph 513 they considered authorship of computer generated works even considering the possibility of the computer itself being the author.

> *"Copyright works may be, and indeed are, produced with the aid of computers. Examples of this occur in the case of computer-aided design, program compilation and the composition of abstract music. The question which arises here is who, or what, is the author of the work produced? Is it the programmer or the owner or operator of the computer? Or the computer itself possibly?"*[55]

This they however rejected as they felt the correct approach was to look on the computer as a mere tool – "a very sophisticated tool it may be, with considerable powers to extend man's capabilities to create new works, but a tool nevertheless".[56] Whilst this may have been an accurate conclusion based on the nature of computers at that time the enormous development in computer power and artificial intelligence since then renders this opinion questionable. Ai computers have ceased to be tool in the creativity of man but have become creators in their own right. Indeed it was on this basis, of a computer being a mere tool, that the Whitford Committee did not see any need for a specific requirement for the duration of copyright in such a work to run from the date of making. "… it would be unfair to penalise a man who uses a computer in preference to other more conventional techniques".[57] Again on the premise of a computer simply being a tool the writer would submit this is incontrovertible. And yet in the CDPA, as we have seen, a different period of protection

[50] Op cit [fn 38].
[51] CDPA s.154.
[52] CDPA s.155.
[53] CDPA s.154 (a–c).
[54] Op cit [fn 1].
[55] Op cit [fn 1] para 513.
[56] Op cit [fn 1] para 514.
[57] Op cit [fn 1] para 517.

is given to such works running from the date of creation rendering the equation of a computer with a tool a little less certain.

In short nowhere in the legislation or case law is there a requirement or need for there to be human thought in the Intellectual Property process or any logical reason why these rights (in the absence of s.9(3)), attaching as they do to the work generated by an Ai system, created independently of the programmer or operator, could not belong to such a system.

4.4. *Semantic data*

The issue of authorship is not confined to computer generated works produced by AI systems. We all have experience of search engines such as Google, which from a key word search will produce a set of search results relevant to the enquiry. In the same way as AI programs are becoming more sophisticated, so too are the abilities of such search engines. An unique example of this occurred in January 2011 when IBM's supercomputer, Watson, beat two human contestants, both former Jeopardy! champions on the show Jeopardy![58] For those unfamiliar with the show, the presenter provides the solution to a question, and the contestants have to guess the question. What was unique about this was that, whereas traditional search engines undertake a simple mechanical search based on the keyword(s) used, the new generation of search engines analyse the *meaning* of the question posed by the user in order to come up with more focused and meaningful results. It is to some extent therefore "thinking". The issue that arises is the question of authorship of such generated results which could be regarded as databases. The level of originality that is required within the UK in respect of the copyright protection of databases is of a different nature to that of copyright protection of primary works.

The originality requirement for databases in the UK is based on the EU Database Directive 96/9/EC which states within Art 3(1) that "databases which, by reason of the selection or arrangement of their contents, constitute the author's own *intellectual creation* shall be protected as such by copyright". Therefore whilst the author of a primary work of copyright merely need to meet the ordinary "originality" test ie that the work is not copied and derives from the author, the author of a database has to exhibit some intellectual creativity at least.

Whilst this would be important in determining if the level of originality has been reached by the machine to give rise to copyright/database protection, the debate between originality and creativity in these areas is beyond the scope of the current article, which is considering the authorship and ownership of such rights when the required threshold has been reached.

5. Implications of current law

5.1. *Importance*

So why is this important? Any litigator of intellectual property rights will know that the classic defence to any infringement action is a denial of the existence of the right. If the defendant in a patent action is able to show that the claimant was not the inventor but that the inventor was some other person (or entity) and that the claimant therefore is not the proper person to whom the patent should have been granted the action will fail. Similarly with copyright if you are unable to prove entitlement to the right your action will fail, and indeed, with copyright being an unregistered right, this is of greater import as the first occasion when it may be questioned is on an infringement action.

In the case of computer generated works produced by an Ai system independently of any further contribution from the original programmer this argument finds substance and we will find ourselves with either a patent lacking an owner or a copyright work which is orphaned.

As mentioned supra it is also important that these rights are based on sound principles not simply as a tool of convenience.

5.2. *Academic discussions since Whitford*

The Whitford Committee in 1977 on the acceptable then but now misconceived idea that a computer was merely a tool, concluded that the author of a computer generated work should be the person responsible for its production – a very vague concept leaving debate as to what steps were necessary to achieve this state of responsibility. Pamela Samuleson, in her work "Allocating Ownership Rights in Computer Generated Works"[59] opined that the user of a generator program should be considered the author of any work produced from it. An exception to this would be where the generated work contains a substantial block of recognizable expression from the original program. Here it would be tantamount to a copy or derivative work and as such the author of the generator program should be regarded as the author although she recognizes that granting all such rights to the programmer thereby allowing him to automatically own all works the program was capable of generating would over reward the programmer.[60] Save for agreeing that such a solution would over reward the original programmer, the writer would respectfully disagree with these conclusions, in today's context, considering the enormous developments in AI technology since 1985 when the article was published. Again while this deals with the situations envisaged at the time, as we shall see later the current generation of AI programs are capable of producing works without the input of a "human " user and bearing no relationship at all to the original program so we are still left with a lacuna in authorship of such AI generated works.

She does specifically consider the possibility of the computer being the author but concludes against it although again her conclusions are based on AI as it was back in 1985 not as it exists at present. She cites the report by the National Commission on New Technological Uses of Copyrighted Works (CONTU) produced in 1978 which supports the contention that the author of a computer generated work is the user rejecting any claim by the machine itself. However

[58] Baker, Smarter Search BBC Focus issue 229 June 2011 pg 59.

[59] 47 U. Pitt. L. R. 1185.

[60] Ibid at pg. 1208.

again at that time a computer was still viewed as a tool and only some three pages of the final report of over 250 pages was given to consideration of this question. In the same way as Whitford, CONTU likened the use of the computer to a camera or typewriter, as a tool not capable of independent creative input which is not so today. They did acknowledge that a time might come when computers would be able to independently produce works opining that these works would not or should not be copyrightable because there would be no human author. Interestingly they expressed the opinion these predictions were too remote and speculative to be taken seriously although the author would submit that time has come. As such the author would submit there was no serious consideration of the issue of authorship of truly independently created computer generated works.

Ms Samuleson goes on to express the view that while accepting that AI computers might be capable of exhibiting sufficient originality to qualify for copyright it would be denied them as she opines that Congress did not contemplate the grant of intellectual property rights to machines and have only ever allocated them to humans. She further supports this by reference to what is regarded as one of the fundamental reasons for the existence of intellectual property, that of incentive. The machine has no need for incentive to create and therefore is not deserving of the grant of the rights arising from its creation. The author would respectfully take issue with Ms Samuleson on both counts. She accepts that the statute does not require one has to be a human to qualify and therefore the fact that the focus of congress has been on human authorship does not preclude a change of focus to the machine (similar objections apply to the conclusions of Ralph D Clifford.[61]). This requirement for incentive in the authorship debate was again raised by Perrya and Margonia as recently as2010.[62] The author would submit that whilst incentive is a justification for the existence of intellectual property rights it is not a requirement for the generation of such rights. The author would further submit that incentive must and does exist somewhere in the chain of production to encourage both the continued development of these programs and the works generated therefrom. The lack of any need for incentive by the author does not mean you should deny them authorship. Milde in his analysis[63] also recognizes the need for some financial reward to be available to a human (he believes, to the manufacturer to encourage investment) but argues that this does not preclude the grant of authorship to the computer, a position with which the author agrees.

Ms Samuleson approaches the problem from a practical standpoint opining that " Only those stuck in the doctrinal mud could even think that computers could be authors"[64] but surely that is a fundamental purpose of academic debate - to consider doctrinal issues which are at the heart of the development of new legislation. Practicalities are best left in the realm of implementation.

Ralph Clifford also addresses this issue.[65] While starting from the premise that throughout history the source of creativity has been believed to be the human being, he acknowledges that times are changing and recognizes the ability of a computer to be creative citing the neural network computers created by scientist Stephen Thaler. His focus is on the question whether such works should be accorded copyright protection at all as he believes Thalers claims are tenuous the works being produced by a non-human author with little input from Thaler. He concludes that Thalers claims do not fit comfortably within federal copyright law. The author would agree that claims by the inventor Stephen Thaler to the output of the Creativity Machine are tenuous but this should not mean the rights should be denied. We simply have to determine in who or what they reside which the author will submit should be the computer. As with Ms Samuleson he cites the lack of consideration of a non-human author by the legislators as implying that all such works require a human author to be capable of protection.

Ralph Clifford cites duration of protection in support of the contention that a human author is required for authorship as duration is linked to the life of the author[66] and while there is no definition of "author" in the U S Code nowhere does Congress indicate that a non-human entity can be an author. However as will be discussed infra linking copyright to the life of the author was no more than an expedient at a time when it could not be envisaged that a machine could acquire such rights. In fact under UK copyright law certain rights eg typographical are determined not by the life of the author but by the date of creation and this distinction is expressly confirmed in relation to computer generated works which exist for 50 years from the end of the year in which the works were created expressly therefore not linking duration with a human author.[67] Further although Congress might not have indicated that a non-human entity can be an author it did not deny that such could be the case – the Code is simply silent on this point. The Code does however recognize that in the case of work produced by an employee in the course of his employment –" work-made-for-hire" a non-human entity ie a corporation can claim copyright,[68] an issue to which we shall be returning later.

He further cites the case of *Burrow- Giles Lithographic Co*[69] in support of his argument, where it was stated that the author is "the person who effectively is the cause of the work which is produced, that is, the person who has superintended the arrangement." Again the author would submit that this use of the designation "person" was simply a reference of convenience at a time when it was not contemplated that anyone other than a human could ever be creative. He goes on to conclude that if we were to accept that computers could be authors this would have massive ramifications throughout

[61] Clifford, Intellectual Property in the Era of the Creative Computer Program: Will the True Creator Please Stand Up,71 Tul L Rev 1996 pg. 1675.

[62] Perraya & Margonia, From music tracks to Google Maps: Who owns computer generated works? Computer Law and Security Review 26(6) 2010 pg. 621.

[63] Milde, Can a computer be an Author or an Inventor 51 J. Pat. Off.Society 1969 pg. 378.

[64] Op cit [fn 59] at pg. 1200.

[65] Op cit [fn 61].

[66] Op cit [fn 61] at pg. 1683.

[67] CDPA s15 and s12(7).

[68] 17 U.S.C. s201(b).

[69] 111 U S 61.

the law.[70] The author would agree but this is not a reason why we should shy away from the possibility.

As with Ms Samuleson, he cites the lack of a need for an incentive for a machine to create as a reason to deny copyright and suggests that such work would therefore simply enter the public domain.[71] The author would repeat the arguments raised supra in this regard. He does however recognize in a footnote that his assumption, that if there is to be an author of computer generated works this must be one of the humans involved and not the machine, may alter over time and that "the challenges placed before the legal system will be immense if such artificial intelligence is achieved".[72] The author wholeheartedly agrees with this sentiment and feels that such a time has arrived.

Ai development has continued to progress since 1997 with a further analysis of the situation by Perrya and Margoni in 2010.[73] Although their focus is on Canadian Law they firstly consider the requirement for originality/creativity in copyright, concluding that while in those jurisdictions where originality is the threshold for protection it is conceivable that a computer generated work could satisfy the requirement, in those jurisdictions where creativity is necessary it may be more difficult. As such in those jurisdictions which utilize the originality test eg UK, South Africa, New Zealand there are specific provisions dealing with computer generated works which are absent from other jurisdictions relaying on the creativity test. However with the exception of the US which specifically requires a human "creator" the other jurisdictions are silent on this point and the author would submit that silence does not equate with a need for a human author. They further consider the relative claims of the various involved parties to authorship – the original programmer, the user, the computer or nobody which claims will be considered in detail infra. They feel that inherent in this analysis is the concept of reward and incentive. As discussed above they see problems in stretching reward to the user[74] and conclude that the original programmer will also fail in those instances where the modified program has developed beyond using substantial parts of the original code.[75] That only leaves two solutions – the machine itself or nobody. They dismiss the claims of the machine on much the same basis as Ms Samuleson and Mr Clifford namely that of the absence of the need for incentive on which point the author repeats his views supra and will further discuss in detail infra. They conclude therefore such work should fall into the public domain with which proposition the author would again respectfully disagree for the reasons discussed infra. Interestingly they do however initially recognize the possibility of granting authorship in the machine before dismissing it.[76]

Wu, in his 1997 article recognizes that neither the programmer nor the user should be granted the copyright in computer generated works, but dismisses the claim of the machine based however, on the premise discussed above, that it was never intended that copyright should be granted to anything other than a human author. To overcome this problem he suggests the courts should devise an entity – the Fictional Human Author to whom copyright could be granted and then assigned to the owner of the Ai system.[77] Yet by creating this fictional entity he is recognizing the true author of the works – the machine, but simply failing to accord credit based on the lack of a human author. For the reasons discussed above the author would question the need to create this fictional entity and one should simply accept the claim of the machine.

In considering the grant of authorship to the machine, other authors have addressed the issues as to whether the user of an AI program should be held accountable for possible intellectual property infringement by AI created programs.[78] Schaal concluded that it would be wrong and counter - productive to economic development to lay responsibility for AI created infringement at the feet of the user, a proposition which the author supports, confirming the autonomy of AI generated works. Al- Majid[79] and Solum[80] recognize the difficulties in granting personality to non-human entities as with rights come responsibilities and enforcing liabilities should these AI programs be granted legal personality may prove problematic, which will be considered infra.

5.3. *The future – another fable*

Let me take you to the future with acknowledgement to Bruce A. Lehman.[81]

It is the twenty fourth century the time of the eighth generation of artificial intelligent robots. Zing 18 – a computer-has recently developed a new type of tube for dispensing toothpaste. Mundane certainly but so revolutionary that it will earn billions for Zing's "employer" the Oral Health Corporation who purchased Zing from the Intelligent Thought Corporation. Zing's Ai program was originally developed by Rufus an employee of the Intelligent Thought Corporation but it has through its self-directed learning capability moved on from its original program amending the program itself as it developed.

However Zing is also linked to other Ai programs developed by other corporations that interact to solve the problems created as Zing's master simulations develop the product. In addition Zing is linked with MPS a market research company who interview potential customers on the high street and whose findings are relayed to Zing to be computed into its calculations. There is also a direct video link from the

[70] Op cit [fn 66] at pg. 1685.
[71] Op cit [fn 66] at pg. 1695 and 1701.
[72] Op cit [fn 66] at pg. 1675.
[73] Op cit [fn 62].
[74] Op cit [fn 62] at pg. 627.
[75] Op cit [fn 62] at pg. 626.
[76] Op cit [fn 62] para 4.3 at pg. 627.

[77] Wu, From Video Games to Artificial Intelligence: assigning copyright ownership to works generated by increasingly sophisticated computer programs, 25 AIPLA Q. J. pg 131 at pg. 159.
[78] E Schaal, Infringing a Fantasy: Future Obstacles arise for the US Patent Office and software manufacturers utilizing artificial intelligence 11 Villanova Sports and Entertainment Law Review 2004 pg. 173.
[79] Electronic agents and Legal Personality: www.bileta.ac.uk/document 20library accessed 31/5/11.
[80] Solum, Legal Personhood for Artificial Intelligences 70 North Carolina Law Review 1992 pg. 1231.
[81] Lehman, Intellectual Property in 21st Century Cyberspace Tokyo Symposium Oct 22 1999.

bathroom of Dan, MD of the Oral Health Corporation who is using the prototype tube so Zing has direct input of potential problems from these sources. He analyses these problems in conjunction with the information from the other computers and MPS to compute a solution.

On the basis of all this information, programming and interaction the product is invented! Utilising an AI based patent writing system Zing prepares all the paperwork and submits electronically to the Patent office. The Patent's office computer using a sophisticated Ai search and analysis program searches through all the relevant databases and requirements and issues the patent.

The Oral Health Corp is a research only based company and has never intended production. Zing therefore places information about the product onto the Patent Auction website of the World Wide Web. The computers of relevant manufactures compute likely annual sales over cost and make a bid for the Patent rights. The governing computer of the patent auction website will automatically sell rights to the highest bidder at the expiry of 24 h from the patent first being processed. A standardised industry contract is produced, electronically sent to Oral Health Corp and the successful bidder's computers who execute on behalf of the parties and exchange - the sale now being regarded as complete.

So who gets the money! Rufus as the original programmer, Intelligent Thought his employer, Oral Health as the owner of the system, MBS and/or the originators of the other systems due to their data input, the originators of the other systems that interacted with Zing and which influenced but did not determine the outcome or Dan for his input! Or, as is to be suggested infra, should their entitlement be based on simple contractual rights determined by individual contracts between the parties involved in the process, with the original IP rights resting with one person – and if so whom?

These conflicting claims will be considered later but it is submitted there can only be one candidate.

5.4. *Current treatment of these competing claims*

How does the law currently deal with these problems? The simple answer is that it does not as the problems have not at present arisen to any great extent. With regard to intellectual property rights in the program itself we must address issues of patent and copyright and the current position is relatively clear.

We have already considered the requirements for a successful patent application. With regard to the patenting of a computer program this is governed by s.1(2)(c) of the PA which specifically excludes from patentability a " *program for a computer*".

However this basic precept has been substantially modified through case law due to the caveat at the conclusion of the section which states,

> *"the foregoing provision shall prevent anything from being treated as an invention for the purposes of this Act only to the extent that a patent or application for a patent relates to that thing as such"*.[82]

[82] PA s.1(2).

If the program produces a "technical result or contribution" that in itself may be patentable. Whilst the terminology for this concept has been changed over time it still remains the standard used. As such we can see that the original computer program would not be patentable per se and would only become so if it produced a further technical effect which in itself must not fall within one of the excluded categories.

It is not the author's intention to examine the current controversy over the patentability of computer programs, merely ownership of any patentable modified Ai programs or patentable products invented by such systems.

With regard to copyright protection however the position is entirely different. If we turn to the Ai program itself this is clearly protected in its initial form by copyright. s.1 of the CDPA accords copyright protection to literary works and in s.3(1) a literary work is defined as any work… which is written, spoken or sung and includes…. a computer program although the statute does not provide any definition of what amounts to a computer program.

5.5. *Deficiencies in the current regime*

So let us set the scene and address further problems that are going to arise with these revolutionary advances in the area of artificial intelligence.

5.5.1. *Original program*

The initial program as we have seen will attract copyright protection and in some limited cases patent protection. To determine which it is necessary to consider the contents of the program very carefully. However in addition to containing the original program code the program will adapt and rewrite itself to include "discoveries" as the Ai learns from its experience.

5.5.2. *Ai generated modified program*

With current computer programs the basic program doesn't change – the operator simply increases the data contained within the program to deal with new situations. An Ai system will through its learning experience not only increase the database of the program but will also be able to rewrite the basic program itself. It will be reacting in a different way to its initial response to any given set of stimuli as it learns from its previous mistakes, and will be "aware" that it must modify its behaviour and thus its program. It will in essence be rewriting the program as it develops.

We are considering here early generation computers."- *Second generation computers will learn some of their tricks on the job. Their big advantage is adaptive learning, which closes the loop on behaviour. Each robot action is repeatedly adjusted in response to measurements of the actions past effectiveness"*[83]

Later generation computers *"will learn much faster because they do much trial and error in fast simulation rather than slow and dangerous physicality"*.[84] By way of example we have a late generation robotic computer working in the home, that has been programmed to recognise human speech. A human tells

[83] Moravec, Robot – Mere Machine to Transcendent Mind; 1999 pg. 100.

[84] Ibid pg. 104.

it that the bath taps are on. It will not have experienced this scenario before although it can draw upon stored memories from other devices which will have experienced this. It will run then a simulation of tap on, water entering the bath, bath overflowing which is not a desired effect and will go and monitor the water flow and turn it off at the appropriate time. It has been able to do this in microseconds based on the learning experiences of its predecessors. Any unknown variable it encounters it will resolve, incorporate into its program making any necessary program rewrites and this modified program will be passed on to future generations.

By way of example, RoboEarth is a European project supported by the European Commission and involving researchers from several leading universities. Its aim is to create a world wide web for robots allowing robots to share their experiences with other robots. So researchers in one location can be teaching a robot a specific task which can then be accessed by robots in other locations that can learn remotely.[85] The potential for learning, with such vast amounts of available data and no limitations on the computer's ability to assimilate it, is enormous. The whole essence of Ai is that the way in which it reacts will not be capable of prediction. Just like the human brain its response will be governed not simply by the program but its interpretation of the program and the stimuli. When the point is reached when this altered programme is no longer regarded as being authored by the original programmer it will no longer be protected. This is bound to have an effect on the enthusiasm of the innovator to invent.

Let us move the scenario on. A programmer develops an effective Ai system, intellectual property rights in which clearly belong to him. This program is then sold to a customer. By its very nature the system is going to develop. We have considered previously the question as to whether or not the original programmer's rights may be lost as the very essence of the program alters even where the original inventor is still the owner of the initial product. If the program has been sold to a customer to whom does the new improved system belong? The original programmer will lay claim to developments on the basis that they arise from his initial program to which (subject to the comments above) he has the rights. The current owner however will argue that as he bought the product he should benefit from any developments since purchase.

Both arguments are flawed. The original programmer will fail on the basis that there has been a radical alteration from his original program and the owner, without possible recourse to s9(3) CDPA should fail, on the basis of no input of skill or labour.

We might actually find a lacuna here where neither the-programmer nor the owner can claim the intellectual property rights. If they become fair game for the public at large again there is no incentive for innovation, research and development.

5.5.3. *Product of Ai program*

If we consider the products of these Ai programs, the position becomes even more removed from the current reality of ownership of rights. Again this scenario is not science fiction but is already with us. Computers already exist that using current Ai systems can produce "original" songs, literature and improvements on their own internal programs. To whom should the intellectual property rights in these products belong?

Products of computer programs are already attracting patent protection. In Virginia a program by D. Linden automatically designed a satellite communications antenna so original Dr Linden obtained a patent on it.[86] In North Carolina programs developed by Engineoud Software came up with improvements to a jet engine, which have formed the subject of two patent applications.[87]

We shall be returning to possible solutions to these problems – but the time has come to recognise that these rights should belong to the creator of these products namely the Ai program. Again it is emphasised this is not to create an Ai Bill of Rights but to solve a practical problem.

6. Future developments

6.1. *Analysis of competing claims*

Let us now analyse the respective claims of these interested parties to the creative work of the computer[88] ignoring the impact of s.9(3).

6.1.1. *Original programmer*

What of the original programmer? Morally perhaps, he should be regarded as having claim to the Intellectual property rights arising from his original program. Yet English law only recognises limited moral rights, these in the realm of copyright and while these give certain rights to be associated with your work they confer no real financial benefit. It is the promise of reward that permeates through the rationale for the grant of intellectual property rights.

If we consider his right to claim intellectual property rights in subsequent modifications of the original program, involving no human input, then difficulties arise. Where is the original programmer's effort? The writer would submit that it no longer exists and that the programmer has no legitimate claim to this radically altered program.

The author of the original work does however retain rights in an adaptation of the original work.[89] For our purposes the relevant adaptation is contained in s.21(3)(ab).

6.1.2. *Adaptation versus derivation*

S.21(3)(a)(b) provides that in relation to a computer program, an adaptation means an arrangement or altered version of the program or a translation of it ie it is one that does not have sufficient addition to make it an original work.[90]

[85] http://www.dw-world.de/dw/article/0,,14861090,00.html accessed May 19 2011.

[86] Eisenberg, When a Gizmo Can Invent a Gizmo; New York Times November 25 1999.

[87] Ibid.

[88] Hewitt, Copyright Claims to Computer Output in the UK; EIPR 11 1983 pg. 308.

[89] CDPA s.16(e).

[90] *Interlego v Tyco Industries* [1989] AC 217.

The whole essence of an Ai programme is that it will continually rewrite its basic programme to adapt to new circumstances. Although this would in the initial stages of modification of the program appear to fall within the section giving protection to the original programmer in time the altered program will bear no similarity to the original program and could not be regarded as simply an adaptation.

So could it at best be regarded as a derivative? It has long been the case that copyright in a "derivative" work belongs to the author of that work[91] and not the author of the original work. In order to qualify as a derivative work rather than an adaptation:

> *"there must in addition be some element of material alteration or embellishment which suffices to make the totality of the work an original work".*[92]

This requirement is unnecessary where the subsequent alterations are effected by the author of the original work itself, each modification attracting copyright.[93] However as has been discussed supra it is the writer's contention that subsequent alterations in an Ai programme do not arise from or should be attributed to the original programmer but to the Ai program itself and therefore should belong to the computer provided it satisfies the aforementioned test. Further it is submitted that as the program develops and is rewritten by the Ai system the program will become so radically different to the original that it would become an original work and therefore qualify for protection in its own right.

This is so even if that derivative has not been authorised by the original author although it could be subject to a possible infringement action. Note the position would be slightly different in the US where if the derivative work is created from an original work without lawful use the author of the derivative is denied protection.[94] In this scenario however, as the original programmer will have specifically written the original AI programme to develop and further enhance its programme one can assume authorisation would be implicit.

This extension of rights was in fact considered by the Government in their review of copyright and design law following the Whitford Report.[95] Having recognised that Whitford was undecided on the extent to which the owner of copyright in the initial program should have the right to control use of the program it concluded that was sufficient for the copyright owner to have control over the initial loading of his program onto the computer. Any rights to be retained beyond that or to obtain recompense for such use beyond that would be dependent on any negotiated licence – a conclusion we shall be returning to later.

6.1.3. *Other claims: products of programs and future generations of the computer program*

Similar arguments arise when we consider the original programmers claim to the product of such a program. Indeed we do not have to await the development of future generation computers for this to arise. Programs albeit primitive compared to those that will exist in the future currently exist where the computer will randomly pick characters, plots, locations and other scenarios from an immense data bank and will generate fiction from this. Who is to benefit from this? While the original programmer had input by designing the program that generates this work can it truly be said that he expended any skill or effort in the production of the work itself? The writer would submit not – the programmer plays no part in the computers selection. We shall look at the competing claim of the data operator later.

In time, the computer will itself be writing Ai programs to be used and further adapted by the next generation of computers. The product attracting intellectual property rights may be produced by a computer removed several times from the original computer. The original programmer cannot continue to lay claim to these rights.

Finally if we were to give rights to the original programmer in these instances what would happen if he sold the original program? Should the rights belong to the original programmer as the creator of the first Ai program or the new owner who may have invested substantial sums of money in its further development and production of its products? If the former how would we determine his entitlement/share of the income generated from developments that could occur many years after his creation and with no further involvement by him? It is submitted that when he first sells/transfers the Ai program he will have been adequately rewarded for his effort and has no further claim thereafter. The writer will contend that he should, in fact, have no further rights in law as he has not created the modified Ai program or output. So his claims fail.

6.2. *Data operator*

Data is clearly an important factor in the computer both developing its Ai program and producing its product. Should intellectual property rights belong to the person responsible for the input of data?

In the early years of Ai development there may indeed be one or several organisations providing data to the computer on the basis of which the computer will analyse the problem it faces and produce a solution. In the absence of this data it will be unable to develop its program or product but can the inputting of this data be truly said to be of such skill and effort or involve such creativity sufficient to give intellectual property rights to these people. The writer would submit not. Again it is the computer itself through its already modified program that will select, analyse, interpret and apply this data to further modify its system. The data operator does not even have to select what information to give the computer – they can feed a wealth of information to the computer and allow it to select what it considers necessary to solve the problem in hand and create from there. It is true that data is vital to the process but no more so than for example electricity and it can in no way be said that the Electricity Company has had input in the development of the program.

With the advent of future generation computers the computer itself may well be generating for itself all the data it

[91] *Macmillan Publishers v Thomas Reed Publications* [1993] FSR 455.
[92] Op cit [fn 90].
[93] LA Gear v Hi Tech Sports [1992] FSR 121.
[94] U S Copyright Act 1976 Pub L No 94-553 103(2).
[95] Reform of the law relating to copyright design and performers protection, Cmnd 8302 London 1981.

requires through its own audio, video and tactile inputs. It will itself "talk" to other computers to obtain further relevant information. As we have seen it will be able to predict the outcome of a given situation, through simulations, without even having to experience it. It will have had downloaded to it from other computers the result for example of trying to cross an obstacle in its path. When faced with an identical problem instead of trying and failing it will use this data to predict it will fall and modify its plan of action accordingly. In that respect it could be said to be even more creative than a human, as a child will only learn from its own attempts, whereas the Ai system will generate data from the input of other Ai systems through the web mentioned supra and from its own almost instantaneous simulations. The data operator will have no input into the program's development and therefore no claim over any intellectual property rights so created.

Similar considerations will apply to the intellectual property products produced by the computer. Whether it is a first generation computer dependent on the data operator for information or a future generation computer obtaining this information independently at no stage can it be said that the data provider has had any input into the final product.

6.3. *Owner/investor*

Claims by other interested parties become even more tenuous. What of the owner/investor? It may be said that one of the functions of intellectual property rights is to encourage research and development and therefore those that invest substantially in its development should reap the rewards. The writer accepts this argument but this does not give that person the initial claim to rights attaching to invention. That person has no claim per se to the rights since the law clearly confirms the need for input by the claimant, which is not provided by the owner/investor. Their claim arises from their special relationship with the creator through contract, express or implied.

The PA clearly provides for "transfer" of intellectual property rights to an employer – s.39 of the Act providing that if an invention is deemed to be an employee invention than the employer has the right to apply for the patent. However it also clearly confirms that the employer has not created that right since the inventor has to be named. This is therefore not based on creative input but on the special relationship between employer and employee and arises after the inventor has created the right. If the employee is an independent contractor transmission of these rights to the "employer" will depend on the terms of the contract. Copyright law has a similar statutory provision.[96]

Intellectual property rights are property rights and therefore can be bought, sold and otherwise dealt with. Again however this transmission of rights only arises after the right has been created – the current owner cannot lay claim to primary creation of the right. So while the owner/investor may, either through statutory provisions or through the terms of their contract acquire the right it can only arise subsequent to its original creation.

In the case therefore of employer, owner and investor there must be an original creator and so we are faced with the problems revealed by our prior analysis. If neither the original programmer nor the data operator can acquire these intellectual property rights then there is nothing to be acquired by the employer, owner or investor through the operation of law or contract.

The original programmer or data operator may no longer be on the scene. The computer itself will independently, with no external human assistance, be improving its Ai program and producing intellectual property products. By whatever means the employer, owner or investor acquired the original program they have had no involvement in the new program or product and therefore it is submitted no entitlement to these new intellectual property rights created whatever moral right may be raised to entitlement through investment.

6.4. *Operator*

One other person may lay claim to entitlement – the operator. For the reasons already elucidated however no claim will succeed. There has been no substantive input by the operator involving skill, judgement and labour and he cannot therefore be entitled to any intellectual property rights. Indeed by the time of future generation computers we may well have attained role reversal. The computer will only require the operator in limited circumstances e.g. maintenance (and even this may disappear over time). The operator will have become the tool of the computer!

6.5. *Public*

Perraya and Margonia postulate that perhaps the solution is not to grant copyright to anyone and to simply allow the computer generated works to become public property.[97] This they maintain would be in keeping with the underlying ethos of intellectual property rights. One of the stimuli for the intellectual property system is that of the rights holder receiving a reward for his labour which in turn leads to the incentive to create. The computer having no desire or need for reward or incentive (unless so programmed) will create without the need for these stimuli and therefore no useful purpose is served in granting copyright over the work. This would accord with the utilitarianism justification for the existence of an intellectual property system. Such works would be freely accessible to all and would lead to further cultural and scientific development. However this utilitarian argument would also hold true in relation to all current patent/copyright work yet where there is no controversy over the entitlement to the right the right is granted. So if one follows this argument either intellectual property rights must disappear altogether or it does not provide a justification for distinguishing between human and non-human authors.

The writer would submit however that this ignores the fact that without a reward/incentive existing for the benefit of

[96] CDPA s.11.

[97] Op cit [fn 62].

someone, somewhere along the chain from creation of the original programme to the final computer generated output there would be no incentive to create the Ai programme in the first instance. Incentive drives the system.

Trademarks are routinely granted to and owned by companies, a non-sentient entity; a process which is not only accepted but encouraged. They hold copyright, patents and design rights. Where is the incentive to create here? Following the argument supra a company cannot possess such desires and therefore should not be entitled to hold such rights. And indeed what labour has it expended that it should be rewarded for? It is the potential reward for those behind the scene, the shareholders, which fuels the system. By the same token the potential reward for those people involved in Ai generated rights is a sufficient justification for granting rights in such works to the computer to be capitalised on by such people. The justification for the grant of such rights remains the same – the only question is to whom these rights should initially be granted.

We shall return to these problems when we consider the proposed solution infra. So where does this leave us? In the writer's opinion with only one conclusion.

7. Computer author/inventor

7.1. *Proposed solution*

We have considered the moral arguments as to why intellectual property rights should not be acquired by the computer but although the law to some extent exists to protect society's morals it does so only to protect the public from harm. It is not its function to impose arbitrary theological or intellectual concepts on the public where decisions contrary to this will not adversely affect society.

We must so to speak become as logical as our computer innovators. We have already addressed granting intellectual property rights to various interested parties engaged at various stages in the computer's development of its Ai program and its eventual output. Problems are inherent in each of these cases and by the time of the third generation of computers, the computers will themselves be writing advanced Ai programs for further development by the next generation of computers.

So we must be radical and innovative – what will happen if we give the initial grant of these rights to their creator, the Ai computer? There is little doubt in the writer's mind that this is the entity best entitled to the grant of these rights. If we consider the legislation surrounding the grant and entitlement to intellectual property rights, as we have seen, nowhere does it indicate that the creative effort required must emanate from a human. What is required is in very basic terms creativity and the computers Ai program is supplying this.

Can a computer hold such rights despite not being human? It is submitted it has a stronger case for such entitlement than the other entity afforded such privileges – the body corporate. A company which does not even exist in physical form is nonetheless regarded as a body capable of possessing property, earning money and being subject to and entitled to certain rights.[98] More particularly it is able to acquire and hold intellectual property rights. So there is no reason why similar status could not be granted to a computer to allow it to hold the intellectual property rights in what it has created.

7.2. *Personality of machine*

So can a machine be given legal personality? There are precedents for the grant of legal personality to inanimate objects – Christopher Stone cites a specific example of an action in India where in a dispute over ownership of an idol counsel was appointed to represent the idol.[99] Of a more general nature, of course, the most common example is that of a body corporate. Solum poses the elemental question, in considering whether or not to grant personality, as being whether or not the entity should be made the subject of a set of legal rights and duties or at the least granted personhood so as to confer rights on a third party.[100] As we have already seen and as will be discussed supra by granting personhood to the machine and allowing them to hold intellectual property rights we will be then be able to confer such rights on the party entitled to them under contract thereby overcoming the problems inherent under the present system and addressing the issue of the need for incentive in the intellectual property system postulated by Samuleson and others.

In considering the possibility of according separate legal personality to the machine we should consider the reasoning behind the grant of personality to a body corporate.

Historically the grant to a corporation of separate personality stemmed from two main considerations – the first was the need for certain organizations to exist in perpetuity such as religious orders and local government (and later companies), and secondly the need for such organizations to be capable of holding and dealing with property and being held accountable for losses. Independent personhood for such entities was accorded in the UK originally by Royal Charter and then under the Joint Stock Companies Act of 1844. In 1855 limited liability was accorded to the subscribers to such entities under the Limited Liability Act.

The difficulty that existed is that while these organizations protected the original subscribers who no longer could be held accountable for company debts, until such companies were recognized as individuals in their own right they could not be sued, this individuality being acknowledged in the case of *Saloman v Saloman*.

The author accepts that an issue could therefore be the question of the accountability of the machine personality and its ability to meet possible claims upon it– the "responsibility objection" as postulated by Solum,[101] although for the reasons set out below the author does not

[98] Op cit [fn 3].
[99] Stone, Earth and other Ethics Harper and Row 1987 cited by Solum op cit 80 at pg. 1239.
[100] Op cit [fn 80].
[101] Op cit [fn 80] at pg. 1244.

consider it an issue in the context of the present discussion. Here we are simply creating personality to determine authorship issues presented by the autonomous production of computer generated works. However if we are to grant authorship to such machine personalities then we must consider responsibility. In the same way as a company can be sued, a machine could be sued but how would it meet any financial obligations imposed? Possible solutions have been proposed by Solum and Al-Majhid.[102] The first of these is the establishment of some form of deposit account to satisfy claims. The difficulty here is from whom this deposit should come although the obvious person here is the person to whom any contractual rights from the machine would attach. The level of such deposit might be difficult to calculate but some protection, albeit limited, would at least be accorded to claimants and such limited protection is in essence no different from that which currently exists for a corporation where liability is limited or a partnership/sole proprietor where the claimants rights would be limited to the assets of such entities. Further there already exists corporations which cannot effectively meet large demands eg a company limited by guarantee where a creditor's claim can only be made against the amount guaranteed by its shareholders (usually nominal).[103]

The second would be the establishment of an insurance scheme to cover such possibilities. While this would be difficult to assess it is no more difficult than that applying to eg new ventures by existing corporations and would simply open up a new field of activity for actuaries.

While these are valid concerns they do not present insurmountable difficulties. It is further the authors' contention that while we are considering granting personality to a machine this would be of a different nature to that of a company. With regards to the latter these are often set up to minimize risk and to trade in their own right. Here we would be granting personality for the purpose of legitimizing the right to intellectual property. It is not proposed that these rights would remain with and be traded on by the machine. They would initially vest in the machine and as has been seen would then be transferred under contract to whomsoever is denoted by the contract. That person who would identifiable from the outset could be required to make any necessary arrangements for protection.

Leading on from this it would not be necessary for there to be any form of shareholding – the personality would simply exist to receive the right and then transfer such right in accordance with contract. It would be a legal fiction to remedy what the author considers a defect in the current authorship/inventor regime of intellectual property.

7.3. *Effect of proposed solution*

How will the author's proposed solution impact on the claims of others?

We have already considered that once the original programmer has finished work on the original Ai program and had no further involvement then he has no primary claim to any further intellectual property rights arising from either a more developed Ai program or what is produced by the program. However if he has not disposed of the original Ai program it can be said that in continuing to use the program the computer is in essence working for the original programmer. It is his employee and therefore the original programmer would be entitled in a secondary sense to the intellectual property rights as an employer and to exploit accordingly (the writer will not raise an employee's rights to compensation under s.41 of the PA here!). The writer accepts it would be necessary to create a sui generis right under both patents and copyright to cover this situation.

If he has licensed the use of the Ai program to somebody else the terms of that licensing agreement would determine who would be entitled to these secondary rights in much the same way as it would so do in the case of an independent contractor or someone on secondment from one undertaking to another.

If the Ai program is sold then the original programmers rights – the amount of any royalties/compensation, duration of entitlement and extent those rights would apply to subsequent generations of the program would be explicitly covered under the terms of the contract between the original programmer and the new owner - not left to the current concepts of authorship/ownership. The new owner would in the absence of anything contrary in the sale agreement acquire entitlement to any new intellectual property rights – the computer would now be his employee and as employer he would be entitled in a secondary nature to any rights generated by the computer.[104]

If, before advanced Ai computers become capable of generating their own data, the programmer were to engage someone to provide data for the computer they would be paid for their services. If regarded as of critical importance for the computers development their entitlement to any share in the intellectual property rights produced by such Ai programs would be governed by the contract between them and those using their services. The computer after all would not be their employee but that of the person for whom they are working – a form of joint venture governed by the terms of their contract.

7.4. *Significance of proposed solution*

Intellectual property rights are extremely valuable rights, ownership and entitlement to which should not be left to vague concepts determined by statute. By the granting of these rights to the computer and leaving resolution of these entitlements to operation of contract the parties themselves are responsible for determination of their respective entitlements which is surely a more attractive proposition to the parties involved. Indeed if one is considering the position of the original programmer this might work to his advantage since depending on the commercial value of the program he may be able to negotiate more extensive rights than he night otherwise enjoy.

[102] Op cit [fn 80] at pg. 1245 and [fn 79] at pg. 4.
[103] Companies Act 2006 s4/5.
[104] Much as proposed by the Government in Cmnd 8302, see discussion supra.

So by giving the intellectual property rights in the radically modified original Ai program and in the product of that program to the computer we are resolving the difficulties apparent earlier.

Let us return to the future and now analyze the situation faced by the Zing dilemma.

In accordance with our conclusion Zing now holds the intellectual property rights in the invention:

- Rufus would have no direct rights in the invention, which is reasonable, as he had no further input beyond developing the original program. Any rights he may claim would arise from the terms of his contract with his employer, Intelligent Thought and their contract on the sale of Zing to Oral Health.
- Intelligent Thought would have no vicarious rights through its employee Rufus and would again fall back on mutually agreed contract terms between it and Oral Health.
- MBS, other data providers, other interactive program providers and indeed Dan would all also have to rely on contract terms governing their input.
- Any operators of the system would again be governed by contract terms either as employees or independent contractors.
- Only Oral Health would be able to claim secondary intellectual property rights as employer of the inventor. Should they sell on the new improved system all products from that system would now belong to its new employer and Oral Health would turn to contract to determine any reward.

Through this grant of intellectual property rights to their originator – the computer – we have substituted resolution by intellectual property law, governed principally by statute and case law and therefore by the State, to that of contract where all interested parties themselves determine their fate, a far more satisfactory conclusion.

7.5. *Duration of protection*

So what of the duration of protection granted to this computer/inventor since this entity is potentially immortal?

Under the terms of the PA the duration of any patent right protected is for 20 years subject as mentioned supra.[105] This can in certain circumstances be protected for a further five years through the use of a Supplementary Protection Certificate. In the realms of patent rights therefore the granting of the right to the computer would create no problems.

Certain difficulties will present themselves in the realm of copyright but are these of such a nature as to preclude the-possibility of the computer being accepted as the author? The Whitford Committee recognized problems of duration when considering the issue of computer generated products.

> *"There will undoubtedly be difficulties knowing when the term which may depend on the life of an author expires but we do not accept the difficulties referred to justify special treatment"*[106].

Consequently minor modifications only were made in the subsequent CDPA to provide a different termination date for computer generated products where it terminates 50 years from the end of the calendar year in which the work was made[107].

Our computer author can simply be substituted for the author in s.12(7) subject to the same termination principles.

8. Conclusion

Many of these problems have not as yet materialized but come they will. As intellectual property rights play a greater part in commerce and become more valuable we shall see many interesting and novel attacks on the ownership of such rights in infringement cases.

Many people say that we will never be able to understand intelligence and therefore never be able to produce a true artificial intelligence system.

Let us not forget that twenty years ago the same was said about life. Life was a gift from God something that could never be understood or created. We have already in that short period of time cracked the genetic code of the building block of life – DNA and through cloning are now producing life which of itself has produced further necessary developments in the protection of intellectual property rights arising from this.

Our system of law is meant to be proactive not reactive. We must not wait for the problems to arise before attempting to resolve them – this can only serve to create uncertainty and restrict innovation in the area of Ai. Action must be taken now to consider the problems that will inevitably arise and the means of resolving them.

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[105] PA s.25.

[106] Op cit [fn1] para 517.

[107] CDPA s.12(7).