

ARTIFICIAL INTELLIGENCE AND THE BELIEVER

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We are standing on the edge of a great unknown and uncharted sea. The world of technology has changed our world in ways that we can only begin to comprehend. It is now possible to have almost instantaneous electronic contact with people from around the world. Countries which have not had the infrastructure to support a viable telephone system are now bypassing this old technology and hardware and are going directly to communication towers and satellite communication systems. Virtual reality¹ has now become a common term and has begun to offer people an alternate form of what is considered real.

The media has become an integral part of the process by introducing movies dealing with artificial intelligence (AI). The most popular of the recent movies, *The Matrix*, depicts a time when the machines are winning the cosmic struggle and all of humanity is in danger of being eliminated. But, thankfully, in the end, Neo, the One, the messiah-like character comes to the rescue and mankind is saved to fight another day.

While the popularized forms of artificial intelligence have been enjoyed by the masses, there is a very real form which is being developed that may surpass what any of us can currently imagine. In 1979, the American Association for Artificial Intelligence (AAAI) was founded with the purpose of advancing the scientific understanding of the mechanisms underlying thought and intelligent behavior and their embodiment in machines. This organization along with many others are pursuing the next generation of "computers" which will truly be able to mimic man's intelligence, with the ultimate goal of surpassing it by eliminating those parts of thinking which are not controlled by logic, a rational

¹ A list of "Hot Virtual Reality Sites" can be found at <<http://www.itl.nist.gov/iaui/ovrt/hotvr.html>> (accessed 27 January 2004).

thought process. While this may still be something in the future, if the observation made in 1965 by Gordon Moore, co-founder of Intel, that the number of transistors per square inch on integrated circuits has doubled every year since the integrated circuit was invented and his prediction that that this trend would continue for the foreseeable future is correct, the “power” of technology will surpass anything even he could have imagined.

And that is a discussion dealing with the power of a single computer. There are organizations today that have created computational grids² that connect hundreds of thousands of individual personal computers as in the case of Distributed.Net³ or entire computer systems in the case of DataSynapse⁴ to a global network designed to harness the collective power of thousands of computers to create virtual organizations and accomplish designated tasks.

What does this mean for Christians? How should we be responding to this emerging field of technology? The very word “virtual” conjures up all kinds of images not the least of which is the virtual sex industry. It is estimated today that the online adult entertainment industry made \$1.7 billion dollars last year with several web sites making over \$150 million dollars each.⁵ And these monies are a significant element in the development of some form of artificial intelligence that will allow for virtual sexual encounters in a variety of forms. What if science can one day create a machine that appears to duplicate the rational thinking processes of man? Should the abuse of a particular technology mean that we are against the development of new forms and types of machines? This

² Distributed Computation. Grids are persistent environments that enable software applications to integrate instruments, displays, computational and information resources that are managed by diverse organizations in widespread locations. Grid applications often involve large amounts of data and/or computing and often require secure resource sharing across organizational boundaries (<<http://www.openp2p.com/pub/t/73>> [accessed 27 January 2004]).

³ *Distributed.Net Home Page*, <<http://distributed.net/>> (accessed 27 January 2004).

⁴ *DataSynapse Home Page*, <<http://www.datasynapse.com/>> (accessed 27 January 2004).

⁵ “New Technologies and the Sex Industry,” <http://www.ex.ac.uk/politics/pol_data/undergrad/aac/techno.htm> (accessed 27 January 2004).

paper provides a brief look at the past, present, and future of technology and a response that we as believers can have to this changing world in which we live and minister.

DEFINITIONS

Given the technological and philosophical complexity of this particular topic, it seems prudent to begin the paper with some definitions of key terms. However, given this complexity, it appears that precise definitions of the major terms have not been clearly established and accepted by the majority of the players. This lack of precise definitions has allowed for a wide variety of explanations and claims of achievement, depending on the particular model the designer is attempting to produce. So, in light of this, I have simply chosen to select definitions which seem to encompass the general theme of the issue and have achieved some form of acceptance in the scientific and philosophical world.

Since this article deals with the topic of artificial intelligence, it seems appropriate to begin with the goal of attempting to establish a working definition of this concept. It is obvious from an evaluation of numerous sources that the ethereal quality of the subject is evident to all those who work in the field. The following quotations help to illustrate the diversity of the views currently held.

Intelligence

The first definition by Allen Newell describes artificial intelligence in a way that allows for considerable breadth of application. It is not that difficult to think of an artificial intelligence, a computer, being able to function in a way that implements the knowledge-level of a system in dealing with a particular problem. The variable would be how much of the knowledge-level was available for the processor to use in its computation.

Allen Newell defines *intelligence* as the degree to which a system approximates a knowledge-level system. Perfect intelligence is defined as the ability to bring all the knowledge a system has at its disposal to bear in the solution of a problem (which is synonymous

with goal achievement). This may be distinguished from ignorance, a lack of knowledge about a given problem space.⁶

This definition leans towards the side of raw computing power. The variable “all the knowledge a system has at its disposal to bear in the solution of a problem” is the key element in the discussion. This limits the available inputs to program accessible data and concentrates primarily on the ability of a machine to manipulate this data according to a prescribed pattern to arrive at a conclusion.

Robert Sternberg’s definition is more precise and divides the topic into three components. It is evident from his definition that his focus is on human intelligence as his terms are much more in keeping with man’s interaction with his world. Sternberg implies that intelligence also requires the ability to think, the processing of information, and to learn, the ability to deal with new tasks or situations. But, he also gives us the concept that his definition is certainly not absolute and must be adjusted over time and with varying situations.

Sternberg has developed the “Triarchic” theory of intelligence, suggesting that there are three dimensions to intelligence. “Componential” intelligence consists of mental mechanisms for processing information. “Experiential” intelligence involves dealing with new tasks or situations and the ability to use mental processes automatically. “Contextual” intelligence is the ability to adapt to, select, and shape the environment. The concept of intelligence is fluid, multi-dimensional and evolving. Intelligence is not a single quality; there cannot be a single definition of it.⁷

An additional note concerning intelligence comes from Robert Sternberg in his description of the marks of a person who is intelligent. His description of intelligent people adds the idea of self-realization or self-consciousness, in that the person is able to understand himself and to make appropriate adjustments for improvement. He also uses the non-mechanistic term, “imagine,” under creative abilities. While this is another word that seemingly

⁶ Allen Newell, “Definition of Artificial Intelligence,” <http://ai.eecs.umich.edu/cogarch4/toc_defs/defs_theory/defs_ai.html> (accessed 27 January 2004).

⁷ “Definition of Artificial Intelligence,” <<http://www.alanapost.com/weblog/archives/001973.html>> (accessed 27 January 2004).

defies a precise definition, it does portray a concept that is outside the typical processing of information arena.

Successfully intelligent people discern their strengths and weaknesses and then figure out how to capitalize on their strengths and to compensate for or remediate their weaknesses. Successfully intelligent individuals succeed in part because they achieve a functional balance among a “triarchy” of abilities: “Analytical Abilities,” which are used to analyze, evaluate, judge, compare, and contrast; “Creative Abilities,” which are used to create, invent, discover, imagine; and “Practical Abilities,” which are used to apply, utilize, implement, and activate. Successfully intelligent people are not necessarily high in all three of these abilities but find a way effectively to exploit whatever pattern of abilities they may have.⁸

The third and final definition adds the connection between intelligence and behavior. Maja J. Mataric assumes that intelligence does not exist in a static, amoral world, but that it will be a part of improving behavior. While this is certainly an option for a human, it would be difficult to conceive of a computer’s behaving better as a result of its ability to process information.

An important aspect of the following definition is the connection between intelligence and behavior. The ability to improve behavior through learning is **the hallmark of intelligence** and thus the ultimate challenge of AI and robotics.⁹

The question which must be posed at this point is “What does it mean to have improved behavior?” Is Mataric referring to behavior in reference to moral/ethical values? Can a machine function more ethically as a result of its ability to process data? Or, can a computer make decisions which include the data of a prescribed ethical code? Would a machine refuse to perform an action if the result was to terminate the “life” of another machine or human being? How would a machine describe the “ultimate good”?

⁸ Robert Sternberg, “What is Intelligence?: Artificial Intelligence (Part II),” <<http://psychology.about.com/library/weekly/aa071001a.htm>> (accessed 27 January 2004). Sternberg is Professor of Psychology and Education at Yale University.

⁹ Maja J Mataric, “What is Intelligence?: Artificial Intelligence (Part II),” <<http://psychology.about.com/library/weekly/aa071001a.htm>> (accessed 27 January 2004). Mataric is the Director of Robotics Research Labs at the University of Southern California.

It is interesting that science understands that intelligence is more than raw computing ability. Words such as “behavior,” “shape the environment,” and “imagine” describe more than the ability to manipulate data; they presuppose the concept that intelligence involves the ability to deal with those life issues which impact the ability to function in a particular setting and community and to consider future implications of current decisions. Can you imagine a machine that can imagine what life would be like without humanity’s weaknesses? Or imagine a machine that can imagine what life would be like with an unlimited energy source that then decides to make it so and shapes the environment by designing this source and appropriating the energy for its own use.

Artificial Intelligence

It is obvious from the previous discussion that if the precise definition of intelligence cannot be established, then neither can the concept of artificial intelligence. However, the term does seem to acknowledge a distinction between artificial intelligence applied to non-human computers and machines and non-artificial intelligence. This is a very important distinction for believers as non-artificial intelligence can be described as arising from natural growth or characterized by vital processes begun by God in distinction from those forms of intelligence which are artificial, not coming from the same source but are being created as a result of man’s intelligence. It is important, however, to see where different forms of artificial intelligence are already occurring within the world around us to gain a better understanding of what has been happening and the possibilities of what can happen in the future.

Artificial intelligence is simply the application of artificial or non-naturally occurring systems that use the knowledge-level to achieve goals. A more practical definition that has been used for AI is attempting to build artificial systems that will perform better on tasks that humans currently do better.¹⁰

Artificial intelligence includes

- “games playing”: programming computers to play games such as chess and checkers

¹⁰ “Definition of Artificial Intelligence,” <http://ai.eecs.umich.edu/cogarch4/toc_defs/defs_theory/defs_ai.html> (accessed 27 January 2004).

- “expert systems”: programming computers to make decisions in real-life situations (for example, some expert systems help doctors diagnose diseases based on symptoms)
- “natural language”¹¹: programming¹² computers to understand natural human languages, commonly called Natural Language Processing (NLP)¹³
- “neural networks”¹⁴: systems that simulate intelligence by attempting to reproduce the types of physical connections that occur in animal brains

¹¹ A human language. For example, English, French, and Chinese are natural languages. Webopedia, “Natural Language,” <http://www.webopedia.com/TERM/N/natural_language.html> (accessed 27 January 2004).

¹² There are five generations of computer languages: **first generation**: machine language; **second generation**: assembly language; **third generation**: high-level programming languages, such as C, C++, and Java; **fourth generation**: programming languages closer to human languages than typical high-level programming languages (most 4GLs are used to access databases); **fifth generation**: languages used for artificial intelligence and neural networks. The goal for fifth generation computers is the ability to sense, reason, and interact with people and the physical world. The author suggests that major step forward comes from current parallel-processing techniques which offer significantly increased performance and reduced costs. *IOP Electronic Journals*, “Parallel-processing Computers for the Fifth Generation,” <<http://www.iop.org/EJ/abstract/0305-4624/17/4/101>> (accessed 27 January 2004).

¹³ Microsoft, “Natural Language Processing,” <<http://research.microsoft.com/nlp/>> (accessed 27 January 2004). The goal of the Natural Language Processing (NLP) group is to design and build software that will analyze, understand, and generate languages that humans use naturally, so that eventually you will be able to address your computer as though you were addressing another person. This goal is not easy to reach. “Understanding” language means, among other things, knowing what concepts a word or phrase stands for and knowing how to link those concepts together in a meaningful way. It’s ironic that natural language, the symbol system that is easiest for humans to learn and use, is hardest for a computer to master. Long after machines have proven capable of inverting large matrices with speed and grace, they still fail to master the basics of our spoken and written languages.

¹⁴ A type of artificial intelligence that attempts to imitate the way a human brain works. Rather than using a digital model, in which all compu-

- “robotics”¹⁵: programming computers to *see* and *hear* and react to other sensory stimuli.¹⁶

Artificial Intelligence Agents

The systems, or agents, of artificial intelligence are those individual parts which are combined for the purpose of achieving the goal of “intelligence.” They should be viewed as autonomous hardware and software interrelated in a design whereby each part does a portion of the task, and together they constitute what is accepted as artificial intelligence. In essence, these are the individual parts of the total machine. These agents may be individual computers, each assigned specific tasks in what is called a hive¹⁷ following the pattern of ants and some bees.¹⁸

tations manipulate zeros and ones, a neural network works by creating connections between processing elements, the computer equivalent of neurons. The organization and weights of the connections determine the output. Neural networks are particularly effective for predicting events when the networks have a large database of prior examples on which to draw on. Strictly speaking, a neural network implies a non-digital computer, but neural networks can be simulated on digital computers. (*Webopedia*, “Neural Networks,” <http://www.webopedia.com/TERM/N/neural_network.html> [accessed 27 January 2004]).

¹⁵ Robotics: the study of robots as a reprogrammable, multifunctional manipulator designed to move material, parts, tools, or specialized devices through various programmed motions for the performance of a variety of tasks, or force through intelligence where AI meet the real world; or: an automatic device that performs functions normally ascribed to humans or a machine in the form of a human (<<http://www.eeglossary.com/robotics.htm>> [accessed 13 January 2004]).

¹⁶ *Webopedia*, “Artificial Intelligence,” <http://www.webopedia.com/TERM/a/artificial_intelligence.html> (accessed 27 January 2004).

¹⁷ A decentralized, multicomponent mind, or appearance of mind, such as that displayed by social insects on earth, notably ants, termites, and some species of bees. The hive centers and functions around the queen, who alone produces new individuals each of which is a slave to the needs and demands of the community. Indeed, the individual in such a “superorganism” is akin to a single cell in the body of a conventional animal and quickly dies if it becomes separated. The cohesion and complex cooperative behavior of the hive is made possible by a tight communications, command, and control system which, in the case of social insects, is based upon the

There is no generally accepted definition of artificial intelligence “agents.” In loose terms, agents are programs that sense their environment, make decisions about how to act based on these sensations, and then execute these actions. Autonomous agents do all three of these steps on their own, that is without a human in the loop. Multiagent systems are collections of multiple agents that interact with one another.¹⁹

This has been proposed as a solution to the coming crisis of the significant growth of Internet users. In 1998 there were approximately 160 million Internet users, and in 2002 there were approximately 544.2 million users.²⁰ This number continues to grow, and it has been suggested that it will take some form of artificial intelligence to manage the World Wide Web in the very near future.

rapid transmission of pheromones (*The Encyclopedia of Astrobiology, Astronomy, and Spaceflight*, “Hive Intelligence,” <<http://www.angelfire.com/on2/daviddarling/hiveintel.htm>> [accessed 27 January 2004]).

¹⁸ A pair of U.S. researchers feel that the future of the ‘Net is in “agent” programs that mimic the hiving and nesting behavior of bees and ants. As more and more people get on the ‘Net from more and more devices (computers, phones, Web appliances, etc.), the current centralized and human-directed Internet management systems will not be able to keep up with the demand. Working at the University of California, Michael Wang and Tatsuya Suda want to organize Internet content delivery using small, individual programs called “agents” to do simple tasks and manage themselves. Like hiving insects, each agent is “unintelligent” and has a simple task to do. Each agent is programmed with only a few simple rules, but in big bunches the agents should be able to have big effects. Wang and Suda’s model views user requests as food, and the agents will move content to servers closer to where the requests are coming from. When requests die down, the supply chain of agents retreats. This should help facilitate high-demand webcasts, very popular websites, etc. Another researcher working on the concept wants to use the agents on the ‘Net’s infrastructure instead of on the content (Geek.com, “Hiving the Internet,” <<http://www.geek.com/news/geeknews/q22000/gee2000526001521.htm>> [accessed 27 January 2004]).

¹⁹ “CS378: Autonomous Multiagent Systems—Fall 2002,” <<http://www.cs.utexas.edu/users/pstone/Courses/378fall02/>> (accessed 27 January 2004).

²⁰ Korea Network Information Center, “The Number of Internet Users All Over the World,” <<http://stat.nic.or.kr/english/iuser.html>> (accessed 27 January 2004).

Consciousness/Cognition

A critical element of achieving artificial intelligence is ability of a machine to achieve some form of self-awareness or consciousness of itself. The goal has been to create a model which exhibits self-referential aspects of intelligence. This model would include ways it refers to itself within language through personal pronouns and time references such as “I” and “now” and through personal actions such as “I promise” and “I apologize.” If the quality of “consciousness” is an inherent necessity of intelligence, then it is mandatory that the form of artificial intelligence possess it.

Unfortunately, there is no precise, widely agreed upon definition of the word *consciousness*. However, most of us have an intuitive sense of what is meant by the term. Consciousness, or cognition, is a sort of awareness—of self, of interaction with the world, of thought processes taking place, and of our ability to at least partially control these processes. We also associate consciousness with an inner voice that expresses our high level, deliberate thoughts, as well as intentionality and emotion. It seems doubtful whether true intelligence can ever arise in the absence of consciousness. Perhaps, one might take the view that intelligent behavior is the outward sign of a conscious being. If so, any machine which could display human-like intelligence qualities could be said to be conscious.²¹

The goal of a machine’s sensing its environment appears to be a critical element in the development of true artificial intelligence. This would require the machine’s having the ability to distinguish itself from its environment or to achieve a level of self-realization.

Computer Intelligence

The following is a brief description of two major systems of thought concerning artificial intelligence: strong/weak, further subdivided into classical computationalism and connectionism, and levels of cognition. The essence of the difference concerns the degree to which scientists feel they can truly duplicate the human

²¹ Mind and Machine: Artificial Intelligence, “Introduction to Artificial Intelligence,” <<http://physics.syr.edu/courses/modules/MM/ai/ai.html>> (accessed 27 January 2004).

brain and its activities. The summary is a compilation derived from *The Internet Encyclopedia of Philosophy*.²²

Weak Artificial Intelligence

Suitably programmed machines can simulate human cognition.

A machine which merely simulates human cognition need not have conscious mental states.

Strong Artificial Intelligence

Suitably programmed machines are capable of cognitive mental states.

Cognitive *replication* occurs when the same internal causal relations are involved in a computational device as compared with a human brain.

Strong Artificial Intelligence—Classical Computationalism

Computer intelligence involves central processing units operating on symbolic representations. That is, information in the form of symbols is processed serially (one datum after another) through a central processing unit. Daniel Dennett, a key proponent of classical computationalism, holds to a top-down progressive decomposition of mental activity. That is, more complex systems break down into more simple ones, which end in binary on-off switches. There is no homunculi, or tiny person, inside a cognitive system which does the thinking.

Strong Artificial Intelligence—Connectionism

Connectionism contends that cognition is distributed across a number of neural nets, or interconnective nodes. In this view, there is no central processing unit, symbols are not as important, and information is diverse and redundant. Perhaps most importantly, it is consistent with what we know about neurological arrangement. Unlike computational devices, devices made in the neural net fash-

²² *The Internet Encyclopedia of Philosophy*, "Artificial Intelligence," <<http://www.utm.edu/research/iep/a/airintel.htm>> (accessed 27 January 2004).

ion can execute commonsense tasks, recognize patterns efficiently, and learn.

Levels of Cognition

First, cognitive *simulation* occurs when a device such as a computer simply has the same the same input and output as a human.

Second, cognitive *replication* occurs when the same internal causal relations are involved in a computational device as compared with a human brain.

Third, cognitive *emulation* occurs when a computational device has the same causal relations *and* is made of the same stuff as a human brain. This condition clearly precludes silicon-based computing machines from emulating human cognition.

Proponents of weak AI commit themselves only to the first condition, namely cognitive simulation. Proponents of strong AI, by contrast, commit themselves to the second condition, namely cognitive replication, but not the third condition.

Neural Networks (NNs)

There has been a shift away from the more traditional computer based model of artificial intelligence to a non-conventional computer-based models of artificial intelligence designed to approximate the functioning of an animal brain. These are called neural networks and vary from tiny processors to physical cellular systems. These systems are closer to the functioning of the human brain and have some ability to “learn.”

A neural network consists of many very simple processors (“units” or “neurons”), each possibly having a (small amount of) local memory. The units are connected by unidirectional communication channels (“connections”), which carry numeric (as opposed to symbolic) data. The units operate only on their local data and on the inputs they receive via the connections.

A neural network (NN) is a processing device, either an algorithm,²³ or actual hardware, whose design was inspired by the design and functioning of animal brains and components thereof.

²³ A computable set of steps or detailed sequence of actions to perform to accomplish some task. Technically, an algorithm must reach a result after a finite number of steps, thus ruling out brute force search methods for

Most neural networks have some sort of “training” rule whereby the weights of connections are adjusted on the basis of presented patterns. In other words, neural networks “learn” from examples, just like children learn to recognize dogs from examples of dogs and exhibit some structural capability for generalization.

Neurons are often elementary nonlinear signal processors (in the limit they are simple threshold discriminators). Another feature of NNs which distinguishes them from other computing devices is a high degree of interconnection which allows a high degree of parallelism. Further, there is no idle memory containing data and programs, but rather each neuron is pre-programmed and continuously active.²⁴

Artificial neural systems, or neural networks, are physical cellular systems which can acquire, store, and utilize experiential knowledge. The knowledge is in the form of stable states or mappings embedded in networks that can be recalled in response to the presentation of cues.

Artificial neural systems can be considered as simplified mathematical models of brain-like systems, and they function as parallel distributed computing networks. However, in contrast to conventional computers, which are programmed to perform specific tasks, most neural networks must be taught, or trained. They can learn new associations, new functional dependencies, and new patterns. Although computers outperform both biological and artificial neural systems for tasks based on precise and fast arithmetic operations, artificial neural systems represent the promising new generation of information processing networks.²⁵

certain problems, though some might claim that brute force search was also a valid (generic) algorithm. The term is also used loosely for any sequence of actions (which may or may not terminate) (*Hyper Dictionary*, “Algorithm,” <<http://www.hyperdictionary.com/dictionary/algorithm>> [accessed 27 January 2004]).

²⁴ *FOLDDOC*, “Artificial Neural Network,” <<http://wombat.doc.ic.ac.uk/foldoc/foldoc.cgi?query=neural+network>> (accessed 27 January 2004).

²⁵ “NN I: The Perceptron Learning Rule,” <<http://www.abo.fi/~rfuller/nfs8.pdf>> (accessed 27 January 2004).

HISTORY OF ARTIFICIAL INTELLIGENCE

A brief historical overview of artificial intelligence allows the reader to see the exponential growth of the industry during the past decade. As computers become more powerful²⁶ and as parallel processing²⁷ is developed, the ability of computers to design computers is being utilized. There are a number of footnotes within the history to allow the reader to have access to more detailed information concerning specific events and programs which were significant in the development of artificial intelligence.

1950: Alan Turing²⁸ publishes “Computing Machinery and Intelligence.”

²⁶ Intel Corporation claims that the power of their microprocessor is doubling every eighteen months. Other components appear to be increasing in capacity by 20 to 30 percent per year. Conservative projections indicate that the PC of 2005 will have a 128-bit data path, run at 2 billion cycles per second, have 6.6 million transistors on its processor chip, perform 6.8 billion instructions per second, and cost less than \$14. Perhaps all the components of that PC will fit on a single chip; that computer might be the size of a wristwatch, use voice input and output, and hold libraries of information (National Center for State Courts: Briefing Papers, “Personal Computers,” <http://www.ncsconline.org/D_Tech/Briefings/pc.htm> [accessed 27 January 2004]).

²⁷ The simultaneous use of more than one computer to solve a problem. There are many different kinds of parallel computers (or “parallel processors”). They are distinguished by the kind of interconnection between processors (known as “processing elements” or PEs) and between processors and memory. Flynn’s taxonomy also classifies parallel (and serial) computers according to whether all processors execute the same instructions at the same time (“single instruction/multiple data”—SIMD) or each processor executes different instructions (“multiple instruction/multiple data”—MIMD). The processors may either communicate in order to be able to cooperate in solving a problem, or they may run completely independently, possibly under the control of another processor which distributes work to the others and collects results from them (a “processor farm”). The difficulty of cooperative problem solving is aptly demonstrated by the following dubious reasoning: if it takes one man one minute to dig a posthole, then sixty men can dig it in one second (*Hyper Dictionary*, “Parallel Processing,” <<http://www.hyperdictionary.com/dictionary/parallel+processing>> [accessed 27 January 2004]).

²⁸ Alan Turing’s 1950 article “Computing Machinery and Intelligence” discussed conditions for considering a machine to be intelligent. He argued

1956: John McCarthy²⁹ coins the term, “Artificial Intelligence” at a Dartmouth computer conference.

1956: Demonstration of the first running AI program at Carnegie Mellon University.

1958: John McCarthy invents the Lisp language,³⁰ an AI programming language, at Massachusetts Institute of Technology (MIT).

1964: Danny Bobrow shows that computers can understand natural language enough to solve algebra word programs (MIT).

1965: Joseph Weizenbaum builds ELIZA,³¹ an interactive program that carries on a dialogue in English on any topic (MIT).

that if the machine could successfully pretend to be human to a knowledgeable observer, then one certainly should consider it intelligent. This test would satisfy most people but not all philosophers. The observer could interact with the machine and a human by teletype (to avoid requiring that the machine imitate the appearance or voice of the person), and the human would try to persuade the observer that it was human and the machine would try to fool the observer. The Turing test is a one-sided test. A machine that passes the test should certainly be considered intelligent, but a machine could still be considered intelligent without knowing enough about humans to imitate a human (“Basic Questions,” <<http://www-formal.stanford.edu/jmc/whatisai/node1.html#SECTION00010000000000000000>> [accessed 27 January 2004]).

²⁹ J. McCarthy, M. L. Minsky, N. Rochester, and C.E. Shannon, “A Proposal for the Dartmouth Summer Research Project on Artificial Intelligence,” 31 August 1955: “We propose that a 2 month, 10 man study of artificial intelligence be carried out during the summer of 1956 at Dartmouth College in Hanover, New Hampshire. The study is to proceed on the basis of the conjecture that every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it.” And so it was that John McCarthy introduced the term “artificial intelligence” (American Association of Artificial Intelligence and Massachusetts of Technology Artificial Intelligence Lab, <<http://www.usatoday.com/tech/news/2001-06-20-ai-history.htm>> [accessed 27 January 2004]).

³⁰ Early key ideas in Lisp were developed by John McCarthy during the 1956 Dartmouth Summer Research Project on Artificial Intelligence. McCarthy’s motivation was to develop an algebraic list processing language for artificial intelligence work (“Brief History of the Lisp Language,” <<http://www.lisp.org/table/Lisp-History.html>> [accessed 13 January 2004]).

1969: Shakey,³² a robot, combines locomotion, perception, and problem solving (Stanford Research Institute).

1979: The first computer-controlled autonomous vehicle, the Stanford Cart, is built.

1983: Danny Hillis co-founds Thinking Machines, the first company to produce massively parallel computers.

1985: The drawing program, AARON,³³ created by Harold Cohen, is demonstrated at AI conference.

1990s: Major advances in all areas of AI. Significant demonstrations in machine learning, intelligent tutoring, case-based reasoning, multi-agent planning, scheduling, uncertain reasoning, data

³¹ Joseph Weizenbaum (MIT) built ELIZA, an interactive program that carries on a dialogue in English on any topic. It was a popular toy at AI centers on the ARPA-net when a version that “simulated” the dialogue of a psychotherapist was programmed (“A Brief History of Artificial Intelligence,” <<http://www.aai.org/AITopics/bbhist.html>> [accessed 27 January 2004]). An online example of ELIZA can be found at <http://www-ai.ijs.si/cgi-bin/eliza/eliza_script> (accessed 27 January 2004).

³² Stanford’s Cart and SRI’s Shakey: The “Stanford Cart” (a) and SRI’s “Shakey” (b) were the first mobile robots to be controlled by computers (large mainframes doing about a quarter million calculations per second, linked to the robots by radio). Both used television cameras to see. The Cart could follow white lines quite reliably; Shakey could find large prismatic objects somewhat less reliably (<<http://www.frc.ri.cmu.edu/~hpm/project.archive/robot.papers/2000/revo.slides/1970.html>> [accessed 27 January 2004]).

³³ AARON exists; it generates objects that hold their own more than adequately, in human terms, in any gathering of similar, but human-produced, objects, and it does so with a stylistic consistency that reveals an identity as clearly as any human artist’s does. It does these things, moreover, without my own intervention. I do not believe that AARON constitutes an existence proof of the power of machines to think, or to be creative, or to be self-aware, to display any of those attributes coined specifically to explain something about humans. It constitutes an existence proof of the power of machines to do some of the things we had assumed required thought and which we still suppose would require thought and creativity and self-awareness of a human being. If what AARON is making is not art, what is it exactly, and in what ways, other than its origin, does it differ from the “real thing”? If it is not thinking, what exactly is it doing? (“Art,” <<http://www.aai.org/AITopics/html/art.html>> [accessed 27 January 2004]).

mining, natural landscape understanding and translation, vision, virtual reality, and games.

1997: IBM computer Deep Blue³⁴ beats world champion Garry Kasparov in chess match.

Late 1990s: Web crawlers³⁵ and other AI-based information-extraction programs become Web essentials.

³⁴ Deep Blue is the **supercomputer** that defeated the world chess champion Kasparov in a six-game series. There has been much debate dealing with if the IBM supercomputer Deep Blue actually uses artificial intelligence. The supercomputer basically uses very quick parallel processing. It has an enormous database with most of the grandmaster games played over the past century. The computer compares whatever position it is in, in the current game, to the database and picks the move that has resulted in victory in the previous grandmaster games. Some experts feel that Deep Blue is just a supercomputer that has absolutely no thought process and just reacts to situations. Other experts feel that Deep Blue does use AI through the use of high-power parallel processing (which happens to be a pertinent field in the development of AI). So the question remains, does Deep Blue use artificial intelligence at all? I feel that the answer lies in what definition a person perceives as being “correct” for artificial intelligence. If a person looks at the more personal definition of AI from a psychological and physiological approach, Deep Blue does not use artificial intelligence at all. It is a machine that shows no emotion and no regard for winning or losing. Many scientists feel that this is a very important aspect of artificial intelligence. On the other hand, if a person looks at the more technical definition of artificial intelligence, Deep Blue definitely incorporates artificial intelligence into its game-play. Through the use of parallel processing Deep Blue has “learned” how to play the game of chess possibly better than any human will ever be able to. Artificial Intelligence is still a very sticky issue and probably will be for many years until someone figures out a way to “personalize” these computer systems. I feel that Deep Blue does use artificial intelligence, but it all depends on what one thinks is the correct definition of AI ([I200] “AI in Deep Blue,” <<http://www.burningchrome.com/archives/i200/msg00372.html>> [accessed 27 January 2004]).

³⁵ A crawler is a program that visits websites and reads their pages and other information in order to create entries for a search engine index. The major search engines on the Web all have such a program, which is also known as a “spider” or a “bot.” Crawlers are typically programmed to visit sites that have been submitted by their owners as new or updated. Entire sites or specific pages can be selectively visited and indexed. Crawlers apparently gained the name because they crawl through a site a page at a time, following the links to other pages on the site until all pages have been read (SearchWebServices.com, “Crawler,” <<http://searchwebservices.com>>).

2000: Interactive robot pets³⁶ (a.k.a. “smart toys”) become commercially available. MIT displays Kismet,³⁷ a robot with a face that expresses emotions. Carnegie Mellon robot Nomad³⁸ explores remote regions of Antarctica and locates meteorites.³⁹

techtarget.com/sDefinition/0,,sid26_gci211854,00.html> [accessed 27 January 2004]).

³⁶ They fight. They flock. They have free will. Get ready for game bots with a mind of their own. By Steven Johnson. *Wired* (March 2002/10.03). “It is the year 2002. After an explosion of R&D funded by software giants and startups, more than a third of US households are populated by sophisticated artificial intelligence bots—their decisionmaking guided by complex neural nets and simulated emotions, their perceptual systems honed to detect subtle changes in their environment. Every day millions of Americans interact with these creatures, encountering advanced technology from nuanced natural language routines to gesture recognition to machine learning. Perhaps most impressive: As the AIs have grown smarter, they have begun to communicate among themselves, sharing new ideas and collaborating on group tasks. This is not some hopelessly optimistic sci-fi scenario from 20 years ago. It is reality. Consumer-grade artificial intelligence is alive and well in the world of games. ... What’s more striking about the latest generation is the appearance of unscripted, emergent behavior—the AI stumbling on new ways of responding to the world, strategies and behaviors that weren’t deliberately planned by the designers” (“Video Games, Toys, Robotic Pets & Entertainment,” <<http://www.aaai.org/AITopics/html/video.html>> [accessed 27 January 2004]).

³⁷ Kismet is an expressive robotic creature with perceptual and motor modalities tailored to natural human communication channels. To facilitate a natural infant-caretaker interaction, the robot is equipped with visual, auditory, and proprioceptive sensory inputs. The motor outputs include vocalizations, facial expressions, and motor capabilities to adjust the gaze direction of the eyes and the orientation of the head. Note that these motor systems serve to steer the visual and auditory sensors to the source of the stimulus and can also be used to display communicative cues (Recent videos from MIT Video Productions, “Kismet, the Robot,” <<http://www.ai.mit.edu/projects/sociable/videos.html>> [accessed 27 January 2004]).

³⁸ Nomad is a four-wheeled robot designed to traverse planetary analogous terrain. Fully deployed, it is 2.4 x 2.4 x 2.4 meters, and it weighs 725 kg. It can travel up to 50 centimeters per second and has the capability to traverse over large obstacles. On this expedition, the robot will be powered by a gasoline generator, will use studded tires for friction on Antarctic ice, and determine its location using GPS (Global Positioning System).

MECHANISTIC VIEW OF MANKIND

One of the most basic philosophical presuppositions of the designers of artificial intelligence is the concept that man, or humanity, is a sum of his parts. This mechanistic view of man is not new, but the significance of the view is becoming more significant as the debate is moving from the realm of philosophy to the field of technology and artificial intelligence in particular. Scientists have traditionally looked at the body from a more mechanical perspective.

Throughout the history of Western science, the development of biology has gone hand in hand with that of medicine. The mechanistic view of life firmly established in biology since the first scientific revolution of the seventeenth century has dominated the attitude of the physicians towards health and illness. The human body is regarded as a machine that can be analyzed in terms of its parts. The diseases are seen as malfunctioning of biological mechanisms and studied from the point of view of cellular and molecular biology. Three centuries after Descartes, the science of medicine is still based on the notion of the body as a machine, of disease as a consequence of breakdown of the machine, and of the doctor's task as the repairer of the machine.⁴⁰

But scientists are now being forced to ask questions concerning the most fundamental relationship between the human body and consciousness. This presupposition has allowed the developers of artificial intelligence to believe they not only have the ability to create the functionality of a human brain, but also the possibility to create consciousness, or a form of life itself.

Do brains account for mind? In an essay entitled "The Materialist Superstition," the Discovery Institute's George Gilder writes,

Finally, Nomad serves as a sensing and computing platform that allows effective remote science to be performed (Robotic Antarctic Meteorite Research, "The Nomad Robot," <<http://www.frc.ri.cmu.edu/projects/meteorobot/Nomad/Nomad.html>> [accessed 27 January 2004]).

³⁹ American Association of Artificial Intelligence and Massachusetts of Technology Artificial Intelligence Lab, *USA Today Online*, <<http://www.usatoday.com/tech/news/2001-06-20-ai-history.htm>> (accessed 27 January 2004).

⁴⁰ BIOMEDICAL MODEL, <<http://www.healthlibrary.com/reading/primer/biomedic.htm>> (accessed 13 January 2004).

“the usual materialist assumption is that the brain, the hardware, comes first and mind somehow emerges from it.”⁴¹

The very definition of life has been brought to the fore as scientists attempt to wrestle with the issue of “intelligence” and how to create an “intelligent being.” But, they are faced with the most fundamental questions of the definition of life and the source of life. The following quotation gives a rather detailed description of the theory of the development of an artificial intelligence with consciousness and self-awareness.

There has been much debate centered around the question of whether out of such learning would truly emerge an intelligent, much less conscious, network. Many argue that consciousness does not simply arise out of intelligent behavior (Gackenbach et al. 1998). Instead, resting on dualistic principles, self-awareness cannot be duplicated just by arranging the appropriate pieces of a network together and letting them function; there is property which is intangible and thus unable to be “built in.”

The answer offered by the strong AI position holds that consciousness is an “emergent [property] of any computational system with sufficient levels of self-modification” (Hunt 1995, 59). That is, consciousness and self-awareness are able to be (or will be in the future) duplicated in any system which demonstrates enough capacity to learn or self-program. This idea that consciousness as we view it, as an awareness of ourselves, as sentience, emotion, and introspection, can be simulated by assembling the appropriate bases is also examined by Penrose (1989). “[All] mental qualities—thinking, feeling, intelligence, understanding, consciousness—are to be regarded, according to this view, merely as aspects of this complicated functioning” of the physical brain. If this be true, that the qualities of thought which set us apart distinctly from machines are simply byproducts of the physiological processes of the brain, then in theory this can be replicated in any system which accurately imitates this biological network.

But how would such complex development come about? Marvin Minsky (1982) offers insight into how to theoretically equip a machine with the resources necessary to become self aware. The critical component in creating an intelligent system, Minsky says, is to give it the capacity to reflect. If given a problem

⁴¹ “Kiss Me, You Human,” <<http://search.csmonitor.com/durable/2001/06/28/p14s1.htm>> (accessed 27 January 2004).

to solve, and if the first attempt fails, a truly intelligent system will not simply try other solutions until the appropriate one is reached. Although this is inherently a process of learning and if the system has the ability to retain the “memory,” all it has really done is reprogram itself. Instead, a reflective machine will attempt to analyze the problem: instead of mindlessly searching for a workable solution, it will make an effort to understand what the problem really is and why the first solution failed, much in the way that humans will try to reason their way through complex questions.

Admittedly, such machines are a long way off, for the technology required to allow a machine to perform meaningful self-analyses simply has not yet been developed. Presently, we do not have the means to mimic that most complex of intelligent systems, the human brain. It is our unique ability to build and constantly rewire the synaptic connections of our brain which give us our unique ability to learn and understand (Gackenback et al. 1998). In other words, until we are able to develop a system which can mimic the plasticity of the human body, it is doubtful that machines will become “conscious,” in the way we apply the word to ourselves.⁴²

This entire debate obviously raises the question concerning man’s desire to be like God and in this arena to be able to create another race of peoples but without the limitations humans experience.

But these days, as neurologists and psychologists develop maps of the brain, many people consider themselves machines. This has profoundly influenced how we understand such concepts as love, free will, and the soul. The flip side of this mechanistic view of human nature has become popular in science fiction (the genre in which the implications of our scientific theories get fleshed out): treating artificially intelligent machines as persons with the same rights as people.⁴³

And so, is it possible that some day there will be an android with a “positronic neural network” that acts as a brain and operat-

⁴² “Strong Artificial Intelligence and Consciousness,” <<http://www.units.muohio.edu/psybersite/cyberspace/ai/strong.shtml>> (accessed 27 January 2004).

⁴³ Peter T. Chattaway, review of *I, Robot*, by Isaac Asimov, *Christianity Today*, 6 August 2001, <<http://www.christianitytoday.com/ct/2001/010/28.67.html>> (accessed 27 January 2004).

ing system? Will it be possible for science to create another “life” form made in the image of man? And, what do these possibilities mean to believers? Should we be fighting the development of artificial intelligence or is this simply another development within the scientific community that demonstrates the creativity of mankind and ultimately the God-given abilities which result from being made in the image of God?

THEOLOGICAL PERSPECTIVE

There have been significant advances in the development of forms of artificial intelligence that have the ability to function in a way that appears to approximate some forms of human thinking. Scientists have begun to think about the possibility of actually creating another race of “persons.” Latanya Sweeney has described the goal of some scientists as far back as 1992 as having a desire to duplicate in some fashion God’s initial creation of man. This goal has probably strengthened over the years as new possibilities have come to light in the realm of computer technology.

Artificial intelligence concerns itself with intelligent behavior—the things that make humans seem intelligent. In an ultimate view, we are re-creating a perception of man and building a machine in our own image. This is a strong statement, but it describes the underlying current of our work.⁴⁴

So, what position should we as believers take in relationship to these developments? Is this a threat to our faith? The main thesis to be advanced in this section of the paper is that the development of highly evolved forms of artificial intelligence does not threaten our Christian theological position. Rather, we should applaud the developments demonstrated today and attempt to be a positive force in not only the continued development of artificial intelligence but perhaps more importantly have a major role to play in the development of ethical standards to guide in this field. We as believers have a responsibility to the world around us to bring the word of God to bear on every aspect of life and to be engaged in development of new fields of learning.

⁴⁴ Latanya Sweeney, “What Is Artificial Intelligence?” March 1992, <<http://privacy.cs.cmu.edu/people/sweeney/aidef.html>> (accessed 27 January 2004).

The Image of God

The central issue which must be discussed concerning artificial intelligence and the development of human-like capabilities is the image of God. The development of artificial intelligence which appears to have the ability to duplicate human learning, human reasoning, or even some form of consciousness which appears to mimic humanity is not a step in man's becoming like God. Regardless of the level of the development of artificial intelligence, man can never make a new life-form in the image of God. It is God alone who has that prerogative. It was God who created man in his image from the beginning by a direct creative act.

As Genesis 1:26-27 states, "Then God said, 'Let Us make man in Our image, according to Our likeness; let them have dominion over the fish of the sea, over the birds of the air, and over the cattle, over all the earth and over every creeping thing that creeps on the earth.' So God created man in His *own* image; in the image of God He created him; male and female He created them."⁴⁵

It is this biblical concept of the image of God that has been foundational for understanding the nature of personhood. The problem is that there has not been consensus within the Christian community concerning a detailed definition of the term. This has not been a critical issue over the centuries as there was not the great debate over man's ability to create some form of artificial intelligence which could be considered conscious. But, in recent history theologians have been faced with this question, and it will continue to grow in importance as technology drives us towards an uncertain future. The following is a brief summary of four concepts which have been proposed as a definition of what it means for man to be made in the image of God.

(1) Thomas Aquinas located the image in the human ability to think and reason, to use language and art, far surpassing the abilities of any animals.

(2) Leonard Verduin says that the image consists in our dominion over animals and plants, which continues despite our sinfulness.

⁴⁵ Unless otherwise noted, all scripture in this article is taken from *The New King James Version*, Electronic ed. Nashville: Nelson, 1996, c. 1982.

(3) A “widely accepted interpretation” is that the “image” is our ability to make moral decisions, which involve self-awareness and social awareness.

(4) Emil Brunner says that it is our ability to have a relationship with God, reflected in the tendency of all societies to have forms of worship.⁴⁶

Each of the positions has strengths and weaknesses, and if they are viewed separately each probably gives a limited perspective of the entire range of the biblical view. One other interesting aspect of these particular definitions is that each of these men was attempting to distinguish man from the animal kingdom. None of these men saw the need of attempting to distinguish between mankind and some form of artificial intelligence. This is particularly important as one examines the position of Thomas Aquinas, a substantive position.⁴⁷

Scientists have already created forms of artificial intelligence which appear to have the ability to think, reason, use language and art. While the definition of science concerning thinking and reasoning and even what it means to use language and be artistic may vary from one to another, theologians have not been any better at being able to define these terms. Verduin’s functional view⁴⁸ deals

⁴⁶ “Humans in the Image of God,” <<http://www.wcg.org/lit/gospel/imagegod.htm>> (accessed 27 January 2004).

⁴⁷ The substantive view is that which understands the *imago Dei* to refer to certain qualities or attributes in humans that mirror those of God himself. Such faculties may include rationality, volition, affections, morality, and so on. The substantive view has been the majority report among theologians throughout the history of the church, concentrating typically upon various psychological or spiritual similarities between God and humans (only very radical, indeed heretical, fringe groups have held to any kind of literal physical similitude) (S. Gannon Murphy, “On the Doctrine of the *Imago Dei*,” Minnesota Apologetics Project, <<http://www.geocities.com/mnapologetics/ImagoDei.htm>> [accessed 27 January 2004]).

⁴⁸ The final view for consideration is what is often called of the *imago Dei*. Essentially, the functional view holds the image of God to be contained primarily and manifested directly in that which a person does. Scriptural support for this view is sought by implication of the command given to man by God immediately following the *imago Dei* narrative of Genesis 1. Verse 28 records God’s command that humans, “Be fruitful and multiply, and fill the earth, and subdue it; and rule over the fish of the sea and over the birds of the sky and over every living thing that moves on the earth.”

with the results of man's capabilities to have dominion over creation. It would be interesting to further examine this position as it relates to man's ability to have dominion over the possible developments of fifth generation computers and beyond. The third view brings up a critical subject in the current debate within the scientific community concerning a definition of what it means to be self-aware. It has been widely held that only humans have this ability even within the scientific community, although for reasons other than the image-of-God debate. But within the past few years there has been speculation that it will be possible to create a form of artificial intelligence which will have some form of an awareness of cause-effect phenomenon.

It is the thesis of this paper that the fourth view, the relational view, is the primary aspect of what it means for mankind to be made in the image of God. The other aspects represented by the first three views are those elements which are needed by man to have a personal relationship with God, a personal relationship with other humans, or are those things which God has commanded man to do as his task in God's creation.

Relational View

It appears from the creation account that God had a personal relationship with Adam and Eve, and this relationship between God and his children was damaged by sin entering the world through the disobedience of Adam. Man died to this relationship and became an enemy of God and was cast out of the garden. While this did not mean that man lost his ability to think or reason or be creative, all of these abilities were certainly impacted by the sin which dwells in our members as a result of the fall:

"And they heard the sound of the Lord God walking in the garden in the cool of the day, and Adam and his wife hid themselves from the presence of the Lord God among the trees of the garden" (Gen 3:8).

"And by Him to reconcile all things to Himself, by Him, whether things on earth or things in heaven, having made peace through the blood of His cross. And you, who once were alienated and enemies in your mind by wicked works, yet now He has recon-

According to the functional view, the *imago Dei* is present in humans to the extent that they submit themselves to this fundamental mandate (Ibid.).

ciled in the body of His flesh through death, to present you holy, and blameless, and above reproach in His sight” (Col 1:20-22).

The most wonderful news is that God made provision even in the garden for a way for man to be reconciled to himself:

“And I will put enmity between you and the woman, And between your seed and her Seed; He shall bruise your head, And you shall bruise His heel” (Gen 3:15).

God describes this act of mercy and grace in the NT by one of the most amazing statements in the Bible through Paul’s description of mankind in relation to God and at the beginning of God’s manifestation of His mercy and grace:

But God, who is rich in mercy, because of His great love with which He loved us, even when we were dead in trespasses, made us alive together with Christ (by grace you have been saved), and raised *us* up together, and made *us* sit together in the heavenly *places* in Christ Jesus, that in the ages to come He might show the exceeding riches of His grace in *His* kindness toward us in Christ Jesus. For by grace you have been saved through faith, and that not of yourselves; *it is* the gift of God, not of works, lest anyone should boast (Eph 2:4-8; emphasis added).

God in his mercy and grace established a way for mankind to be reconciled to himself through the sacrifice of his own Son. God manifested his love towards man, even when man was lost in sin and rebellion. And through this act God made it possible for man to once again have a personal intimate relationship with his creator God. And while this does not automatically give a believer the ability to think, to reason, or to be creative as he had before the fall, it does allow a child of God to begin to know God’s love and to develop a personal relationship with Him.

And this personal intimate love relationship we have with our God and Father is the message we have to share with the world around us, the people who are still searching for a fulfillment of the one true relationship which they desire deep within themselves.

Being Conformed to His Image

God made man in his image in the garden and man sinned and marred that image. But, through the acceptance of the gift of God’s Son, believers today are in the process of being conformed to that image again. This truth is presented to use through the following statements and related passages.

Christ is the image of the invisible God: “He is the image of the invisible God, the firstborn over all creation” (Col 1:15).

Believers are in the process of being conformed to the image of Christ: “For whom He foreknew, He also predestined *to be* conformed to the image of His Son, that He might be the firstborn among many brethren” (Rom 8:29). “And have put on the new *man* who is renewed in knowledge according to the image of Him who created him” (Col 3:10).

We will not experience total true conformity during this life, but it is a part of our hope that one day we will be free from the sin which dwells in our members and once again know what it is to be made in the image of our creator God.

Behold what manner of love the Father has bestowed on us, that we should be called children of God! Therefore the world does not know us, because it did not know Him. Beloved, now we are children of God; and it has not yet been revealed what we shall be, but we know that when He is revealed, we shall be like Him, for we shall see Him as He is. And everyone who has this hope in Him purifies himself, just as He is pure (1 John 3:1-3).

Familial Relationship

One of the greatest tragedies of true Christendom is the fact that many believers do not understand the familial relationship which exists between God and his children. It seems that the reformers, in a desire to move away from the Roman Catholic church and their belief system, placed an emphasis on the individuality of salvation almost to the exclusion to the body relationship God has established. The epistles are full of references to this familial relationship we enjoy as believers, and it is only as we come to appreciate what it means to know God in this way that we can look at the developers of artificial intelligence and know they will never achieve the goal of creating an artificial man in their own image. The following are a few of the ways God has demonstrated this great truth to us in His Word:

Believers have the privilege to call God “Abba Father” (Rom 8:15).

Believers are called the “children of God” (1 John 3:2).

The term “brother” is used over 180 times in the epistles to describe the relationship which exists between believers (Jas 2:14-16).

There are over 35 instances of references to responsibilities believers have to “one another” (John 13:34-35).

Believers share a commonality as all being baptized into the body of Christ and sharing in that “body relationship” (1 Cor 12:13).

FINAL STATEMENT

Today’s Christians may find refuge and great comfort in this doctrine. For to be created in the image of God means that we have not only the ability, but indeed privilege, of relating to, serving, and loving our heavenly Father. Science may be able to create a form of artificial intelligence which is able to do absolutely astounding things not yet even considered, but they can never duplicate what it means to be a child of God. They can only manifest a form of thinking and reasoning that has attempted to box God out of the equation and establish man on the throne. We, as believers, can use the incredible complexity of the human brain as a beginning for a discussion concerning the true creator. As we talk of this creator God and present the word of God to those outside the faith, God can use our words as an instrument to touch their hearts and minds and draw them to himself.

It is because of the veracity of the *imago Dei* doctrine that humans possess Pascal’s proverbial “God-shaped vacuum” deep inside them which God may often use to draw us nearer. Or, as Augustine put it, “You have made us for yourself, O God, and our hearts are restless until they find their rest in you.”⁴⁹

Further, our inherent value is firmly established in direct relation to our being created in the image of an absolutely perfect and loving God. Human life is wholly precious to God (Ps 72:14). Biblically, we should strive to treat all peoples with the divine view of life’s sanctity in mind. Christians, being commanded to “give an answer to everyone who asks you to give the reason for the hope that you have” must show the world that the true basis for bewailing the suffering we see around us is in the inherent dignity of humans as being created by God in his image. This is the inestimable value that only the biblical worldview places on human life as sacred in the eyes of God.

⁴⁹ S. Gannon Murphy, “On the Doctrine.”

Research on artificial intelligence could strengthen the case for Christianity. It is currently looking into the brain and using the information gained to try to recreate the intelligence of unique and special beings (humans). Preliminary findings indicate that the brain is much more complex than first thought. Many people believe the brain to be like a computer: information input, conclusions output. In fact, the research in the arena of artificial intelligence is showing that the brain is not like a computer; rather computers are a poor, limited simulation of the vast intricacies and capacities of the brain. The probability of such a brain “evolving” over time is astronomical (as most any specialized computer system would recognize).

As with all new technologies, Christians should approach the strides being made in the field of artificial intelligence with thoughtful caution. It is cowardice to reject the idea immediately based on its novelty or change; however, it is folly to embrace it fully without investigating the dangers it may pose to the Christian faith. At this time it is not evident whether the advantages will outweigh the disadvantages, or vice versa.⁵⁰

⁵⁰ “AI and the Christian Faith: Advantages and Disadvantages to Further Research,” <<http://t3.preservice.org/T0300851/AIChristianity.htm>> (accessed 27 January 2004).