

# Computer Origins and the Defense of the Faith

John Warwick Montgomery

In virtually all discussions of the prehistory of computing, the following names are mentioned: Ramon Lull (thirteenth century), Wilhelm Schickard (1592–1635), Blaise Pascal (1623–1662), and Charles Babbage (1791–1871). Their religious orientations, however, are rarely, if ever, discussed. This essay, based on the primary as well as authoritative secondary sources, demonstrates that all four were serious, orthodox Christian believers with strong apologetic concerns. The argument is presented that scientific genius – particularly in the computing realm – correlates positively with a sound theology and a concern to discover and present evidence for the faith. Andrew Dickson White's "warfare of science with theology" turns out to be the least satisfying category for understanding computer prehistory.

he first president of my Alma Mater, Cornell University, set an ideological trend which has been generally followed in modern times. Andrew Dickson White's *A History of the Warfare of Science with Theology in Christendom* (1896) endeavored to show that theology was the implacable foe of true science and that, in that fight to the death, science always wins in the end. In the computer sciences, a late twentieth-century monograph follows in White's wake: Geoff Simons attempts to de-theologize computing in his *Is God a Programmer? Religion in the Computer Age.*<sup>1</sup>

It therefore will come as a surprise to many that at least four of the major figures in the prehistory of modern computing were not only serious Christian believers but also directly concerned with the defense of Christian truth. The purpose of this paper is briefly to introduce readers to these individuals and to attempt to determine why computing and apologetics have been—and continue to be—natural bedfellows.

# Ramon Lull

L(l)ull—or Lullius (the Latin form of his name)—was a thirteenth-century contemporary of Thomas Aquinas. Like Aquinas, he was a theologian in what one of the Roman Church's eulogists has termed the "greatest of centuries," since it was then that the Church's enduring systematic theological formulations were developed.<sup>2</sup> But Lull was very different from Aquinas. The latter devoted his life to the systematizing of the Church's teaching, based on the philosophical principles of the Aristotelian revival in his time.<sup>3</sup> He wrote for those within the framework of western Christendom. One interpreter has observed, not unjustly, that when Thomas wrote his *Summa contra gentiles* ("Summation Against the Pagans"), he had probably never met a pagan!

Lull, on the other hand, was a polymath<sup>4</sup> who believed that theology could only be properly pursued in the context of missionary endeavor – and that new methods had to be developed to achieve results in contexts where western approaches would not carry the weight they did at home. Lull was ultimately to die a martyr for his beliefs whilst preaching the gospel to that most difficult audience, the followers of Islam. The great nineteenth-century missionary statesman Samuel M. Zwemer characterized Lull as, quite simply, the "first missionary to the Moslems."5 And, like C.S. Lewis in the twentieth century, Lull's apologetic was not just a tough-minded one; he produced (in



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his own Catalan tongue) a remarkable missionary novel, *Blanquerna*, which has been compared to Bunyan's *Pilgrim's Progress*.<sup>6</sup>

Lull's theological "Art" or method was scholastic but not Aristotelian – and its unique character has given it a place in the history of logic.<sup>7</sup> Lull is frequently mentioned by students of the prehistory of computing. Martin Gardner, in his well-received work on *Logic Machines and Diagrams*, begins with Lull and devotes to him an entire chapter of the nine comprising his book.<sup>8</sup> Gardner offers the following illustration of the Lullian method for resolving theological problems by exhaustively interrelating combinations of divine qualities:

For example, we realize that predestination and free will must be combined in some mysterious way beyond our ken; for God is both infinitely wise and infinitely just; therefore He must know every detail of the future, yet at the same time be incapable of withholding from any sinner the privilege of choosing the way of salvation. Lull considered this a demonstration "per aequiparantium," or by means of equivalent relations. Instead of connecting ideas in a cause-and-effect chain, we trace them back to a common origin. Free will and predestination sprout from equally necessary attributes of God, like two twigs growing on branches attached to the trunk of a single tree.9

Lull's approach literally became "a method for 'finding' all the possible propositions and syllogisms on any given subject and for verifying their truth or falsehood."<sup>10</sup>

Lull saw that everything could be systematically related back to God by examining how Creation was structured by the active manifestation of the divine attributes—which he called Dignities and used as the absolute principles of his Art. Examining their manifestations involved using a set of relative principles; and both sets could be visualized in combinatory diagrams ...

The most distinctive characteristic of Lull's Art is clearly its combinatory nature, which led to both the use of complex semimechanical techniques that sometimes required figures with separately revolving concentric wheels — "volvelles," in bibliographical parlance ... — and to the symbolic notation of its alphabet. These features justify its classification among the forerunners of both modern symbolic logic and computer science.



Fig. 1. The Lullian "Dignities"



**Fig. 2. Lull's Combinatory Art.** The fourth figure of the later Art: the inner wheels rotate independently, allowing all possible ternary combinations of the letters *BCDEFGHIK* to be read off.

Yet the Art can be understood correctly only when viewed in the light of Lull's primary aim: to place Christian apologetics on a rational basis for use in disputations with Muslims, for whom arguments *de auctoritate* grounded on the Old Testament—widely used by Dominicans in disputations with the Jews—carried no weight ... Lull advanced what he called necessary reasons for accepting dogmas like the Trinity and the Incarnation.<sup>11</sup>

We illustrate with but a single example of Lull's apologetic reasoning: his overarching concern to justify Trinitarian doctrine over against the Muslim refusal to accept it.<sup>12</sup> Lull poses the key question "whether there is plurality in God." To answer this he appeals to a subspecies of one of what he has earlier set forth as the "ten general questions, to which all other possible questions can be reduced," namely Question C (*Quid*? – "What Is It?"). That subspecies deals with the question:

What does the intellect have coessentially [essentially, naturally] in itself? To which one must reply that it has its correlatives, that is to say, intellectivity, intelligibility, and understanding, without which it could not exist, and would, moreover, be idle and lack nature, purpose, and repose.

Now Lull draws the inevitable logical conclusion on the original issue of plurality within the Godhead:

One should answer yes, with respect to His correlatives as exemplified in the Second Species of rule C, without which He could not have in Himself an infinite and eternal operation bonifying, magnifying, eternalizing, etc., as a result of which His dignities would be constrained and idle, which is impossible.<sup>13</sup>

What Lull is arguing here is that if God did not consist of more than one Person He could not have manifested from eternity the characteristics such as "understanding" which are essential to an intelligent being. This argument is the logical underpinning of such modern justifications of Trinitarian theology as that which we have presented in our *Tractatus Logico-Theologicus*, 3.747:

The philosophical importance of Trinitarian doctrine (three Persons in one Godhead) is often overlooked: if God is indeed love, and has always been so (even before he created other persons), he would have to be more than monopersonal.<sup>14</sup>

## Wilhelm Schickard

For Protestantism, the seventeenth century corresponded to Roman Catholicism's thirteenth: it was the great period of the Protestant dogmaticians and savants who systematized the results of the Reformation and applied those consequences to cultural life in general. The center of much of that Lutheran activity was the province of Württemberg and its university city of Tübingen. In that region, the learned theologian and littérateur Johann Valentin Andreae (1586-1654) created a "Societas Christiana" - a fellowship of likeminded believers in the sciences and the arts for the purpose of transforming society on the basis of sound, confessional Lutheran theology. Though the Thirty Years' War prevented the practical realization of Andreae's utopian dream of a "Christianopolis," that little band accomplished remarkable feats of learning and social amelioration under exceedingly difficult conditions.<sup>15</sup>

Among the leading members of the *Societas Christiana* was Wilhelm Schickard or Schickhardt (1592–1635).<sup>16</sup> Like



Fig. 3. Wilhelm Schickard (1592-1635)

Lull, Schickard was a polymath. He was an ordained Lutheran pastor with a scientific background and a knowledge of several oriental languages. He was a long-term friend of Johannes Kepler (also a member of the Andreae's *Societas*) and an early supporter of his astronomical theories. At Tübingen he held professorships in the oriental languages, astronomy, mathematics, and geodesy.

Schickard ... was a skilled mechanic, cartographer, and engraver in wood and copperplate; and he wrote treatises on Semitic studies, mathematics, astronomy, optics, meteorology, and cartography. He invented and built a working model of the first modern mechanical calculator and proposed to Kepler the development of a mechanical means of calculating ephemerides. Schickard's works on astronomy include a lunar ephemeris, observations of the comets of 1618, and descriptions of unusual solar phenomena (meteors and the transit of Mercury in 1631). He also constructed and described a teaching device consisting of a hollow sphere in three segments with the heavens represented on the inside.<sup>17</sup>

What I have written elsewhere of Schickard's friend Kepler could likewise be applied to him:

Ludwig Guenther has shown in his *Kepler und die Theologie* that this Lutheran father of modern astronomy was consistently and vitally concerned about theological issues; his desire to ground his astronomical work in the biblical revelation is evident.<sup>18</sup>



Though it has been maintained by some that Schickard is only "the principal precursor of mechanical calculation but not the inventor of the calculating machine," the general judgment is that his device was indeed the first working arithmetical calculator, and, as such, a giant step in the future development of the computer.

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Schickard's *Purim* (1634)<sup>19</sup> was an attempt of an eschatological and apologetical nature to unlock the numerical prophecies of the Book of Daniel and to develop a philosophy of history on the basis of them; the effort may remind one of Sir Robert Anderson's *The Coming Prince.*<sup>20</sup>

Though it has been maintained by some that Schickard is only "the principal precursor of mechanical calculation but not the inventor of the calculating machine,"<sup>21</sup> the general judgment is that his device was indeed the first working arithmetical calculator, and, as such, a giant step in the future development of the computer. Michael R. Williams, in his *History of Computing Technology*, takes that view.<sup>22</sup> He argues as follows: (1) Two letters from Schickard in Kepler's papers (letters of 20 September 1623 and 25 February 1624) describe the machine in very

clear terms: it consisted of eleven "complete" and six "incomplete" or "mutilated" sprocket wheels and "carries by itself from one column of tens to the next or borrows from them during subtraction. [This machine] which immediately and automatically calculates with given numbers ... adds, subtracts, multiplies and divides." (2) Though the actual machines constructed by Schickard apparently have not survived, his original sketches turned up as a bookmark in a copy of Kepler's Rudolphine Tables in the library of the Pulkovo Observatory near Leningrad. (3) On the basis of the information provided by the letters and the sketches, Professor Baron von Freytag Löringhoff of the University of Tübingen (whose specialities included a knowledge of the techniques of seventeenth-century clockmakers) was able to build a successful working model of the original device.23



Fig. 4. The Schickardian Sketches

The mechanism used to effect a carry from one digit to the next was very simple and reliable in operation ... Every time an accumulator wheel rotated through a complete turn, a single tooth would catch in an intermediate wheel and cause the next highest digit in the accumulator to be increased by one ...

The major drawback of this type of carry mechanism is the fact that the force used to effect the carry must come from the single tooth meshing with the teeth of the intermediate wheel. If the user ever wished to do the addition 999,999 + 1, it would result in a carry being propagated right through each digit of the accumulator. This would require enough force that it might well do damage to the gears on the units digit. It appears that Schickard was aware of this particular weakness because he constructed machines with only six-digit accumulators even though he knew that Kepler undoubtedly needed more figures in his astronomical work. If the numbers became larger than six digits, he provided a set of brass rings which could be slipped over the fingers of the operator's hand in order to remember how many times a carry had been propagated off the end of the accumulator.



Fig. 5. Schickard's Carry Mechanism



Fig. 6. The Tübingen Reconstruction of Schickard's Calculating Machine

A small bell rung each time such an *overflow* occurred to remind the operator to slip another ring on his finger.<sup>24</sup>

But with all its limitations, Schickard's calculating machine was a remarkable accomplishment, and one essential for the eventual development of the modern computer. At very minimum, his machine incorporated "both a set of Napier's bones and a mechanism to add up the partial products they produced in order to completely automate the multiplication process."<sup>25</sup>

#### Blaise Pascal

Schickard's invention had no direct influence, since he made no effort to promote or manufacture it. A generation later, the great French mathematician, scientist, and Christian apologist Pascal (1623–1662), apparently without any knowledge of Schickard's work, developed a similar but more sophisticated calculating machine which had an immediate impact.

Before examining it, we should remind ourselves of Pascal's ideological orientation. He was a Roman Catholic of the school of Port-Royal (the so-called Jansenists). He therefore was deeply committed to an Augustinian theology, to the point of being regarded by many as virtually Protestant in his emphasis on divine grace.<sup>26</sup>

Pascal's apologetic activity expressed itself especially in numerous fragments collected after his death. These *Pensées* or thoughts have been ordered in a number of different ways by different editors, ancient and modern, and the arrangements can give quite diverse impressions of Pascal's apologetic method.<sup>27</sup> The most effective ordering is certainly that by the English scholar H. F. Stewart, who used the *entretien*, *discours*, or lecture on apologetics given by Pascal to friends in 1658 (or the year before or the year after) as a natural structure for arranging the "thoughts."<sup>28</sup> The result shows decisively that Pascal was anything but a modern subjectivist or existentialist.

Thus, the Stewart edition of the Pensées shows that Pascal never intended his celebrated Wager to be a device to avoid objective evidence of religious truth. That Wager (arguing that even if the evidence for and against Christianity were exactly balanced, one ought still to accept Christ, since if Christianity were false, one would still benefit from the highest moral principles and example, but if true and one rejects it, one goes to hell) was to be used at an intermediate point in witnessing to a non-Christian, not as a final proof of any kind. Its purpose was to counter indifference-to give the unbeliever the maximum motivation to engage in a serious quest for religious truth. Pascal follows the Wager with arguments showing the failure of non-Christian solutions to the human dilemma and the soundness of the case for the unique, revelatory character of Jewish history in the Old Testament and for

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the prophetically anticipated, miraculous, saving activity of Jesus Christ in the New Testament—as attested by solid eyewitness testimony.<sup>29</sup>

And now to the calculating machine, called the "La Pascaline." Pascal's father Etienne was an investor, tax collector, and no mean mathematician in his own right. The tedium of assisting his father in the taxation area led Blaise, at the age of only nineteen, to design his first calculating machine.<sup>30</sup> Eventually he would produce –

and in a number of instances market—some fifty different machines, but they all were refinements of the fundamental design of the original machine.<sup>31</sup>

Pascal seems to have realized right from the start that the single-tooth gear like that used by Schickard, would not do for a general carry mechanism. The single-tooth gear works fine if the carry is only going to be propagated a few places but, if the carry has to be propagated several places along the accumu-



Fig. 7. One of the Surviving Examples of Pascal's Calculating Machine.



Fig. 8. Pascal's Calculating Machine, 1642. Length: 36 cm.

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lator, the force needed to operate the machine would be of such a magnitude that it would do damage to the delicate gear works. Pascal managed to devise a completely new mechanism that was based upon falling weights rather than a long chain of gears ...

This carry mechanism, which would have been the pride of many mechanical engineers 100 years after Pascal, eliminated any strain on the gears. However, it did have the drawback that the wheels turned in only one direction, and this meant that it was only possible to add and not to subtract with the machine ... The subtraction problem was solved by simply adding the nines complement of the required number, a process which limited the use of the machine to those with a better than average education.<sup>32</sup>

Of the Pascaline, his sister Gilberte wrote:

My brother has invented this arithmetical machine by which you can not only do calculations without the aid of counters of any kind, but even without knowing anything about the rules of arithmetic.<sup>33</sup>

Comments Georges Ifrah in his *The Universal History of Computing*:

Pascal's sister's letter perceptively foresaw the nature of the era which her brother had just inaugurated ... an era soon to be marked by the rapid development of a great variety of machines which not only eased the heavy burden of tedious and repetitive operations, but, in carrying out automatically an increasingly wide field of intellectual tasks with complete reliability, would come to replace the human being who would be able to use them without having even the slightest knowledge of the physical and mathematical laws which govern their working.<sup>34</sup>

That Pascal anticipated the philosophical issues attendant upon that "new era" is evident from the *Pensées*. He wrote:

The arithmetical machine produces effects which come closer to thought than anything which animals can do; but it can do nothing which might lead us to say that it possesses free will, as the animals have.<sup>35</sup>

To which Ifrah comments: "[This] is as true today as it was then regarding any calculator or computer."<sup>36</sup>

## Charles Babbage

The final figure to be treated here is universally regarded as the most important name prior to the twentieth century in the history of modern computer technology. Babbage's famous Engines were "the true ancestor of our modern computers."<sup>37</sup>

Charles Babbage, perhaps more than any other person, can be considered to be the grandfather of the computer age ... His ideas were so far in advance of his time that they would have fit easily into the early computer work being done by people like Konrad Zuse and Howard Aiken in the 1940s.<sup>38</sup>



Fig. 9. Pascal's Calculating Machine: Detail of the Mechanism.

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Babbage's Analytical Engine could actually store the sequence of operations to be performed on the data, thus displaying the character of a modern computer program. In Babbage's work, we see the first automatic computer conceived by humans.

The reason for this was the unique character of Babbage's "Analytical Engine": though never actually constructed, it was far more than a Schickardian or Pascalian calculator capable of storing and then manipulating data by selecting built-in operations; the Analytical Engine could actually store *the sequence of operations to be performed on the data*, thus displaying the character of a modern computer program. In Babbage's work, we see the first automatic computer conceived by humans.

Charles Babbage (1791-1871) was, like Lull, Schickard, and Pascal, "a vigorous polymath."39 The son of a well-to-do banker, he took a mathematics degree at the University of Cambridge (Trinity College) and his first scholarly contributions lay in mathematical papers and the construction of computational tables. This led to his years of work designing his "Difference" and "Analytical" Engines to automate the preparation of such tables. Constructing these engines was a task so far in advance of the mechanical skills of his day that he himself had to study the nature of manufacturing machinery and improve upon it. This in turn led to his becoming a lay specialist in economic and industrial theory and the eventual publication of his influential book, On the Economy of Machinery and Manufactures (1832).<sup>40</sup>

Babbage became one of the founders of the London Statistical Society, the Astronomical Society, and the British Association. He was elected to the Royal Society as early as 1816. From 1828 to 1839 he held his only paid position during his lifetime-that of Lucasian Professor of Mathematics at Cambridge. He obtained less than sufficient support from the government for the development of his Difference Engine No. 1 (Figure 11) and none at all for his Analytical Engine or for the Difference Engine No. 2 (Figure 12); by 1842 the government ceased entirely to support his work.41 Financial considerations were certainly the root cause of his never completing more than a portion of the Difference Engine and the fact that the Analytical Engine remained only a design. After Babbage's death, his labors were virtually forgotten until twentieth-century computer historians recognized his unparalleled genius. This was due in part to Babbage's son's having sent a small demonstration model of the calculating mechanism of Dif-



Fig. 10. Charles Babbage (1791–1871) Daguerreotype by Antoine Claudet, 1847–51. Babbage, now in his late fifties, began work in 1847 on the design of his second Difference Engine. In the King William Street studio, he and Claudet experimented during this time with photography of specimens of colors on porcelain, and Babbage sat for several portraits.

National Portrait Gallery, London

ference Engine No. 1 to Harvard University, where Howard Aiken, the computer pioneer, saw it (as far as we know) in the late 1930s.<sup>42</sup>

A "Difference Engine" is a device which accomplishes multiplication and division by the simpler process of addition, based on the fact that in a series of numbers raised to a given power the differences can be represented by single constants. Thus, for example, the products of a series of numbers squared differ by a constant factor of 2, making the results calculable by machine addition:

 $2^2 = 4$  [ "4" and  $3^2 = 9$  [ "9" differ by "5"; "9" and  $4^2 = 16$  ["16" differ by "7"; "16" and  $5^2 = 25$ ; etc. ["25" differ by "9"; etc.] (Note that the bold-face numbers -5, 7, 9, etc. – are *always* just *two* apart.)

Babbage's Difference Engine No. 1, if completed, would have required 25,000 parts, weighed several tons, and measured 8 ft. by 7 ft. by 3 ft. Trouble with his toolmaker and the high costs of construction meant that only a single portion of it was ever completed (one-seventh of the whole). That working "finished portion of the unfinished engine" may still be seen at the Science Museum, London, England. Babbage used it at his celebrated Saturday evening soirées to illustrate his argument in behalf of the genuineness of New Testament miracles such as the Resurrection of Christ (more on this below).

The Difference Engine gave Babbage an even more ambitious idea—that of the "Analytical Engine," which, however, never came to realization owing to cost projections and the refusal of the government to finance it. Like the Difference Engine, the Analytical Engine was a sophisticated decimal digital machine.

The value of a number is represented by the positions of toothed wheels with decimal numerals marked in them. Each digit position in the number has its own wheel and only discrete positions e wheels are valid representations of the numbers.<sup>43</sup>

For the Analytical Engine, Babbage prepared the most extensive set of mechanical drawings ever seen up to his time (they covered 1,000 square feet of paper)<sup>44</sup> and – going far beyond the Difference Engine, which was essentially a high-powered calculator – represented characteristics which we today would associate with full-scale computer sophistication:

- 1. an input/output unit;
- a unit for setting the machine in motion (for which Babbage did not coin a term), which transferred the numbers from one section to another in order to place them in the correct sequence: it was the machine's *control unit*;
- 3. a store, which was a numerical memory capable of storing the intermediate or final results of the calculations that had been carried out: it was the machine's *memory*, able to receive the numbers used in the calculations and store the results;
- 4. a *mill* which was designed to carry out the operations on the numbers that had been introduced into the Analytical Engine: this was the machine's *arithmetic unit*, in which numbers were combined according to the required rules — in other words it was the *processing unit* whose job it was to carry out the calculations by employing the data that had been introduced into the machine and transforming it in order to produce the desired results;
- 5. finally, a *printing device* to provide the results.<sup>45</sup>

The machine was designed to use punched cards to input data and instructions; it was capable of conditional ("if ... then") branching and looping; and it could handle seventh order polynomials, and would thus have been highly useful in finding trigonometric functions. It benefitted from fail-safe devices: pins and springs forced the wheels back into place if they got out of line and created an automatic shutdown of the machine if the problem was very severe. If one were using the machine to compute tables which did not have a constant difference (e.g., a table of logarithms), one could set it so that a bell would ring after a given number of calculations to tell the operator to reset the difference wheels for a new polynomial. The machine was even capable of computing the rational roots of certain functions – and when a function had imaginary roots the first difference bell would ring to indicate that one should stop computing and find the pair of imaginary roots by inspecting the other axles. Printing involved wheel cams acting against levers whose ends moved arms containing ten steel punches corresponding to the digits 0 to 9; these punches made impressions on a lead or copper plate, from which a stereotyped printing plate could be cast.<sup>46</sup>

Finally, in 1847–1849, Babbage planned a simpler but more elegant version of his Difference Engine No. 1 which would benefit from some of the characteristics of the Analytical Engine. This also was never constructed by Babbage but the Difference Engine No. 2 was successfully reproduced from his plans in the 1990s and the impressive results can be viewed at the Science Museum, London.

#### In sum:

Since Babbage's machine required no human intervention in the carrying-out of its sequences of operations, it thus ... synthesized the concept of an



**Fig. 11. Charles Babbage's Difference Engine No. 1 – Portion, 1832.** This portion of the engine, assembled by Joseph Clement in 1832, is the first known automatic calculator. It represents about one-seventh of the calculating mechanism of the full size engine which was not completed. The portion shown has nearly 2,000 individual parts, and is one of the finest examples of precision engineering of the time. Size: 72 x 59 x 61 cm. 1862–1889.





A "Difference Engine" is a device which accomplishes multiplication and division by the simpler process of addition, based on the fact that in a series of numbers raised to a given power the differences can be represented by single constants.

automatic sequential digital calculator with a non-cyclical automaton governed by a flexible programming system and equipped with a modifiable control unit, independent of the material structure of the corresponding internal mechanisms.

Even more importantly, Babbage defined, for the first time in history, a true precursor of today's universal computers: general-purpose analytical machines that are not specialized for solving only certain categories of problems, but are conceived to deal with a vast range of computable problems.<sup>47</sup>

Charles Babbage had a fascinating personality. He was a convinced, orthodox Christian believer with a finely tuned sense of humor. He begins his semi-autobiographical reflections with a chapter on his "Ancestry" in which he suggests that his lineage derives from Tubal-Cain, since the latter was "a great worker in iron." He says that the force of evidence is pushing him to believe that the age of humankind on the earth is far greater than Ussher's traditional chronology would put it and that "in this single instance the writings of Moses may have been misapprehended."<sup>48</sup> This, however, does not bring him to "the philosophic, but unromantic, views of our origin taken by Darwin."

As a boy, Babbage's enquiring mind led him to want to test the truths of the faith. He tells us that he once tried to get the devil to appear so as to verify what the Bible said about him—fortunately without success. Then, he writes:

I resolved that at a certain hour of a certain day I would go to a certain room in the house, and if I found the door open, I would believe in the Bible; but that if it were closed, I should conclude that it was not true. I remember well that the observation was made, but I have no recollection as to the state of the door. I presume it was found open from the circumstances that, for many years after, I was no longer troubled by doubts.



Fig. 12. Difference Engine No. 2 at the London Science Museum (reproduced by permission of the Museum).

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At Cambridge, Babbage tells us, "I came into frequent contact with the Rev. Charles Simeon, and with many of his enthusiastic disciples." Indeed, Babbage abstracted the sermons of that great evangelical divine – though sometimes altering their content in an original, scientific direction. (The "Alexander the coppersmith" of 2 Tim. 4:14 led Babbage to the isomorphous character of copper and to a teacher's reaction which Babbage describes as an "awful explosion which I decline to paint.")<sup>49</sup>

Babbage's Ninth Bridgewater Treatise shows how Babbage's speciality – machine assisted computation – can have significant apologetic relevance.

As an adult, Babbage's great apologetic contribution was his Ninth Bridgewater Treatise: A Fragment,<sup>50</sup> the circumstances of whose production need to be mentioned. The eighth Earl of Bridgewater (d. 1829) had bequeathed a princely sum to the Royal Society to encourage the creation of works "on the Power, Wisdom and Goodness of God, as manifested in the Creation," i.e., for the defense of natural theology at a time when it was being threatened by more modern geologic theories. The most impactive of the books written under this grant was William Whewell's Astronomy and General Physics. Though a serious believer, Whewell expressed the opinion that "deductive" mathematicians lacked "any authority with regard to their views of the administration of the universe; we have no reason whatever to expect from their speculations any help, when we ascend to the first cause and supreme ruler of the universe."

Whewell had unwittingly thrown down the gauntlet, and Babbage did not hesitate to pick it up. Babbage's *Ninth Bridgewater Treatise*, though indeed fragmentary (with intentional—and sometimes irritating—gaps in the text) is a decisive refutation of this viewpoint. It was a labor of love (or of love and spleen) and was never remunerated as were the eight official Bridgewater productions.<sup>51</sup> Most important, it shows how Babbage's speciality—machine assisted computation—can have significant apologetic relevance.

"If it is meant," says Babbage of Whewell's position, "that there is a 'higher region' of *evidence* than that of 'mathematical proof and physical consequence,' then it is in my opinion utterly and completely erroneous." A most valuable illustration of this point in the *Ninth Bridgewater Treatise* is Babbage's refutation of Hume's classic argument against the miraculous: chapters 10 and 11 and the extended mathematical note "E" to chapter 10 are specifically devoted to this end.

The essence of Babbage's destruction of Hume lies in the latter's inadequate understanding of probability and Babbage's masterly grasp of that mathematical concept. So important is Babbage's argument that it is reprinted in its entirety at the close of Earman's recent, comprehensive critique, *Hume's Abject Failure: The Argument Against Miracles.*<sup>52</sup>

Hume, it will be remembered, declared that it would always be more miraculous if those reporting a miracle such as the Resurrection of Christ were neither deceived nor deceiving (were actually telling the truth) than it would be if the miracle had actually occurred – for "a miracle is a violation of the laws of nature; and as a firm and unalterable experience has established these laws, the proof against a miracle from the very nature of the fact, is as entire as any argument from experience can possibly be imagined."<sup>53</sup> After quoting this passage, Babbage writes:

The word *miraculous* employed in this passage is evidently equivalent to *improbable*, although the improbability is of a very high degree.

The condition, therefore, which, it is asserted by the argument of Hume, must be fulfilled with regard to the testimony, is that the *improbability* of its falsehood must be GREATER than the *improbability* of the occurrence of the fact ...

The only sound way of trying the validity of this assertion is to *measure* the numerical value of the two improbabilities, one of which it is admitted must be greater than the other; and to ascertain whether, by making any hypothesis respecting the veracity of each witness, it is possible to fulfil that condition by any finite number of such witnesses.

Hume appears to have been but very slightly acquainted with the doctrine of probabilities.

Babbage then subjects the question to a rigorous probabilistic analysis and concludes:

Pursuing the same reasoning, the probability of the falsehood of a fact which six such independent witnesses attest is, previously to the testimony,  $1/100^{6}$  or it is, in round numbers, 1,000,000,000,000 to 1 against the falsehood of the testimony.

The improbability of the miracle of a dead man being restored, is, on the principles stated by Hume,  $1/(20 \times 100^5)$ ; or it is 200,000,000,000 to 1 against its occurrence.

It follows, then, that the chances of accidental or other independent concurrence of only *six* such



The Ninth Bridgewater Treatise ... employs the principles of Babbage's Difference Engine to make a powerful apologetic point over against the general deistic position ... that miracles are impossible because they would contradict God's original and perfect arrangement of the universe.

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independent witnesses, is already *five times* as great as the improbability against the miracle of a dead man's being restored to life, deduced from Hume's method of estimating its probability solely from experience ...

From this it results that, provided we assume that independent witnesses can be found of whose testimony it can be stated that it is more probable that it is true than that it is false, *we can always assign a number of witnesses which will, according to Hume's argument, prove the truth of a miracle.*<sup>54</sup>

The Ninth Bridgewater Treatise does not limit itself to decimating Hume's argument against the miraculous. It also employs the principles of Babbage's Difference Engine to make a powerful apologetic point over against the general deistic position—that viewpoint which sees God as little more than a "Divine Clockmaker"—that miracles are impossible because they would contradict God's original and perfect arrangement of the universe.

The object of the present chapter is to show that it is more consistent with the attributes of the Deity to look upon miracles not as deviations from the laws assigned by the Almighty for the government of matter and of mind; but as the exact fulfillment of much more extensive laws than those we suppose to exist ...

Let the reader suppose himself placed before the calculating engine, and let him again observe and ascertain, by lengthened induction, the nature of the law it is computing. Let him imagine that he has seen the changes wrought on its face during the lapse of thousands of years, and that, without one solitary exception, he has found the engine register the series of square numbers. Suppose, now, the maker of that machine to say to the observer, "I will, by moving a certain mechanism, which is invisible to you, cause the engine to make one cube number instead of a square, and then to revert to its former course of square numbers"; the observer would be inclined to attribute to him a degree of power but little superior to that which was necessary to form the original engine.

But, let the same observer, after the same lapse of time – the same amount of uninterrupted experience of the uniformity of the law of square numbers, hear the maker of the engine say to him-"The next number which shall appear on those wheels, and which you expect to find a square number, shall not be so. When the machine was originally ordered to make these calculations, I impressed on it a law, which should coincide with that of square numbers in every case, *except* the one which is now about to appear; after which no future exception can ever occur, but the unvarying law of the squares shall be pursued until the machine itself perishes from decay.

Undoubtedly the observer would ascribe a greater degree of power to the artist who had thus willed that event which he foretells at that distance of ages before its arrival.<sup>55</sup>

Atheist Geoff Simons dismisses this argument as presenting God in the guise of "celestial programmer"; it is, for him, little more than a "redraft of the ancient Teleological (design) Argument." "Babbage, like many of his contemporaries, was wedded to the 'other' world, chained to concepts and connotations fashioned in prescientific epochs."<sup>56</sup>

In point of fact, (1) there is nothing logically wrong with the Teleological Argument (particularly when formulated in terms of its foundation, the Argument from Contingency), and (2) more scientific evidence is available today than in Babbage's own time to show the soundness of Intelligent Design in the universe.<sup>57</sup> Sadly, it is those of Simons' persuasion who are living the "prescientific" dream of Naturalism, whilst Babbage stands not only as the grandfather of our computer age but also as a sound apologist for biblical truth which, like its Lord, remains the same yesterday, today, and forever.<sup>58</sup>

### Conclusion: Why the Strong Connection between Computing & Apologetics?

In 1973, a Federal District Court rightly ruled that the Sperry Rand Corporation, in spite of having created ENIAC in 1946, could not claim a patent for the electronic computer, thereby obtaining royalties on all electronic data processing from Honeywell and other competitors, since the company had not invented computers as such!<sup>59</sup> It is certainly correct that "in this history there cannot be a single invention, still less an inventor."<sup>60</sup>

We are not claiming that Lull, Schickard, Pascal, or even Babbage was *the* inventor of the computer. However, their vital contributions cannot be gainsaid. This being so, the inevitable question arises: Did they have a common motivation in engaging in their scientific work? All four of them were convinced Christian believers who, moreover, were vitally concerned with defending the truth of the "faith once delivered to the saints."

The solidity of Christian conviction on the part of [Lull, Schickard, Pascal, and Babbage] led them to a cosmic perspective in which it was natural to seek maximum generality ...

At the same time, it should be evident from the foregoing treatments of the lives of Lull, Schickard, Pascal, and Babbage that their faith was intimately connected with their intellectual endeavors. Common to all four was a serious commitment to the fundamental Christian verities: they believed that the Bible was an objectively truthful revelation from God and that Jesus Christ was no less than the God in the flesh, a miraculous Savior.

This brings us to an important *caveat*: the likelihood of engaging in serious or successful work in this field is seriously diminished if one falls into the ideological camp of the "existentialistically motivated churchmen, neo-orthodox theologians, and all those influenced by the current denigration of propositional truth, formal logic, and the subject-object distinction … The entire computer concept is founded on the law of non-contradiction: in binary computer language you must choose 'yes' or 'no' – a 'dialectic answer' is no answer at all. There are no neo-orthodox computers."<sup>62</sup>

Moreover, the solidity of Christian conviction on the part of all four of the savants we have treated led them to a cosmic perspective in which it was natural to seek maximum generality: one was not limited to a world of "blooming, buzzing confusion" (to use William James' felicitous expression) or to a universe in which the vast number of particulars (the Many) could never be integrated by way of abstract, general ideas (the One). Babbage, for example, summed up his work in the following terms: "It seems that all of the conditions that allow a finite machine to carry out an unlimited number of calculations have been fulfilled by the Analytical Engine." In other words, Babbage consciously moved from finitude to the realm of unlimited operations, and his unwavering faith in the unlimited God of the Scriptures surely predisposed him to such an endeavor.

Georges Ifrah argues that the combination of *abstraction* and *generalization* were essential to development of the modern computer.

As abstraction and generalization are closely linked, Babbage accordingly produced a sort of "algebrization" of the fundamental concepts of mechanical calculation. This led him, thanks to his obsession with the difficulties of human calculation and his realization that existing calculators were very inadequate, little by little to a desire to leave behind the great variety of specific data, and so arrive at a much larger construct that approached a universal view.<sup>63</sup>

"Constructs that approach a universal view" are far easier to appreciate when one has met the Christ of the Scriptures, since proper theology is just such a universal construct.<sup>64</sup> And defending that theology intellectually becomes part and parcel of the conviction that God has spoken both in nature and in history and that his Word is the final truth and must be demonstrated to be such.

Despite the temporal distances separating them, therefore, it is entirely sensible to find much in common as we observe Ramon Lull using his Trinitarian "wheels within wheels" to convert the lost, Wilhelm Schickard calculating the years of Daniel's prophecies, Blaise Pascal figuring not just tax receipts but also the most logical reasons to believe the gospel, and Charles Babbage working out a solid base in mathematical probability for the great miracle of Christ's Resurrection.

Are we saying that these intellectual pioneers did their scientific work solely because they were committed Christians? It is plain that native intellectual curiosity—what Aristotle at the beginning of the *Metaphysics* called human-kind's inherent "desire to know"—played a part. Babbage, for example, noted in his autobiography that as a child his "invariable question on receiving any new toy, was 'Mamma, what is inside of it?" The intellectual attainments of great mathematicians outside the faith such as Bertrand Russell or modern secularists in the computer field such as Alan Turing attest to the power of such curiosity, wholly apart from religious faith.<sup>61</sup>

#### Notes

<sup>1</sup>Geoff Simons, *Is God a Programmer? Religion in the Computer Age* (Brighton, Sussex, England: Harvester Press, 1988).

- <sup>2</sup>James J. Walsh, *Thirteenth Greatest of Centuries* (New York: Fordham University Press, 1943). Catholic Summer School Press issued this work as early as 1913, and it was reprinted by AMS Press in 1981.
- <sup>3</sup>Cf. especially the general studies of Aquinas by Etienne Gilson, A. D. Sertillanges, M. C. D'Arcy, and M. D. Chenu.
- <sup>4</sup>Lull's productivity in the widest range of fields, including medicine – was simply enormous, even after excluding the alchemical works falsely attributed to him. According to the latest catalogue, he produced 265 titles, of which 237 have survived. The *Book of Contemplation* alone contains almost a million words. A large number of Lull's writings remain unedited and in manuscript even today.
- <sup>5</sup>Samuel M. Zwemer, *Raymund Lull: First Missionary to the Moslems* (New York and London: Funk & Wagnalls, 1902). Cf. Mark D. Johnston, *The Evangelical Rhetoric of Ramon Llull: Lay Learning and Piety in the Christian West around 1300* (New York: Oxford University Press, 1996).
- <sup>6</sup>Ramon Lull, *Blanquerna: A Thirteenth Century Romance*, trans. E. Allison Peers (London: Jarrolds, n.d. [1925/1926]).
- <sup>7</sup>For example, in the (rather dismissive) treatment given to Lull in W. and M. Kneale's *The Development of Logic* (Oxford: Clarendon Press, 1964), 241–2, where, however, Lull's influence on Leibniz is at least mentioned. Carl von Prantl's older and far more comprehensive *Geschichte der Logik im Abendlande*, 4 vols. (Leipzig, 1855–1870), III:145–77, is much more informative on the details of the Lullian system.
- <sup>8</sup>Martin Gardner, *Logic Machines and Diagrams* (New York: McGraw-Hill, 1958), 1-27.

<sup>9</sup>Ibid., 12.

- <sup>10</sup>Anthony Bonner, ed. and trans., *Doctor Illuminatus: A Ramon Llull Reader* (Princeton, NJ: Princeton University Press, 1993), 294. This anthology is a shorter version of Bonner's *Selected Works of Ramon Llull* (1232–1316), 2 vols. (Princeton, NJ: Princeton University Press, 1985).
- <sup>11</sup>R. D. F. Pring-Mill, "Lull, Ramon," *Dictionary of Scientific Biography*, ed. C. C. Gillispie, 16 vols. (New York: Scribner's, 1970–1980), VIII:548–9. The accompanying diagrams have been reproduced from this article.
- <sup>12</sup>For the central place of Lull's apologetic for the Trinity in his thought, see his *De Quadratura*, originally written in Catalan and accessible in the excellent French edition titled, *Principes et questions de théologie*, ed. and trans. R. Prévost and A. Llinarès (Paris: Editions du Cerf, 1989), especially pp. 36–57, 95–9, 116–56, 246–54. Lull thoroughly integrates Trinitarian doctrine with Christology (his apologetic also covers the Incarnation, the Resurrection, and the Last Judgment).
- <sup>13</sup>Lull, *Ars brevis*, in *Opera* (Strasbourg [Argentorati]: Zetzner, 1651), 11, 41. On this influential "final" edition of Lull's works, of which I personally possess a copy, see Bonner, *Doctor Illuminatus*, 67–8. I have modified Bonner's translation at several points on the basis of the original Latin text. The bracketed words appear in the parallel passage in Lull's *Ars generalis ultima*.
- <sup>14</sup>John Warwick Montgomery, *Tractatus Logico-Theologicus* (corrected ed.; Bonn, Germany: Verlag für Kultur und Wissenschaft, 2003). Available from the Canadian Institute for Law, Theology and Public Policy: www.ciltpp.com
- <sup>15</sup>See John Warwick Montgomery, *Cross and Crucible*, 2 vols. (The Hague, Netherlands: Nijhoff [now Kluwer], 1973), 55. The Introductory Essay to this work has appeared as a journal article in the *Transactions of the Royal Society of Canada*, 4th ser., I (June 1963): 251–70, as well as in *Ambix: The Journal of the Society for the Study of Alchemy and Early Chemistry*, XI (June 1963): 65–86; and it was published in French in the *Revue d'Histoire et de Philosophie Religieuses* (1966): 323–45. See also the author's reinforcement of his argument in F. A. Janssen, ed., *Das Erbe des Christian Rosenkreuz* (Amsterdam, Netherlands: In de Pelikaan, 1988), 152–69.

<sup>16</sup>Montgomery, Cross and Crucible, I:48, 69, 144, 176–7; II:545. For biographical articles on Schickard, see the Allgemeine deutsche Biographie; Hoefer's Nouvelle Biographie Générale; and Michaud's Biographie Universelle.

<sup>17</sup>Wilbur Applebaum, "Schickhard, Wilhelm," *Dictionary of Scientific Biography*, XII:163.

<sup>18</sup>Montgomery, Cross and Crucible, I:11.

<sup>19</sup>Wilhelm Schickhard, "Purim," sive Bacchanalia Judaeorum (Tubingae: Werlin, 1634).

<sup>20</sup>On Anderson's prophetic apologetic, see John Warwick Montgomery, *The Transcendent Holmes* (Ashcroft, BC, Canada: Calabash, 2000), 129–30, 135–9; and Montgomery, "Prophecy, Eschatology and Apologetics," in his *Christ Our Advocate* (Bonn, Germany: Verlag für Kultur und Wissenschaft, 2002), 255–65, and also in David W. Baker, ed., *Looking Into the Future: Evangelical Studies in Eschatology* (Grand Rapids, MI: Baker, 2001), 362–70.

<sup>21</sup>René Taton, "Sur l'invention de la machine arithmétique," *Revue d'histoire des sciences et de leurs applications*, XVI (1963): 139–60, at 144.

<sup>22</sup>Michael R. Williams, *A History of Computing Technology*, 2d ed. (Los Alamitos, CA: IEEE Computer Society Press, 1997), 119–24. One of the illustrations to follow (that of Schickard's machine's carry mechanism) has been reproduced from this work; the others have been obtained from Walter Gerblich et al., *Herrenberg und seine Lateinschule. Zur Geschichte von Stadt und Gäu* (Herrenberg, Germany: Theodor Körner, n.d. [1962]), 176–80 (section contributed by Baron von Freytag Löringhoff).

<sup>23</sup>In 1971, West Germany issued a stamp picturing that reconstruction in honor of the 350th anniversary of Schickard's invention.

<sup>24</sup>Williams, A History of Computing Technology, 122–3.

<sup>25</sup>Ibid., 120.

<sup>26</sup>See in particular the excellent treatments of Pascal's thought by Emile Cailliet: *The Clue to Pascal* (London: S. C. M. Press, 1944), *Great Shorter Works of Pascal* (Philadelphia: Westminster Press, 1948), etc. It should be noted that, in spite of his Augustinianism, Pascal clearly distinguishes his theology from that of Calvinism, which he regards as a heresy (ibid., 136–42).

<sup>27</sup>Fortunately, there is a standard numbering of the fragments so that one can (usually, but not always!) locate a given *Pensée* regardless of which edition is being consulted.

<sup>28</sup>H. F. Stewart, *Pascal's Apology for Religion Extracted from the Pensées* (Cambridge, England: Cambridge University Press, 1942), especially pp. vii–xxiv ("Preface"). As an Appendix (pp. 203–31), Stewart gives the French texts from which the content of the *entretien* is known: "The *Discours sur les Pensées de M. Pascal* by Filleau de la Chaise compared with the Preface to the Port Royal edition by Etienne Périer."

<sup>29</sup>Theologians such as Clément Besse (*Le Pari. Avec un Discours critique* [Paris: Gabriel Beauchesne, 1922]) could have avoided much agony over the apparent illogic of the Wager had they paid more attention to the structure of Pascal's 1658 discourse.

<sup>30</sup>He says this specifically in a letter written in the year 1645; the text of this letter is given in Cailliet, *Great Shorter Works of Pascal*, 40–1.

<sup>31</sup>See Taton "Sur l'invention de la machine arithmétique"; and Jacques Payen, "Les exemples conservés de la machine de Pascal," *Revue d'histoire des sciences et de leurs applictions* XVI (1963): 161–78 (with numerous photographs).

<sup>32</sup>Williams, A History of Computing Technology, 128.

<sup>33</sup>Mme Périer, "La vie de Monsieur Pascal," in Pascal, *Oeuvres complètes*, ed. Louis Lafuma (Paris: Editions du Seuil, 1963), 19.

<sup>34</sup>Georges Ifrah, *The Universal History of Computing*, trans. and ed. E. F. Harding (New York: John Wiley, 2001), 123–4. It was therefore not without reason that Swiss computer expert Niklaus Wirth named his immensely influential programming language "Pascal."

<sup>35</sup>"La machine d'arithmétique fait des effets qui approchent plus de la pensée que tout ce que font les animaux; mais elle ne fait rien qui puisse faire dire qu'elle a de la volonté, comme les animaux" – Pascal, *Pensées*, 4th ed., 2 vols., ed. Ernest Havet (Paris: Ch. Delagrave, 1887), II:118. <sup>36</sup>Ifrah, *The Universal History of Computing*, 122. The example of the Pascaline shown here may be seen in the Musée des Arts et Métiers in Paris, where there is also a working reproduction which can be tried by visitors to the museum. Cf. *De la machine à calculer dePascal à l'ordinateur [exposition du 26 avril au 23 septembre 1990]* (Paris: Musée National des Techniques, CNAM, 1990).

<sup>37</sup>Ifrah, The Universal History of Computing, 245.

- <sup>38</sup>Williams, A History of Computing Technology, 154.
- <sup>39</sup>"General Introduction," *The Works of Charles Babbage*, 11 vols., ed.
- Martin Campbell-Kelly (London: William Pickering, 1989), I:14. <sup>40</sup>This book constitutes Vol. VIII of Babbage's *Works*, ed. Campbell-Kelly.
- <sup>41</sup>In fairness to Disraeli, the Chancellor of the Exchequer, it should be pointed out that the government's subsidy to Babbage before payments to him ceased was over twenty times what the Crown paid for Robert Stephenson's steam locomotive, the *John Bull*. In his autobiographical *Passages from the Life of a Philosopher (Works,* XI:97–111), Babbage shows that he could never excuse the government's cessation of interest in his projects. His machine, after all, could readily "calculate the millions the ex-Chancellor of the Exchequer squandered"!

<sup>42</sup>Doron Swade, *Charles Babbage and His Calculating Engines* (London: Science Museum, 1991), 36 (with excellent bibliography of primary and secondary materials on Babbage's work).

<sup>43</sup>Ibid., 32. The illustrations below are reproduced from this publication (credit: Science Museum/Science & Society Picture Library).

<sup>44</sup>Thirteen plates or sectional plans for the Engine may be seen in the Campbell-Kelly edition of Babbage's *Works*, III:239–53.

<sup>45</sup>Ifrah, The Universal History of Computing, 191.

<sup>46</sup>The London Museum of Science version of the Engine, though 10 ft. long and 6 ft. high and containing 4,000 parts, does not include the printing unit, which was omitted for cost considerations.

<sup>47</sup>Ifrah, *The Universal History of Computing*, 191–2.

<sup>48</sup>In his *Ninth Bridgewater Treatise*, chaps. 4–5, Babbage speaks to this point *in extenso*.

- <sup>49</sup>Babbage, "Passages from the Life of a Philosopher," chaps. 2-3, Works, XI:7-24.
- <sup>50</sup>The 2d ed. comprising Vol. IX of Babbage's *Works*, ed. by Campbell-Kelly. The *Ninth Bridgewater Treatise* was widely read both in England and in America. I have in my personal library a copy of the Philadelphia printing by Lea & Blanchard (1841), which follows the 2d London edition.

<sup>51</sup>For the list, see the editor's preface to Babbage's Works, IX:6–7.

<sup>52</sup>John Earman, *Hume's Abject Failure: The Argument Against Miracles* (New York: Oxford University Press, 2000), 203–12; Earman's mathematical analysis of Babbage's case is given on pp. 54–6. See also Montgomery, *Tractatus Logico-Theologicus*, 3.67 and subpropositions.

<sup>53</sup>David Hume, Enquiry concerning Human Understanding, sec. X.

<sup>54</sup>Ninth Bridgewater Treatise, in Works, IX:122–7 (Babbage's italics). In his more comprehensive mathematical demonstration in Note E to chap. 10 (pp. 201–3), Babbage states the italicized conclusion in a slightly different way: "If independent witnesses can be found, who speak truth more frequently than falsehood, it is ALWAYS possible to assign a number of independent witnesses, the improbability of the falsehood of whose concurring testimony shall be greater than that of the improbability of the miracle itself."

<sup>55</sup>Ibid., 92–7.

<sup>56</sup>Simons, Is God a Programmer? 3, 78.

<sup>57</sup>Montgomery, Tractatus Logico-Theologicus, 3.8.

<sup>58</sup>Significantly, Babbage concludes his Ninth Bridgewater Treatise with a quotation from Anglican Archbishop Whately, the great nineteenth-century orthodox Christian apologist who wrote a devastating satire against Hume, Historic Doubts Relative to Napoleon Bonaparte, and an equally trenchant decimation of Deistic and skeptical historical criticism of the Old Testament, Historic Certainties Respecting the Early History of America. Cf. Craig Parton, ed., Richard Whately: A Man for All Seasons (Edmonton, AB, Canada: Canadian Institute for Law, Theology and Public Policy, 1997). <sup>59</sup>Bizarrely, however, the judge attributed the invention to a pair of researchers at Iowa State University – whose work was on a very basic device lacking even the structure of an analytical calculator. See Alice Rowe Burks, *Who Invented the Computer? The Legal Battle That Changed Computing History* (Amherst: Prometheus Books, 2003).
 <sup>60</sup>Ifrah, *The Universal History of Computing*, 283.

<sup>61</sup>However, unfaith cries out for explanation, since Scripture tells us that it is the "fool" who says that there is no God and that there are "many infallible proofs" of the truth of Christ's claims. Serious scholarly work needs to be done on what R. C. Sproul has termed in a book title (but hardly touched on academically), *The Psychology of Atheism* (Minneapolis: Bethany, 1974). The need for such research is particularly evident when one reads in the first volume of Bertrand Russell's autobiography the details of the bizarre anti-religious upbringing he received as a young child.

<sup>62</sup>Montgomery, Computers, Cultural Change and the Christ [trilingual: English, French, German] (Wayne, NJ: Christian Research Institute, 1969; now available from the Canadian Institute for Law, Theology and Public Policy, Edmonton, AB, Canada: www.ciltpp.com), 15. Cf. Montgomery, "Automating Apologetics in Austria," Christianity Today (November 8, 1968) – abridged in the International Christian Broadcasters Bulletin (January 1969).
<sup>63</sup>Ifrah, The Universal History of Computing, 246–7.

<sup>64</sup>Montgomery, "The Theologian's Craft: A Discussion of Theory Formation and Theory Testing in Theology," in his *The Suicide of Christian Theology*, 2d ed. (Newburgh, IN: Trinity Press, 1998), 267–313; also published in the *Concordia Theological Monthly* (February 1966), and in the *Journal of the American Scientific Affiliation* (September 1966).

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