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Steven M. Gollmer
Cedarville University

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MAN, MACHINE, SCIENTIFIC MODELS AND CREATION SCIENCE

Steven M. Gollmer, Cedarville University, 251 N. Main St., Cedarville, OH 45314, gollmers@cedarville.edu

ABSTRACT

Historically, physics was the most quantitative of the sciences. Geologists and biologists built their models based on observation, categorization and generalization. This distinction between qualitative and quantitative sciences prompted the quote attributed to Ernest Rutherford that “All science is either physics or stamp collecting.” In the intervening 80 years all sciences have exploded in the use of quantitative measures to find patterns and trends in data. A review of a half-century of creationist literature shows that this transition has not been lost to the creationist community.

As this trend continues to accelerate, two areas of caution need to be taken seriously: 1) the use of properly validated techniques and 2) evaluating the role of assumptions in the development of models. In addition, advancements in machine learning tend to blur the lines between human insight and computational power. With a proper understanding of the nature of man, creation scientists are well suited to evaluate the unique role human investigators play in the choice, guidance and interpretation of that which is processed by the machine.

KEY WORDS

Machine learning, Data Science, Computational Methods, Model building, Creation Science, Presuppositions

INTRODUCTION

Creation science exists because the Creator revealed Himself through His creative works, supernatural acts and His spoken word. The spoken word provides the least ambiguous knowledge of who God is and what He has done. The veracity of the word rests in the very nature of God, but was confirmed to man through many signs and wonders (Romans 15:19). Signs apart from revelation leave room for misunderstanding, like a horn making an uncertain sound (1 Corinthians 14:6-8). Prophets used signs and wonders to validate their message from God, but signs with messages inconsistent with God’s revelation were to be rejected as from a false prophet (Deuteronomy 13:1-3). Although less certain than the revealed Word and less spectacular than supernatural acts of God, the creation is no less valuable. Genesis 1:1 states that God created the entirety of heaven and earth. Continuing from vs. 2-31 a description is given how the spaces were brought into existence and then filled over the course of six normal days. Throughout the creation account, the evaluation that it was good is repeated and upon conclusion of the sixth day a summative evaluation is given that it was very good. With the creation of man and woman two commands were given that are still in effect today: 1) be fruitful and multiply and 2) have dominion over the face of the earth (Genesis 1:28).

In the process of fulfilling the second command mankind must understand those things over which he is to have dominion. This dominion is not an exploitation to fulfill the selfish desires of the human population, but the responsible management of resources entrusted to a steward by the sovereign owner (Matthew 25:14-30). This is best illustrated before the Fall when man was instructed to tend and keep the Garden. What that looked like without sin is hard to imagine, but it involved work and it brought glory to God. One example of man’s responsibility was the naming of animals. Although this responsibility helped Adam recognize that he was alone and demonstrated his authority over the animals, it also hints

at the role of science to appropriately classify and identify parts of the created order.

The goal of science is much broader than classification. Once differences are identified, questions arise as to the nature of the differences and why differences exist. This process of observation and questioning helps mankind better understand the creation and in turn see the wisdom, power and glory of God (Psalm 19; Proverbs 3:19; Romans 1:20). As previously mentioned, the physical universe has value. However, this extends beyond an inherent property to an extrinsic value as its parts interact in an orderly and lawful fashion. Mankind is able to study the design of creation and use it for the benefit of all.

The rebellion in the Garden resulted in disrupted relationships of man with God, with other men, with creation and even with himself. The physical universe was no longer an ally in the pursuit of fulfilling the dominion mandate, but an adversary. However, this did not eliminate the value of creation nor the image of God in man (Genesis 9:6). The systematic study of creation has value and will yield profitable results. Pearcey and Thaxton (1994) elaborate on this idea in the opening chapter of *The Soul of Science: Christian Faith and Natural Philosophy*. They make a point that the scriptures provide a sound philosophical basis for science. To summarize pages 21-37, creation has value, God is rational, man is given rationality, the creation acts in a rational fashion, creation acts lawfully; therefore man is able to understand the creation, codify the lawfulness of the creation and use it to the glory of God. This logical basis for science permeated western civilization and gave rise to achievements outpacing the accomplishments of previous civilizations. Needham stated in *Science and Civilisation in China*,

It was not that there was no order in nature for the Chinese, but rather that it was not an order ordained by a rational

personal being, and hence there was no conviction that rational personal beings would be able to spell out in their lesser earthly languages the divine code of laws which he had decreed aforetime. The Taoists, indeed, would have scorned such an idea as being too naïve for the subtlety and complexity of the universe as they intuited it (p. 581).

Coupled with a belief in a rational universe is an understanding of the finiteness and fallibility of mankind. The curse of sin did not wipe out man's ability to study the universe, but it did hamper it in a number of ways. The physical universe was fundamentally changed so that man's achievements would be through difficult labor, the sweat of the brow (Genesis 3:17-19). Weeds, thistles and death gave a different perception of a good creation. Man's finite lifespan, although initially quite long compared to current standards, cut off pursuits of inquiry through failing health and degraded ability to comprehend. Selfish ambition and destructive exploitation misdirected man's efforts away from glorifying God through the study of the beauty of God's creation. Had man not fallen, he could have spent eternity exploring the richness of God's creation without coming to the end of knowledge. Man's finiteness keeps him from full understanding and makes him impotent to achieve what that knowledge implies is possible.

Since science studies the lawfulness of God's creation, productive results can be achieved by the most unrepentant individual. Through God's common grace, "he makes his sun rise on the evil and on the good, and sends rain on the just and on the unjust" (Matthew 5:45). But Christians, being redeemed from the curse of the law and provided a comforter (the Holy Spirit), are able to commune with God and are enlightened by God's Word (I Corinthians 2:14-16). Walking in the light restores relationship with God and removes one of the hindrances to studying God's creation for the right reason. One cannot go so far as to claim infallibility in his pursuit of science. If Christians fail to agree on interpretations of biblical passages, which are part of the infallible, revealed Word of God, how much more will disagreement arise when studying the creation, which does not "speak" as clearly (I Corinthians 13:12).

This lack of clarity is more than a basis of disagreement, but can lead to false conclusions, although the person conducts his research with the purest of motives. One example comes from nineteenth century England. Paley's book *Natural Theology or Evidences of the Existence and Attributes of the Deity* published in 1802 was influential in higher education and in the early life of Charles Darwin. In 1829, the Earl of Bridgewater bequeathed ~\$900,000 in today's dollars for additional works to be written and published related to natural theology. Within a decade *The Bridgewater Treatises On the Power, Wisdom, and Goodness of God, as manifested in the Creation* consisted of eight volumes covering topics ranging from biology, astronomy, geology and anatomy to chemistry. An unofficial ninth volume was written by Babbage (1838) in which he discusses a number of subjects. One of particular value is his critique of Hume's view of miracles by alluding to possibilities presented by a calculating engine. Although the Bridgewater Treatises present wonderful examples of God's design described by experts of the day, a theology of God developed that arose from observations of the creation apart from

scripture. Using arguments hailing back to natural theology, the Intelligent Design movement of today avoids making theological conclusions by disconnecting the argument for the existence of a Creator from the nature of the Creator, which must be inferred from scripture.

One may discard the cautionary nature of this example stating that these scholars were not young-earth creationists, but this would be unwise. Each one comes to his study of science with assumptions about the nature of the physical world and how science interfaces with scripture and faith. Although we have an infallible revealed scripture and using a grammatical-historical approach to interpretation provides a solid basis for using scripture to inform our science, we must exercise humility in developing our physical models of creation. Our information is limited, our conceptualization of the problem is finite, our methods of exploration are constrained and, therefore, our conclusions need to be held tentatively. These limitations to science are well delineated and explained in Barrow's book *Impossibility: The Limits of Science and the Science of Limits* and in Ratzsch's book *Science and its Limits: The Natural Sciences in Christian Perspective*.

As the amount of available data explodes and computational power expands at an unwaning pace, we may be lured into believing that our models of creation are superior to those of bygone eras. Although the limitations seem more distant, they are there nonetheless. We are tempted to place more validity on numerical results than on a well-grounded conceptual framework that provides context for those results. As creation scientists, we need to make sure our presuppositions are clear, our methods are sound and our conclusions are consistent. For the remainder of the paper this idea will be explored. First a short summary of creation science will be provided with an emphasis on the increasing use of numerical results to support conclusions. Second, our perception of acceptable science will be explored in the context of presuppositions, paradigms and metaphors. Finally, the unique role that the Christian plays in the pursuit of creation science is illustrated through our use of methods and tools.

CREATION SCIENCE

In a mundane way all science is creation science because it drives mankind to ask the ultimate questions of "Why is the universe the way it is?", "How did it get here?" and "What is my role in the universe?" Since all that exists was created and is sustained by Jesus Christ (Colossians 1:15-17), the answers to these questions are found in Him. However, in a more restricted sense creation science is an act of worship by Christians desiring to see the glory of the Creator proclaimed to all of mankind. It is used as a polemic to demonstrate that we have a reasonable faith and it uses the presumption that the scriptures, although not a comprehensive source of scientific knowledge, provide facts and a framework from which to build our models.

We tend to separate science from philosophy, but that artificial barrier prevents us from thinking beyond our observations and immediate conclusions to a consistent worldview of reality. Many individuals known historically as philosophers based their views on physical observations of the world, such as Aristotle, Augustine, Thomas Aquinas and Descartes. Famous scientists such as

Newton, Boyle, Faraday and Maxwell are remembered for their scientific contributions to the neglect of valuing their Christian worldview, which guided their pursuit of knowing the Creator and His creation. More well-known writings connecting science to the works of the Creator come from authors such as John Ray and William Paley. Although they did not necessarily hold to a recent creation, they developed arguments from creation to demonstrate that our universe is consistent with the volitional, creative work of an omnipotent, personal creator.

The modern young earth creation movement is often linked to the publication of *The Genesis Flood* by Whitcomb and Morris. Although previous writings promoted evidence for flood geology, such as *The New Geology* by George McCready Price, *The Genesis Flood* provided both biblical justification from a theologian and physical justification from a civil engineer with a specialty in hydraulics. Writings by Frank Marsh were also influential in the creation community. His book *Fundamental Biology* coined the term *baramin*, a reference to the created kinds. In 1963 the Creation Research Advisory Committee was organized and became the predecessor to the Creation Research Society (CRS). In the early years, articles in the *CRS Quarterly* addressed a variety of issues. Of those that involve numerical data and modeling, topics include radioactive dating, decay of the earth's magnetic field, speed of light, classical electrodynamics, thermodynamics of the vapor canopy, a rapid post-flood ice age, sea floor sediments, ice cores, cosmology models and the improbability of biochemical evolution. Today, some of these topics continue to reverberate through creationist journals such as *Answers in Genesis* (AIG) *Answers Research Journal* and Creation Ministries International's (CMI) *Journal of Creation*.

During the 1980's the Institute for Creation Research (ICR) explored the validity of a collapsing vapor canopy supplying the precipitation necessary for 40 days and nights of rain at the beginning of the flood. Vardiman and Bousselot (1998) concluded that water vapor providing more than one meter of precipitable water would result in temperatures at the earth's surface that are unsuitable for life unless the earth's albedo were modified. At the same time creationists were considering the breakup of the fountains of the deep as the primary source of flood waters. Catastrophic Plate Tectonics (CPT) became a dominant model by proposing runaway plate subduction at the beginning of the flood (Wise et al. 1994). This model had broad appeal because it unified explanations for geological features, torrential precipitation at the beginning of the flood due to an enhanced hydrologic cycle and oscillating geomagnetic fields as plate subduction impinged on the earth's outer core (Humphreys, 1990). CPT moved from a conceptual model to an operational hypothesis as Baumgardner employed a computational geo-fluid model to simulate this scenario (Baumgardner, 1994). Advancements in this model continue today as better validated material properties of the mantle are incorporated into the geo-fluid model (Sherburn, Jesse, John Baumgardner and Mark Horstemeyer, 2013).

Another area of creation research that makes extensive use of physical models and analysis of numerical data is the development of the ice age after the Genesis flood. Although some still look to the Flood to explain the existence of erratic boulders, fjords,

moraines and rock striations; many creationists believe a post-flood ice age best explains this evidence (Oard, 1990). Oard (1979) proposed a single rapid ice age after the Flood and used calculations to propose the need for ocean temperatures in the range of 30 °C. Spelman (1996) and Vardiman (1998) explored the validity of this scenario using the National Center for Atmospheric Research's (NCAR) Community Climate Model 1 (CCM1). Additional work in this area was done by Gollmer (2013) using a global atmospheric circulation model with dynamic warm oceans. Vardiman (2003) and Vardiman and Brewer (2010a, b, c) moved from a global model to a regional atmospheric model to study the effects of warm oceans on hurricane intensification.

In tandem with climate model simulations, numerical work related to the ice age continues in several forms. If the Quarternary ice ages are post-flood phenomena, there is a need to evaluate data collected from ice sheets and sea floor sediments. Vardiman (1993) and Vardiman (1996) addressed ice cores and sea floor sediments respectively by assuming non-uniform deposition rates rather than rates based on current measurements, which are much smaller than those expected immediately after the flood. Critiques of Vardiman's work come predominantly from those who believe that ice age cycles are driven by the earth's orbital distance from the sun as proposed by J.A. Adhemar and James Croll, and refined by Milankovitch (Hays, Imbrie and Shackleton, 1976). Evaluating the seminal work on the validation of Milankovitch cycles, Hebert (2016a, 2016b, 2016c) performs a reanalysis of the ice cores to demonstrate that the presence of these cycles are not statistically significant. Horstemeyer and Gullett (2003) studied the mechanical issues related to a rapid ice age using finite element analysis (FEA). A follow up study by Sherburn, Horstemeyer and Solanki (2018) modeled glacial surging.

In 1997 an eight year project was initiated to evaluate dating using radiometric techniques. The Radioisotopes and the Age of The Earth (RATE) project, sponsored by the ICR and CRS, resulted in two extensive volumes (Vardiman et al, 2000, 2005). A limited executive summary of the work is as follows: 1) there is evidence for large amounts of radioactive decay, 2) discordance exists in dating techniques, 3) measureable anomalous carbon-14 in diamond and coal should not exist if vast ages are assumed and 4) helium in zircon's are at a concentration consistent with a young earth. Therefore, there must have been accelerated radioactive decay in the past. This summary obscures the amount of work invested in this research and the role that assumptions and models had on the interpretation of the data.

Given the success of RATE Vardiman (2005) discussed "What Comes After RATE?" Of the projects listed many had a computational component to the research. GENE studied genetic information with regard to its origin and its maintenance. Part of this research resulted in a population genetics model called Mendel's Accountant, which concluded that "genetic deterioration is an inevitable outcome of the processes of mutation and natural selection" (Baumgardner et al, 2008, p. 98). FAST explored sedimentary layers and the possibility of building them up through rapid processes. Prabhu, Horstemeyer and Brewer (2008) and Baumgardner (2013) modeled ocean circulation velocities during the flood and considered erosional and deposition effects to account

for the mega-sequences in the Phanerozoic sediments. COSMOS had a goal of testing the computational consistency of young universe cosmological models. EPIPHANY was a 40-processor Linux cluster obtained by ICR to support computational work in many disciplines of creation research.

Building on the concept of *baramin* and discontinuity systematics (Remine, 1993), the discipline of Baraminology was introduced by Wise (1990). Initially using hybridization data to determine the boundaries between created kinds, Robinson (1997) used mitochondria DNA to look at phylogenetic discontinuity in the context of Testudine (turtles). Using a combination of “ecological, morphological, chromosomal, and molecular data,” Robinson and Cavanaugh (1998) looked for “statistically significant gaps” among the cats. A technique called Analysis of Patterns (ANOPA) was used by Cavanaugh and Sternberg (2004) to identify statistical similarities/dissimilarities between organisms using phylogenetic traits. Wood (2005) describes a program BDIST (Baraminic Distance) that is commonly used for baraminological studies. Many examples of this analysis exist in the *Occasional Papers of the Baraminology Study Group* and its successor *Journal of Creation: Theology and Science Series B: Life Sciences* produced by the Creation Biology Society (CBS).

This review is limited to young earth organizations in the United States with which the author is familiar. Casting the net wider for examples of creationists using statistical methods, modeling and computation is beyond the scope of this work. However, one notable source would be the Geoscience Research Institute’s publication *Origins*. In Germany the organization Studiengemeinschaft Wort und Wissen publishes a technical journal called *Studium Integrale*. Although the intelligent design (ID) community is a broad umbrella, there are a number of individuals in the movement addressing issues of design and exploring the fitness of the earth and the universe for life. Two prominent ID sources are The Discovery Institute and the Access Research Network.

It should not go without saying that the Creation Science Fellowship (CSF) has provided many examples of computationally-based creation articles through the years. Many of the authors and published works cited previously are well represented in the *Proceedings of the International Conference on Creationism* (ICC). Horstemeyer (2013) summarized the use of computational methods in creation science with his talk “Simulating Genesis.” This vision not only documented what has been done, but proposed how additional work could be done to model the creation from cosmology to biology ranging from the beginning of creation through the Flood to the present. One facet of this vision, addressed by this paper, is the increased use of computers not only to run simulations, but to synthesize data and validate models.

PRESUPPOSITIONS AND ACCEPTABLE SCIENCE

The introduction of this paper presented a rationale for doing science from a Christian and creationist perspective. This rationale is not unique to young earth creationists, but establishes a worldview from which to pursue science. Because the world is lawful, it makes sense that a codified observation of the creation would prove useful for developing best practices and making predictions of the future. However, underlying all of this “common sense” are

unproven beliefs.

1. Presuppositions

For the Christian, beliefs or presuppositions are acted on by faith in who God is and how He has worked in the world. Stating that beliefs are unproven is not the same as saying irrational. God has revealed Himself and we accept by faith that “He is and that He is a rewarder of those who diligently seek Him” (Hebrews 11:3). When we do science we believe God is lawful, but at the same time know He is omnipotent and sovereign, thus making room for miracles. One critique of miracles in the pursuit of science comes from Lewontin (1984, p. xxvi) who states “We cannot live simultaneously in a world of natural causation and of miracles, for if one miracle can occur, there is no limit.” However, we do not believe God is capricious in His use of miracles, since He is not the author of confusion (I Corinthians 14:33). Therefore, we do not feel that miracles undermine the validity of science.

Uniformitarianism has become a dirty word in creation circles because it hails back to Lyell’s statement “the present is the key to the past” (Lyell, 1833). However, without a belief in a uniformity or lawfulness of God’s creation, science becomes impossible. As a result, in our development of models, we hold them tentatively recognizing our finiteness in properly interpreting the past and extrapolating to the future. Allowance is made for miracles as God unfolds human history.

To what extent and in what manner miracles occur is important to consider. As to the extent, most creation scientists take a conservative view towards supernatural miracles, those that suspend the lawfulness of God’s physical creation. We have examples of time changing for Joshua (Joshua 10:12-14) and Hezekiah (II Kings 20:8-11). Christ’s demonstration of power over the physical world (Mark 4:35-41) and His healing miracles could not be explained through natural causes. They were not performed arbitrarily, but to validate His message and His claim as the promised Messiah (Matthew 11:2-6). As a result, most creationists would expect the non-miraculous to be the norm when studying science. When miracles do occur, they are to promote God’s purpose and bring glory to Himself.

Miracles of a supernatural nature are one thing, but what about the miracle of God’s providence? We know God is sovereign and events do not happen by accident. Therefore, we look for purpose in the trials and blessings of life, though from an earthly perspective they may look random and vain (Ecclesiastes 9:11). The question that follows is “when should we look for a scientific explanation of God’s work through providence rather than expect supernatural divine intervention?” A paper by Nof and Paldof (1992) illustrates this question by describing the weather conditions that may have contributed to the parting of the Red Sea during the Exodus. Using the biblical description of a strong wind and identifying a specific geographic location for the crossing, a computation was performed to determine the wind speed necessary to expose an underwater shelf. The authors conclude that this scenario is a reasonable possibility for explaining the events of Exodus 14. Whether God used naturalistic means or not, the crossing of the Red Sea is miraculous due merely to the unique timing of the event. The tension of letting “miracles be miracles” or explaining them

naturalistically is constantly with us. Was the long day of Joshua an optical effect or did the rotation of the earth stop? Was the star of Bethlehem and the darkening of the sky during the crucifixion astronomical phenomena? Was the flood initiated by a swarm of comets or asteroids? In some cases these explanations hinge precariously on special insights while in others the explanation is driven by a need to explain the existence of physical features due to past events. This tension is clearly seen in the creation literature related to accelerated radioactive decay and its implications of excess heat and mutation. Many theories can be proposed, but in the end one's presupposition of how God acts miraculously in the world is the key. We can strongly debate and develop our models, but we must be clear about our assumptions and with humility know our models are limited.

2. Paradigms

The models we generate are not only affected by our presuppositions, but are also limited by the paradigm we adopt. Translation of Greek and Arabic texts into Latin during the High Middle Ages had a profound effect on the intellectual community of Europe. The Scholastics adopted philosophical traditions from Aristotle and this provided a paradigm on how science was done. In this tradition Thomas Aquinas argues for God's existence through first causes (cosmological argument) and design (teleological argument). Theologians and scientists influenced by Aquinas looked for these evidences and wrote such manuscripts as *The Wisdom of God Manifested in the Works of the Creation* by John Ray and *Natural Theology* by William Paley.

However, Aristotelean science is quite limited, and with respect to the physical sciences, flawed. Because of the limitations of this paradigm, there was a scientific revolution that shifted the paradigm away from seeking "why" to asking "how." Reason was still important; however, experimentation and quantitative observations increased in importance. Galileo figured prominently in this transition by studying the effect of gravity on falling objects and the velocity of rolling balls.

It is easy in retrospect to judge Aristotelean physics as inferior to Galilean physics. However, when immersed in a paradigm, it is hard to see outside of accepted or "normative" science. There may be problems with the paradigm, but there is always hope that further study will provide discoveries that resolve the problems. Galileo's backing of Copernicus' model of the solar system over Ptolemy's was not based on quantitative accuracy, but on consistency with his telescopic observations of the planets. The quantitative superiority of the model was not possible until Kepler refined it with elliptical planetary orbits about the sun. We laud Galileo's insight and fortitude, but fail to realize that many intelligent scholars accepted the Ptolemaic model due to its accuracy and its position within the reigning paradigm.

A. Mechanical Universe

As creationists, we deal with the paradigm established by the scientific revolution. Newton's universal law of gravity not only provided a conceptual framework for unifying the "falling tendencies" of objects on the earth with the motion of the planets and moons, but also provided a computational basis for predicting future motion of those objects. So successful was this framework and its calculations, that the universe was viewed as a large clock.

Christians are not surprised by this description of a clockwork universe since Genesis 1:14-15 states the purpose of the sun, moon and stars was for "times and seasons." However, the regularity of the universe was used to deny the immanent God, who is actively involved in His creation (Col. 1:17). This denial is illustrated by the anecdotal conversation related to Laplace's book *A Treatise of Celestial Mechanics*. When asked by Napoleon why God was not mentioned when discussing the motion of the heavens, Laplace replied "I have no need for that hypothesis" (Ball, 1888, p. 363).

Successfully building on the regularity of the universe, physics is often viewed as the father of the sciences. It deals with the fundamental physical principles upon which the universe operates in a quantitative manner. Marrying the study of science with mathematics makes this discipline both powerful and dangerous. It is powerful because the methods of analyzing data and modeling phenomena are no longer applied to the motion of simple objects and understanding fundamental forces, but is extended to every branch of science and even social science. The quote attributed to Ernest Rutherford, "All science is either physics or stamp collecting" asserts that most disciplines of science are qualitative in nature and, therefore, more akin to stamp collecting, which uses observation, categorization and generalization in its field of study. This statement, although intended as a barb, illustrates that the success of physics exists because it has primarily focused on simple systems or simple phenomena within complex systems, such as near equilibrium conditions. The fact that these simple systems give insight into more complex behavior is due to the way God has ordered His creation in a rational and discoverable manner.

However, this limitation of physics to simple systems is changing. With the advent of inexpensive computational power physicists have moved beyond idealized systems described by analytic solutions and approximations. Numerical methods provide solutions of sufficient accuracy to test physical models of increasing complexity. Illustrative of this progress is the development of numerical weather prediction. With the assumption that thermodynamics and fluid dynamics are the underlying principles describing the behavior of the atmosphere, Bjerknes developed a procedure for making a model-based weather forecast (Lynch, 2008). In 1922 Richardson took six weeks to make a six hour forecast using a similar model. In 1950 the first successful 24 hour forecast was made using the ENIAC computer. Since then, computational resources have increased in power and decreased in cost. Presently, accurate 3.5 day forecasts are made every six hours on a grid with 12 km resolution. Similar advances are being made in geophysics, biophysics, systems biology and social dynamics.

The danger in this physics-based methodology is that it affirms materialistic explanations of all phenomena. Since model building can only describe lawful phenomena, by default it must exclude supernatural, miraculous action. Divine action can still be inferred by the existence of model parameters that appear to be fine-tuned; however, there is nothing in the models that require an immanent God. Failures of models to describe complex phenomena are not attributed to the limitations of the materialistic paradigm, but to a lack of model sophistication. There is faith that given sufficient discovery and computational power there is no phenomenon beyond the reach of this methodology.

One critique of this process, which is indicative of scientism, is that of reductionism. Complex systems are reduced to their component parts. Once the parts are simple enough, a physical model is possible. However, these models ignore the subtle interactions that give rise to lawful behavior that is more than the sum of the parts. These additional tiers of phenomena become the foundational principles of the traditionally separate disciplines of chemistry, biology and cognitive science. Hawking and Mlodinow (2010) describe this separation of disciplines as ‘effective theories,’ where it is unnecessary to work from the first principles of physics.

B. Holism

The impact of this critique is somewhat blunted in recent years as sophisticated models of non-linear interaction give rise to analogous tiered behavior. Instead of studying the component properties of a system, computers are used to simulate the holistic interaction between multitudinous parts. It is found that simple rules of interaction give rise to complex behavior similar to that found in insect colonies and large populations of humans. This self-organizing interaction gives rise to higher levels of predictable behavior, which is sometimes called an emergence.

Instead of replacing the materialistic paradigm due to its deficiencies, complexity studies complement it by generating computational models that are holistic in their approach. This does not validate the paradigm, but it provides more possibilities when imagining how the shortcomings of reductionism can be overcome. In the 1970’s Dean Kenyon recognized the inability of chemistry to explain the information contained in large functional proteins. Since amino acids do not assemble with a preferential order, the probability of a large functional protein assembling by chance was impossibly small. However, if complexity theory is correct, the impossibility disappears as biochemical processes self-organize into ordered systems. These processes, according to Stuart Kauffman, embody a “fourth law” of thermodynamics, which implies that systems far from equilibrium will generate order for free (Kauffman, 2000). William Dembski takes Kauffman to task in *No Free Lunch*, pointing out that self-ordered systems have no means of maintaining their order once formed and “evolutionary algorithms, apart from careful fine-tuning by a programmer, are no better than blind search and thus no better than pure chance” (Dembski, 2002, p. 212).

The materialistic paradigm assisted by physical modeling and sufficient computational capacity is seen as the future of discovery. It asserts that there is analogous behavior between populations of people and mindless law abiding particles. For example, first-order differential equations are used to predict both the decay rate of radioactive particles and the growth of human populations. They are analogous mathematically, but are not the same materially. These differences are glossed over in the paradigm by accepting the metaphor that everything is a computable entity.

3. Metaphor

A metaphor is a powerful tool and multiple metaphors can be consistent with a materialistic paradigm. Paley used the properties and workings of a pocket watch to demonstrate the need for a watch maker: Creator. This illustration is effective because the metaphor relating living objects to machines is accepted in a clockwork universe. Objections to Paley were raised by

challenging the machine metaphor: “Living things are able to reproduce, but machines don’t.” Paley responded by declaring that a self-reproducing machine is an even grander design. In that era the distinction between living organisms and even the most complex non-living machines was evident. However, our current understanding of biology reinforces the machine metaphor from the largest organism to the chemical processes within the cell.

Advancements in biology have made other metaphors applicable. With Watson and Crick deciphering the structure of DNA, the information storage mechanism of the genome became clear. Since the mechanism of storage does not impose order on the information content, arguments similar to Kenyon’s dilemma with proteins arise. Gitt (2006), Meyer (2009) and Dembski (1998) use the information metaphor to argue for the existence of a creator or at least an intelligent designer. The information metaphor naturally morphs into that of a computer, since the information is translated, transformed and transmitted. Although the computer metaphor can be used to describe cellular processes, it is more often applied to organisms with a brain. Equating the brain to a universal computing machine gives insight into man’s cognitive capabilities, but it blurs the line between human intelligence and machine intelligence. Since the brain consists of a network of interconnected neurons, the neural network metaphor has led to advancements in machine learning algorithms.

A metaphor is useful because it illustrates one aspect of a system’s behavior, but it does not encompass the entirety of the system. “To a hammer everything is a nail” points out that metaphors have limited usefulness and when over-extended can result in destructive outcomes. In like fashion Weizenbaum (1976) points out that to a computer everything is a calculation. If a program or model is unable to explain observed phenomena, more algorithms or subroutines are added to make it more realistic. However, this process fails to provide additional insights into the system’s operation. The computer model hides the knowledge to be discovered behind a façade of numerical accuracy. This is no different than Ptolemy’s epicycles being used to support a geocentric solar system to the detriment of accepting, as seen in retrospect, the scientifically superior model of Copernicus and Kepler.

As creationists and theologians we recognize that a materialistic-based paradigm is fundamentally flawed. Since scientific methods can only study the lawfulness of the creation, science itself is limited in its ability to describe all of reality. The metaphors of machine, information, computers and networks are applicable as long as they are limited to material explanations. Science becomes unacceptable when it imposes a materialistic explanation on all phenomena. The challenge for creation science is to utilize the strength of the computational metaphor, but avoid the replacement of a consistent biblical framework by a purely materialistic one validated with numerical results.

COMPUTATIONAL METHODS AND TOOLS

1. Models

Computational methods prior to computers relied on analytic techniques provided by algebra, calculus, partial differential equations, etc. Patterns observed in quantitative measurements were embodied in a function, which could be used to make

predictions. These predictions could either fill in gaps between measurements (interpolation) or be extended beyond known values (extrapolation). The value of the model rests on its correspondence to physical phenomena and its reliability when tested against new situations.

It is easy to get correspondence between a model and the observed phenomena; however, its reliability against new conditions is contingent on quality data and appropriate assumptions. To illustrate this point Figure 1 plots five data points as enumerated in the bottom right corner.

This data is fit with five different models: linear ($y = Ax + B$), quadratic ($y = Ax^2 + Bx + C$), cubic ($y = Ax^3 + Bx^2 + Cx + D$), exponential ($y = e^{Ax} + B$) and sinusoidal ($y = A \sin(Bx + C)$). The capital letters in these formulas represent parameters that can be adjusted to fit the data. In this case the data looks linear and, therefore, the first model is a natural choice. The slope, A , and the y-intercept, B , are adjusted to minimize the distance between each data point and the predicted line. If a better fit is desired, a model with either a different inherent shape or more free parameters is chosen.

As long as the data show some level of smoothness over the domain of collected values, multiple functions can be used to accurately model the data. If a prediction for y at $x=4.5$ is made, any of the plotted functions will give an approximate value of 11.5 with a spread of ± 0.4 between models. Assuming the phenomena being measured is well behaved, this implies a prediction error of less than 4%. In the absence of physical knowledge about the system, there is no reason to choose one model over another.

Physical knowledge along with assumptions (or presuppositions) are used to select one model over another. This becomes crucial when extrapolating the model beyond the domain of collected data. Figure 2 illustrates the same five functions by extending the x-axis both to the left and right. In this extended plot the oscillatory nature of the sine wave becomes clear. Likewise the exponential

function asymptotically approaches zero as the independent variable becomes more negative. In this context Lyell's quote "the present is the key to the past" becomes moot. Future predictions are heavily contingent on assumptions.

So what criteria are used to determine the best model? Although this question seems to be important, it is secondary to the question "What is the quality of the data?" If there are few data points, they could be fit exactly with an equation with an equal number of free parameters. Although not shown in Figure 1, a quartic equation, which has five free parameters, could be used to fit the data exactly. This is called "over-fitting" and makes the predictive power of the model suspect. There is no need to think about the science behind the observations because numerical accuracy is most important. Ptolemy's epicycles follow this process by repairing inaccuracies in the model with additional epicycles.

Even if numerous data points are available, are they representative of the full behavior of the phenomena? Using Figure 1, we can imagine collecting 1000 data points between $x=1$ and 5 and still come to the same conclusion. However, if these same 1000 points were collected between $x=\pm 70$, it would be clear which models fail the test. Unfortunately, quantitative measurements regarding the earth's geophysical processes extend back at best three centuries and this is restricted to air temperatures in London. If measurements are desired beyond this window of time, assumptions and an understanding of the physical system must be applied.

Extensions of data into the past are accomplished through proxy data. A well understood process in the present is used to interpret the age of past geophysical features. Once again this ties into Lyell's "the present is the key to the past." We use tree rings to infer the age of trees, we use layers in lake beds to determine the age of past events (Austin, 2012) and we use ice cores to determine past climates. All of these processes assume some level of uniformity in God's lawful creation. However, validity of one's conclusions depend on three assumptions: 1) The initial state is

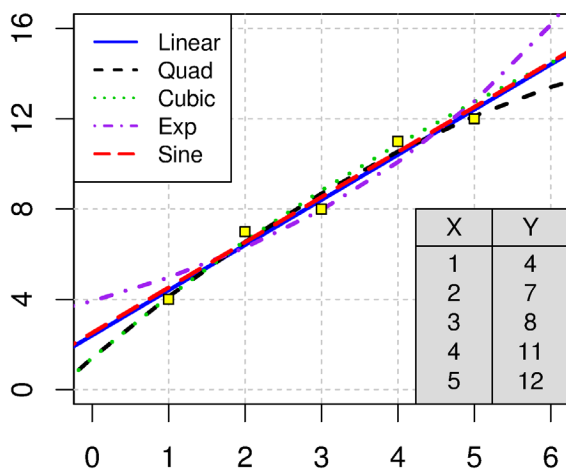


Figure 1. Interpolation. Plot of the five data points listed in the bottom right corner. Parameters from five different models are adjusted to give the best fit of the data.

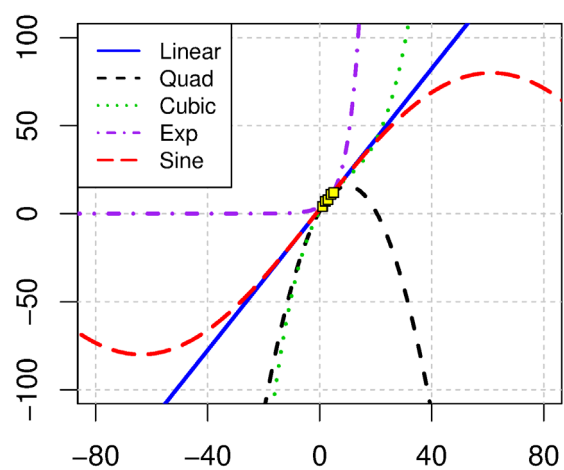


Figure 2. Extrapolation. The domain of Figure 1 is extended to the left and right to illustrate the divergence between the five models.

known or can be reasonably inferred, 2) Any disturbance of the system is absent or can be accounted for and 3) The processes generating the proxy data operate at a predictable rate. With regard to radiometric dating these issues have been addressed numerous times through creationist literature, and most exhaustively with the RATE project. However, any reconstruction of past history using proxy data is contingent on these three assumptions.

2. Example: Earth's Magnetic Field

The history of the earth's magnetic field is used to illustrate the importance of physical understanding and assumptions when reconstructing the earth's past. Barnes (1971) made the creation community aware of the measured decrease in the earth's magnetic dipole strength. At the time Barnes noted there was an approximate 6% decrease in the earth's magnetic field since the first measurements made in the 1840's. Given current understanding, this magnetic field is due to electric currents in the earth's molten outer core. Assuming a free decay process (decay of currents due to electrical resistance partially offset by magnetic self-induction), Barnes calculated a magnetic field half-life of 1400 years. Extrapolating his model into the past resulted in a limit for the age of the earth's crust, ~10,000 years.

Critics of Barnes brought up the following objections: 1) He only considered the dipole moment and neglected the high order moments, 2) His model is simplistic and does not take into account the dynamo effects of convection in the earth's mantle and 3) His conclusions are not consistent with the proxy data of magnetic field reversals. The first objection claims that Barnes does not take full account of the initial state of the whole system (dipole, quadrupole, ...). The second objection states that the system is not isolated because there are processes that introduce additional current to the outer core. The third objection states that Barnes' rate of decay is not constant and his model should be oscillatory, not exponential decay. Notice these objections challenge the three main assumptions of dating, which are similar in nature to objections creationists make with regard to radioactive dating.

The model proposed by the geophysical community is distinctly different than Barnes'. Citing evidence of multiple magnetic field reversals at the Mid-Atlantic Ridge, this model assumes the earth's magnetic field goes through periodic reversals. The energy of the magnetic field does not dissipate as in Barnes' model. The geodynamo converts the mechanical motion of convection in the outer core and the earth's rotation into electrical energy in a fashion similar to an electric generator. This process is able to offset any resistive losses in the outer core. Instabilities in the geo-dynamo result in magnetic pole wandering and reversals, which occur on average every 450,000 years. For a more thorough treatment of the history of this subject see Olson (2006).

Magnetic field reversals are also supported by solar observations. Since the time of Galileo, sunspot activity has been observed to go through an approximate eleven year cycle. Our current understanding links sunspots to a 22 year cycle of solar magnetic field reversal. During that cycle an external dipole field, associated with sunspot minimum, transitions into an internal quadrupole field, associated with sunspot maximum. If this model corresponds to the earth's dynamo, then the earth's external magnetic field could

be weak for tens of thousands of years, which can have a significant impact on organisms living on the surface (Gonzalez and Richards, 2004). Although current dynamo models are adjusted to initiate rapid reversals to avoid biological consequences, they still estimate transition times taking thousands of years.

Humphrey (1990) modified Barnes' model in light of the CPT flood model. If a portion of the earth's crust plunged to the interior, it would disrupt the currents in the outer core thus initiating field reversals. Adding his mechanism to the model may appear to be unsubstantiated, but it makes a prediction of rapid reversals. Not in thousands of years, but in weeks. In agreement with Humphrey's model a rapid change in the orientation of the earth's magnetic field was captured in a lava flow at Steen's Mountain, Oregon (Coe, Prevot and Camps, 1995) implying a rate of change of 6° per day. As seen in this comparison, the observational data and associated models must be framed within the context of a consistent framework. What is the best model for fitting the data? When the data are extensive it may be clear what physical mechanism is responsible. In this case, a model can be constructed and reasonable extrapolations can be made. There is a confidence that the best model is being used. However, when data are limited in scope either spatially or temporally, multiple models can be proposed with significant differences in their extrapolations. In these cases the best model is contingent on the researcher's worldview and paradigm.

3. The Computer as a Tool

Once a model is constructed, its validity does not rest on its method of construction, but on its ability to further the understanding of God's creation. There are many cases where this author has heard claims of biblically superior models that have failed to provide a coherent and consistent extension to well-known phenomena. Arguments are made to justify the model in a manner reminiscent of the scholastics.

Generating a model is actually the easy part. Any computer can fit data and generate a model. The next step is to select a model that is consistent with known science, unless a compelling reason exists to upend the reigning paradigm. The last step and by far the most difficult is to test the model in realms where data are available or where simulations can be constructed. Because of this difficulty, the tools used to test models must also be used with care.

Since this paper is focusing on the impact of computation on creation science, the central tool of discussion is the computer. After World War II computers were expensive and only used by specialists. With the invention of solid state electronic devices and large-scale circuit integration, the speed and costs of computers changed dramatically. During the 1970's and 80's use of the computer expanded from the specialist to the hobbyist and layman through inexpensive and increasingly powerful microcomputers. This opened the door for analysis and modeling unheard of in previous decades. Today computing is so ubiquitous that computing tools no longer focus on constraints of memory and speed, but on ease of use. As a result, in the words of chef Gusteau of *Ratatouille*, "Anyone Can Cook!" (Bird, 2007)

Continuing in the vein of *Ratatouille* "to cook" is not the same as "following a recipe." There are many ways to do science by recipe

that lack understanding. As a result, the unstated assumptions of the process are ignored and questionable results ensue. As mentioned previously, multiple models can be generated using the same data; however, not all models interface with a comprehensive view of the science being done. Therefore, implementing computers to assist with science requires a knowledgeable researcher. This statement will be explored with regard to simulations and machine learning.

Simulations in creation science are used at an increasing rate. Simulations can be either constructed from scratch or through modification of an established model. As a trained geophysicist, Baumgardner (1985) developed a model to simulate circulation in the earth's mantle. This model named TERRA simulated mantle convection and continental crustal motion that correlated with observed values of plate motion. Sanford et al. (2007) developed a model called Mendel's Accountant to simulate the effect of mutation on population genetics. This model was validated against cases where theoretical predictions could be calculated without simulation. Individuals involved in the model's development had expertise in genetics and computer software development.

TERRA and Mendel's Accountant are examples of models developed from scratch. The software was not an adaptation of a previous program, but generated using known relationships observed and measured in the physical world. Given the complexity of these types of models there is always a concern about validity. The more complex the program the less likely that a thorough testing of all cases is possible. However, this is the reason why computer simulations are developed, to explore cases inaccessible through analytic methods. Therefore, it is necessary to validate the model with idealized conditions, which are derived directly from theory. Likewise a new model should be compared to work done by established researchers in the field. If there is a divergence of results, it means either there is a flaw in the model or the assumptions held by the two research groups differ. Combing through the logic of the program will often reveal flaws; however, incomplete implementation of physical effects and differences of assumptions require more scrutiny.

Most models are built with a core functionality that captures the essential physics, chemistry and biology of the phenomena being simulated. Once the core is working as anticipated, more detail is added. Ideally, added features are based on well understood physical principles, which improve the accuracy of predictions. Some features are either so complex that implementation is computationally prohibitive or incompletely known such that only bounds of possibilities can be determined. In these cases the phenomena are parameterized to give realistic results.

For example, parameterization is used to calculate transmission of electromagnetic (EM) waves through the atmosphere in climate models. Each type of gas absorbs and emits EM waves differently depending on wavelength. To accurately perform this calculation it may be necessary to calculate transmission for over 10,000 different wavelengths ranging from infrared to ultraviolet light. Instead, eight to sixteen representative wavelengths are used to achieve results that are comparable in accuracy. In cases when direct physical validation is not possible, parameters are "tweaked" without physical justification to improve the predictive accuracy of

the model.

Instead of developing a model from scratch, some creationists use models that are recognized by the scientific community as well-established. These models have been validated over a wide variety of test cases by experts in the field. Vardiman (2001) used the CCM1 developed at NCAR and Gollmer (2013) used the GISS ModelE to perform climate simulations with warm oceans. Vardiman and Brewer (2010a, b, c) used the NCAR Mesoscale Model 5 (MM5) to simulate hurricane intensification over warm oceans.

Each of these models was developed to accurately represent present day climate and weather conditions. Different results can be achieved by changing the initial conditions (IC) and boundary conditions (BC) of the simulation. Since changes in the IC and BC leave the fundamental physics and parameterizations of the model unchanged, it is concluded that the results have validity as long as the IC and BC are reasonable. Modeling of past climates is challenging because the model may be "tuned" to present conditions and, therefore, biased away from the actual historical climate.

No matter how a model is developed, there are certain things of which a researcher must beware. First the researcher should not confuse the model with reality. By its very nature a model or simulation is a simplified version of observed phenomena. Therefore, the model is not 100% predictive. Failure does not invalidate the model as long as its performance is superior to other means of studying the phenomena. Second, although the model constrains scenarios to a range of behaviors, it is possible by using unique BC, IC and/or additional programming to find what one is looking for. This is called confirmation bias and can be minimized by selecting conditions and algorithms that have reasonable physical justification. Third, a computer model can only reproduce what it has been programmed to do. This may seem obvious, but when a program is developed using thousands of man hours, it is hard for one researcher to know the outcome of every calculation. As a result, one might conclude that an outcome is impossible because it does not happen in the simulation, when in fact the model was not sophisticated enough to simulate that possibility. Fourthly, a model is often viewed as being an objective representation. However, the biases of the researcher can easily be incorporated in the implementation of the model. This is another example of confirmation bias. Fifthly, a model cannot simulate miraculous action, only the regularity of God's creation.

4. Data Science and Machine Learning

"Big Data," machine learning and artificial intelligence are terms that are appearing with increasing regularity in the news. Interest in these topics is driven by advances made by Google, Microsoft, IBM, Facebook, Amazon and other tech companies. The convergence of heterogeneous computing environments, distributed computing and self-adaptive programming techniques has led to accurate voice transcription, language translation, image recognition and augmented/virtual reality. The creation literature has not been greatly impacted by these recent developments, but it is expected that in not too many years creationists will find these to be powerful tools.

The umbrella discipline that encompasses these developments is

data science. Training in data science prepares an individual to use computers and statistical techniques to manage, analyze and generate actionable insights from large amounts of data. Wood (2005) and Cavanaugh and Sternberg (2004) use data science techniques related to principle component analysis to study baraminological distances. Clarey (2015) visualizes geological columns using a geographic information system (GIS) to study megasequences. Turner, Chadwick and Spencer (2000) use the global positioning system (GPS) to generate a high resolution mapping of dinosaur remains in a quarry. These endeavors take advantage of powerful tools, but only represent the initial steps in what is possible.

The amount of information generated on the earth each day is staggering. A Cisco white paper (2017) states that the global data traffic in 2016 was 26,600 GB per second. The National Weather Services' (NWS) National Centers for Environmental Prediction (NCEP) processes 1.7 billion observations totaling 6 TB every day (Starosta, 2012). Considering the amount of astronomical, geological, biological and genomic data archived on the network, creationist should see this as a treasure trove of information for research. Much of this information is generated through government funding and, therefore, is freely available for public access. The primary limitations lie in the knowledge of how to retrieve it, the skills of managing and analyzing large bodies of data, trained researchers with interesting hypotheses to explore and the computational hardware to process the information in a timely fashion.

Some of these limitations will resolve themselves as the learning curve for doing data science is eased through advancements in analysis software. Currently Python and R are the most common programming languages for data science. Because the user community is so large, tens of thousands of open source packages are available to extend the capabilities of these languages. Since these packages are developed in a grass roots fashion, there originally was not a unified vision of developing the scope of what could be done.

Among the R programming community, that has changed with the integrated development environment, RStudio, and contributions of its chief scientist Hadley Wickham. Wickham and Golemund (2017) provide a unified approach for data science by developing a suite of packages intended to work together. Williams (2011) introduces an R platform called Rattle that provides quick entry into data mining. Options for analysis are chosen from a visual interface, thus allowing non-programmers access to powerful analysis tools. With time it is anticipated that the tools will become as intuitive as drag and drop.

As the next generation of analysis software becomes available, scientists in general and creationist in particular must be careful to use these tools properly. There is always a temptation to overstate a new system's capabilities because it is novel and often not well understood. Within data science and its tools the caution consists of three facets: 1) Data selection, 2) Application of tools and 3) Interpretation of results.

As expressed earlier, having large amounts of data does not necessarily mean more information. Even if all the data about the

universe past, present and future were available there is no computer large enough or fast enough to process all of this information. As a result, a subset of available data is used based on the researcher's assumptions. When modeling the motion of a falling apple, we neither consider the phase of the moon nor the current value of the stock market nor the emotional state of the researcher. All of these factors are assumed to be unrelated to the effects of gravity because we expect the universe to operate in a rational manner. This rationality relies on past observations under controlled conditions using a limited number of locally relevant variables. Data selection limits what patterns can be discovered by machine learning algorithms; however, it does not follow that adding more data provides better results. Not all patterns discovered by analysis of indiscriminately collected data have meaning.

5. Tool Selection and Use

Data science makes use of many powerful tools. These tools can sort through vast amounts of data and identify relationships sometimes overlooked by the researcher. This oversight can be attributed to the sheer volume of data, but also to an unforeseen connection that has a physical basis. The tools of data science are designed to present results in the form of statistics and informative graphics. As a result, the data can be explored rapidly and represented in different forms. This flexibility hides the fact that not all tools are equally effective on all types of data. We often fall into the habit of using the tool we know best rather than taking the time to know the strengths and weaknesses of all the tools. "To a hammer everything is a nail" applies in this situation. As long as your data fits the metaphor of a nail, your hammer will give you good results. However, there are more tools in the box than just a hammer.

Another problem that arises with tool use is expecting exceptional performance and doing everything to achieve it. Neural networks are a popular tool and can be very effective at making predictions from a large number of input factors. To improve performance hidden layers and additional nodes can be added. However, this is no different than adding additional fitting parameters as discussed previously. If you train the model to predict your outcomes exactly, what will be the performance when new data requires the model to interpolate or more importantly extrapolate an outcome?

To prevent neural nets from being over-trained, data are broken into a training set and testing set. Once the model has been trained and adjusted to give good results on the training set, estimates of actual performance are determined by applying the model to the testing set. This simple procedure along with rules of best practice established by experienced practitioners help data scientists avoid unrealistic models and from having unrealistic expectations. The lesson learned is "know your tools and use sound methodology."

From press releases related to machine learning and artificial intelligence one would think that given enough data, deep learning algorithms can demonstrate intelligence comparable to that of humans. IBM's Watson's success on *Jeopardy!* makes some think that machines will one day replace the need for scientists. What is overlooked is the thousands of man hours in programming that made a system like Watson possible and the specialized methodology used that does not generalize to all problems. In addition machines that perform unsupervised learning do not operate as objective

observers. The programming, although complex and adaptive in its approach, is still linked to human conventions on how to draw conclusions. Ultimately the tool defines what you will find.

Weizenbaum describes his program ELIZA, which carries on a natural language conversation by maintaining “the illusion of understanding with so little machinery” (Weizenbaum, 1966, p. 43). He continues his evaluation by stating “the crucial test of understanding... (is)... to draw valid conclusions from what he is being told.” The same applies to unsupervised machine learning and its application to data analysis. The learning algorithm attempts to find the most important factors (minimal machinery) needed to produce reasonable outcomes (carry on a conversation). This goal can be accomplished by having the computer sort through large amounts of relevant data and, therefore, provide an invaluable service to the researcher. However, identifying factors and generating outcomes can be done without any recognition of its significance (understanding).

The evaluation of “understanding” changes depending on the researcher’s worldview. If man is assumed to be solely the product of a materialistic process as described by science, then the difference between machine and human understanding is a matter of degree. As computational speed continues to rise with a comparable decrease in cost, it seems reasonable to some transhumanists that the complexity of neural processes in the human brain can eventually be simulated. If true, then human reasoning can be trained into the machine by encoding the knowledge and decision processes of expert practitioners from a number of scientific fields. These heuristics can be enhanced through the adaptive refinement of deep learning neural networks. Some would say this is exactly what humans do; however, their conclusion is contingent on a materialistic worldview.

In reality the transhumanist vision of a technological singularity, as predicted by Ray Kurzweil (2005), is overly optimistic and inherently biased by naturalistic assumptions. Assuming technology will increase its capabilities exponentially, it is anticipated that machine cognitive abilities comparable to humans will be achieved by 2045. This underestimates the incredibly dense dendritic interconnections within the brain which provide an energy efficient means of immense information processing and storage. In addition, it is being discovered that neurons come in an increasing number of types which add to the structure and organization of the brain. Finally, it is assumed that human intelligence, although different than machine intelligence, is inherently reducible to a very complex biochemical machine.

So how should a creationist think about the role of the researcher in a world where machines automate roles previously held by humans? The answer lies in the creation of the first man, Adam. Man is made in the image of God and as such is more than the physical qualities that can be measured. We measure human intelligence, but it is a limited tool that focuses on knowledge and learned relationships. By this standard a sophisticated machine could potentially simulate man’s intelligence. Turing proposed a test whereby a machine, if able to fool a human observer, could be deemed to have intelligent behavior equivalent to a human (Turing, 1950). However, humans are not the standard for determining the

significance of humans. This is an error that has infiltrated our thinking on many levels hailing back to Protagoras, “Man is the measure of all things” (Plato 660 BCE).

God is the source of all truth and is also the one that defines the uniqueness of man above the rest of creation. Man is a worshipper and brings glory to God as he directs his activities toward God in thanksgiving. When man fell in the Garden, his worship was directed towards the creation rather than the Creator (Ro. 1:25). In addition, because mankind was not thankful, “they became futile in their thinking, and their foolish hearts were darkened” (Ro. 1:21). It is no wonder that man considers himself no more than a machine and feels he will eventually be replaced by one. But a redeemed soul is no longer in darkness (Ephesians 5:8-17) and realizes his/her rightful role in the world. As a result, the purpose of mankind is restored and this applies to the role of the researcher in the process of doing science.

Purpose, or in the words of Aristotle’s final cause, is “that for the sake of which a thing is done” (Aristotle, 350 B.C.). This ‘telos’ in man and in God’s creation has been discredited by evolutionary thinking as expressed by Mayr (1961) stating “Darwin ‘has swept out such finalistic teleology by the front door.’” However, the creationist recognizes that God’s creation is full of purpose. Although marred by the effects of sin, the creation retains its purpose of bringing glory to God (Psalm 19:1). As a result, a creationist can expose this purpose through the scientific study of the universe as an act of worship.

This connection between purpose and worship is something that can never be replaced by a machine. It is more than mathematical correlations between physical observations, which can be performed by both man and machine. A machine can cluster data based on similarities and differences. Correlations within the data can be used to infer causality and, therefore, provide the basis for developing scientific principles and laws. However, the purpose of those clusters, correlations, causes and principles transcend their pragmatic, materialistic value. Creationists are able to identify some of these purposes through God’s revealed Word. Other purposes are inferred imperfectly and hopefully tentatively until a fuller understanding develops within the framework of a comprehensive creationist model. Ultimately, this process of creation research leads to a greater appreciation for the Creator and a more effective means of serving mankind to the glory of God.

CONCLUSION

Technological advances have changed society at fundamental levels. For good and for ill, young earth creationists have been impacted by this change. On the positive side the speed of communication, volume and accuracy of collected data and the tools for analysis are unparalleled by past generations. However, to the deficit technological progress is seen to support the indomitable progress of science to explain all of reality. The vast size of the universe and unknowability at the sub-atomic scale convince many scientists that God, the Creator, could not possibly be this powerful or capable. God is dismissed, the creation is seen as the sum of reality and man is no longer unique in the physical realm.

Operating within this worldview man is seen as an advanced machination which can eventually be supplanted by a sufficiently

complex and programmed machine. When applying the metaphors and tools of our technological society, one can be deceived into thinking that man's role in the scientific endeavor is reduced in significance. However, this is far from the truth. The Uncanny Valley (Mori, 2012) is a term of increasing importance in the realm of computer animation and robotics. The "uncanny valley" is experienced when a Hollywood technological thriller or 3-D video game fails to accurately represent a human performance. As simulations of human appearance and behavior become more "lifelike," there is an increased awareness of the artificial nature of the representation. As a result, incremental improvements to human facsimiles become less pleasing and break the observer's "suspension of disbelief." It is the author's opinion that the inherent limitations of machine intelligence will become more acute as more sophisticated attempts are made to apply machine learning to the process of science.

Creationists do not need to be afraid of an increased use of artificial intelligence in science for it will ultimately demonstrate the wisdom and power of the Creator. Man has purpose in God's creation and as a result serves a special role as a steward. Stewardship is not only effectively understanding and using entrusted resources, but implementing those resources to bring increased glory to the Master. This is the role we play as we look to the future of creation research. The available data and tools lie before us. It is up to us to apply proper presuppositions, paradigms, metaphors, methods and tools to worship our Creator effectively.

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THE AUTHOR

Dr. Gollmer has served on the faculty of Cedarville University since 1994. With degrees in physics and atmospheric science he enjoys an inter-disciplinary approach to research. This has led to such diverse subjects as systems biology, climate modeling and origins studies. Preferring computer analysis over field work he has experience using Monte Carlo simulations and analyzing large data sets. Dr. Gollmer is a member of the Creation Research Society, Creation Biology Society, American Geophysical Union and the American Association of Physics Teachers.