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Odd Bedfellows? Churchly Employment of Science and Technology

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Abstract: Although there are exceptions, the church has generally used both science and advances in technology seamlessly to spread the Gospel and promote the Word of God more generally. This article explains this through several examples: the use of technology in spreading information through visual art and architecture, and eventually printing; the use of science to affect the world view and argue for who was right, given the evidence from the creation, particularly in the structure of the solar system; the use of science to prove that there was logic and order to the creation, supported by a mathematical foundation. In addition, the article briefly touches on other topics such as education, healthcare, and other areas the church has used to carry out its work and foster its message, that also support science and technology.

"Science, Technology, and the Church" seems like a subject that might involve much controversy and many contradictions. Certainly one can point to areas of dispute, both between the church and these outside disciplines, as well as within the church on the matters that are sometimes at issue. As has often been said, "The squeaky wheel gets the grease"; and so these contradictions might be seen too prominently. Could there not perhaps also be areas that should draw our attention, in which the church, science, and technology have worked harmoniously and seamlessly with one another, particularly in the church's adoption of science and technology in its daily practice, as well as in its promotion of science through its fostering of education?

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This article will explore several examples of situations in which the church enthusiastically adopted findings of science or advances in technology, including cases in which such adoption made a difference between surviving and not surviving. In some cases, flexibility in the use of new technologies was a boon. For example, it allowed parachurch organizations to accomplish tasks that had been hindered by entrenched church bureaucracies and traditional solutions and practices. In pursuit of these points, I have chosen the following subtopics:

- Information science and the preservation of ideas—stained glass, Gutenberg, the power of the printing press, and the survival of dissenters.
- Science and technology as disruptor and enhancer of church authority—Copernicus and the Lutherans who spread his work.
- Science and technology as witness to order in God's Creation—Kepler, Newton, and the role of mathematical modeling in ratifying an orderly universe and God.

The second and third topics will be handled together and treated broadly in the form of an essay. Given the space limitations, it will also be something of a cook's tour.

First, what might be said about the preservation and dissemination of ideas and how the church used technology, even early on? One factor not taken seriously enough by people living in Western culture today is that most of the people within the church for most of the time it has been in existence could neither read nor write. If they were literate, for the vast majority, it was at only the most basic level.[1] Of course, this led to a more highly developed ability to memorize, in some cases to commit complex poetry to memory in one hearing; but not everything was reduced to poetry, nor was every book readily available in the language of the people. Until the development by Gutenberg of the movable type printing press (at least in the West) in the 1440s, all books and documents were painstakingly hand copied. Furthermore, in order to ensure that some people could read the few documents available, a more or less universal language among literate scholars was employed—Latin. It was the language of the Vulgate Bible (although when Jerome translated the Vulgate, it was simply the language of the people), and it allowed at least someone (usually the priest) in most locales to understand what the Bible said and to translate and interpret it for others.

However, the inability to read presented a problem for the people and their literacy in God's Word. The church solved this problem through the use of technology, specifically through the use of elaborate depictions in stained glass and other visual arts. Tremendous technological problems had to be overcome to make stained glass windows in the medieval period. First there were chemical problems with getting the vibrant colors into the basically clear silica (sand) that the glass was made of. Second, as all glass was blown at the time (there was no plate glass) and therefore curved, the matrix of the glass in the window, along with its lead framework to mount the individual pieces, was quite complex and heavy. The glass

had to be broken up into quite small pieces to appear flat, and so the framework had to be thin yet strong to allow the colors to predominate and keep the windows relatively light.

Furthermore, there was the problem of mounting the windows, which in some cases were more than 33 feet high, involving the use of precise technology and mathematics. In fact, the whole transition in the twelfth and thirteenth centuries from the relatively short (usually 40 to 50 feet) Romanesque style of cathedral, in which the weight of the walls and roof were borne on the stone walls' own structure, to the Gothic with its transfer of weight of the roof to flying buttresses and the cathedrals' attendant dramatic increase in height, to about 150 feet in some cases, presented a major scientific and technological challenge that the church enthusiastically embraced.

In addition, the Romanesque style required thick walls and small windows, leaving the interior dark, while the Gothic afforded the opportunity for large portions of the walls to be made up of windows, creating a bright and airy interior infused by a riot of light and color.

Patterned stained glass windows told the stories of the Bible, a book many of the people could neither read nor understand. Here were depicted the major sins and the grace of Christ with His sacrifice on the cross. Here was the Trinity, both in symbol and in depiction. Here were the patriarchs and the apostles, as well as prominent saints of the church. And to add to the stained glass, there were statuary and altarpieces, sometimes with changeable art, dramatically telling the seasons of the church and its major figures and events.

Printing, with its expanded audience, different parameters of copying error, and economy of scale, would soon make much clearer the message of the church. Gutenberg's first significant project on his printing press was a Latin Vulgate Bible, with the first copies coming out in 1454 or 1455. God's Word would be beautifully reproduced, and what a wonderful print job it was! The pages were clear and the text was carefully checked for errors. Here was a Bible, in its approximately two hundred initial copies, that more people could begin to afford and read.[2]

Printing was more precise in that, once a text had been carefully checked for errors, relatively error-free text was then reproduced many times. However, a new kind of hazard also crept in; for if an error were reproduced, it was then replicated many times. Printing also became somewhat controversial. As long as it was under the control of the authorities and the documents that they approved of were reproduced, everything was fine. However, there were also economic factors in printing, as well as subject matter in conflict with established authorities, such that ideas not approved by authorities were reproduced and spread in ways that were significantly amplified and uncontrolled when compared to previous times.

It could be stated, for example, that without the printing press there would have been no Reformation, or at least it would have assumed a quite different form and progress from what occurred. Ideas popular with the people or held by the Reformers, but in conflict with the papacy and authorities, could nonetheless be spread abroad. It was much more difficult to suppress what the authorities considered heresy when it was reproduced so easily, a problem Martin Luther himself also encountered with those of different visions of Reformation than his own, as in the cases of Andreas Carlstadt or Thomas Müntzer.

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Desiderius Erasmus, the chief Renaissance humanist figure and scholar of Luther's day, once he found out that his press had published one of the Reformer's pieces, saw to it that they would publish no further works by Luther. Following his return from the Wartburg, Luther, in turn, would see that the writings of Carlstadt received the same banned treatment in Wittenberg.

The papacy also had problems with the press in Luther's Germany. When the papal emissaries wished to publish the bull of excommunication against Luther in 1520, it took them four months to find a willing publisher, for the Reformer was so popular (and profitable). Finally, in desperation, they set up their own press in the territory to get the job done. Their comment in their report on the matter was telling. When asked about the delay they replied, "Nine tenths of the people favor Luther, the last tenth despise the Pope." As a result, rather than having only two months to deliberate his excommunication, as stated in the original document, Luther actually received six months.

Certainly the press played a role in the survival of reformers and their ideas, but it had a further salutary effect. It encouraged literacy, particularly in the vernacular languages of the people. Because of the relative cheapness of printed documents, the Reformers and others began to see the advantages of a literate population, attuned to God's Word in their own language. After all, Latin was not the original language of the Bible, and so why not produce Bibles in German, English, and other languages, now made economically possible?

This in turn would foster an educated and enlightened laity, capable of differentiating between the truth of God's Word and critical errors. The Reformation and later the Counterreformation placed a tremendous premium on learning and

literacy, in the one case to defend doctrine from the text of Scripture, in the other the teaching of the Catholic Church that depended more on a blend of tradition and Scripture. Literacy contributed to a rise in individualism and general learning and would lead to the contributions of both Pietism and the Enlightenment.

Of course, this tradition of information spreading continues in the church, as it tends to innovate in this area without much friction. Hymnals, worship programs, newsletters, tracts, publishing houses, and real time projection of worship are all further examples of innovation in this area.

A second example of how science and technology were adopted and used by the church is found in the struggles that arose as a result of the heliocentric theories of Copernicus. As the topics are difficult to separate without telling the story twice, I will also deal with the third topic in this section—the notion of science and technology as establishing mathematical models that ratified an orderly universe made by God. Here we see one side or the other using knowledge to foster its point of view, or to undermine the point of view of those in opposition to them, or sometimes to undermine their own position in opposing the patently obvious, when there was no scriptural reason to do so. Here there were deeper presuppositions at stake, including the central role of mankind in the universe and the fixity of the Earth in the cosmos. If the Earth were not the center of the solar system and universe, what then was special in the eyes of God about the men and women who inhabited the planet?

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Nicholas Copernicus was a Polish Catholic thinker who introduced the heliocentric theory of the cosmos to the Europe of the day. He had arrived at the idea that the Sun was the center of the universe some thirty years before he published it at a time when he was close to death in 1543. The problem with the sky from an observational standpoint was not the stars, which moved steadily over the course of the year to return to their original positions and provided a comfortingly stable background. It was rather the planets, those pesky wanderers, that were at issue.

Had the planets proceeded smoothly against the background of stars, there would have been no real problem explaining their movements through the then current theory that the Earth was the center of the universe; however, they occasionally and apparently unpredictably reversed their motion against the stars, and often at irregular speeds, something called retrogression. And this was true of only certain planets: Mars, Jupiter, and Saturn.[3] Mercury and Venus were also

difficult to explain, but did not show the same kind of apparent retrograde motion, instead moving back and forth across the sky in close proximity to the Sun.

With the Earth at the center of things, the motion of the Sun and the background stars were easily explained, as if they were mounted on two crystalline spheres. This neo-Platonic system of spheres was designed to create an elegant solution to the need for an orderly universe, based on the perfected form of the sphere. And yet it became more and more complicated as observation became more precise, a trend disturbing to those who sought order in the universe.

Copernicus' solution was simpler and more elegant. He stated that the planets, including the Earth, revolved around the Sun in circular orbits at different distances, and that the Earth turned on its axis. The Moon orbited the Earth, about every 28 days. Mercury and Venus, with orbits within and faster than the orbit of Earth, always were found near the Sun and so were always seen near sunrise or sunset. Furthermore, they did not reverse direction in the normal way of the outer planets, as they were always moving faster than Earth and always within its orbit.[4] Mars, Jupiter, and Saturn were outside the orbit of the Earth; and so when the Earth was catching up to them, they appeared to move backwards against the sky. When the Earth was moving opposite them, on the other side of the Sun, for example, they appeared to move forward. Of course, there was a small problem that would be soon revealed about this system as well. It still depended on circles inscribed in spheres. The planets' motion was in fact slightly elliptical.

But it was not the Catholics who advanced Copernicus' theories; it was rather the Lutherans at Wittenberg and elsewhere whose point of view on Creation advanced the notion that the universe was one of natural order that could be explained by elegant and orderly mathematics. In a certain sense, this amounted to an attack on the scientific works of Aristotle, particularly his *Physics*, a move that would have been approved by the Renaissance humanists, including Luther himself in his early career,[5] among the Reformers.

Andreas Osiander, the Lutheran theologian and controversialist, contributed the preface to the publication of Copernicus' theory and saw to it that it received attention. Philip Melanchthon adopted Copernicus' view early on, but with modifications. He did not so much adopt the naturalist theories presented but rather left the power to accomplish such things to the unseen work of God.

The new heliocentric theory was also used to teach mathematics at Wittenberg. Out of this curriculum came Tycho Brahe, who considerably advanced the observational precision of the measurement of planetary motion, and Johannes Kepler, who provided a somewhat flawed mathematical proof for heliocentrism, that nonetheless balanced out. He correctly employed elliptical orbits, with the Sun at one focus of the ellipse, and explained the differing speed of the planets in their orbits by positing that they moved more rapidly when closer to the Sun and more slowly when

further away along their ellipse.[6] This mathematical constancy worked well with the Lutheran view of the First Article of the Creed and left-hand kingdom theology of consistent natural order and would also have worked well with the order appreciated by Calvinists as well.

Kepler corresponded with Galileo Galilei, a Roman Catholic, who also admitted to being a Copernican, and who, with his new telescope, contributed observational evidence of the new model (phases of Venus and moons of Jupiter), as well as experiments with gravity (lighter and heavier objects fall at the same rate in a vacuum) in its support. When Galileo attempted to use Scripture to justify his conclusions, he was ordered not to write on Copernicus' views again. It was this introduction of Scripture to the arena of controversy that caused the Catholic Church's reaction and subsequent condemnation of the scientist. In other words, as long as his research remained in the realm of nature, his theories were considered acceptable, perhaps even laudable; but the use and interpretation of Scripture by a layperson was too Lutheran a move and resulted in his subsequent condemnation, inquisition, and trial on the matter by Catholic authorities.

Eventually, it would be Sir Isaac Newton who more harmoniously brought together religious, cosmological, and mathematical views in his laws of motion, with a model more thorough going and appealing to the burgeoning Enlightenment position that there were natural laws established by God that the creation followed. Subsequent generations often were of the opinion that science could advance just fine apart from theology and that the mathematical modeling stood quite elegantly autonomously, without the need to introduce religion or God.[7]

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Here we can see how science and technology contributed to the establishment of competing world views by different church bodies, and the eventual condemnation of one of these views by Roman Catholicism, leading to the house arrest of one of the great minds of science, Galileo. Heliocentrism was promoted by some, notably Lutherans and other Protestants, eventually leading to a perceived threat to the Catholic authorities through the scriptural edits of Galileo and what eventually would be a more mechanistic view from Newton.

These changes in turn allowed for a divorce of scientific and theological perspectives during and following the Enlightenment. Of course, one can also see in these examples the work of various figures to establish order in the universe through mathematical modeling. Until the Enlightenment enshrined the individual and in

some cases pushed God off to the side, a secondary purpose of this modeling (besides supporting the theory in question) was to provide evidence of an orderly universe of elegant consistency that must have had a personal Creator—God.

I have explored a couple of prominent examples of how the church made use of science and technology, both for the establishment of its own positions and for the spread of the Word and the Gospel of Christ. Other avenues of adoption of science and technology by the church could also be readily explored. For example, the church was indirectly responsible for much of the advancement of science, as it founded the universities and hospitals where many of its practices and discoveries were established.

Parachurch organizations also played a prominent role in the adoption of technological advances; mission societies often used the latest advances in moving their work forward. Catholic nuns and Lutheran deaconesses were often trained as nurses, compassionately bringing antiseptic practices and individualized care to bear on the sick and dying. Groups like the Red Cross, founded by Clara Barton, provided more adequate care for the sick and dying on the battlefield and on the home front. Electronic sound amplification was quickly adopted by others so that the Word of God might be spread, not to mention the significant roles of radio and television with their ability to reach many to expand ministry by churches adaptable enough to have a vision for what could be done with these new media.

Just because there is some antipathy on the part of some Christians to some aspects of science should not blind people to the significant use the church has made of the knowledge, discipline, and products of science's general endeavors.

Individual Christians turned the assets gained from secular developments in technology and science into contributions to Christian causes, both at home and overseas. John D. Rockefeller, for example, spent much of his early career giving away money to causes of Christian universities, as well as to outreach overseas; others created foundations that supported both civic society and Christian causes. Many other examples of the ready adoption of technology and science in the advance of the cause of the Gospel could be adduced.

Just because there is some antipathy on the part of some Christians to some aspects of science should not blind people to the significant use the church has made of the knowledge, discipline, and products of science's general endeavors. Who could envision a situation where the church would not use the fruits of aerodynamics to fly missionaries overseas, or of the internet to maintain communications with them? It will be essential to the advancement of Christ's church that it continue to be

open to adopting appropriate and applicable advances in science and technology in its work of proclaiming the Gospel.

Endnotes

[1] I think this is forgotten today when we consider some Majority World missions as well as people within our own congregations who may be functionally illiterate due to poor vision, or just being too young or uneducated to read. Traditional liturgies used to compensate for this by repetition, which people could then use to memorize what was said and in that way participate.
[2] Two hundred or so copies may not seem like very many, but there were soon imitators and Bibles in Latin became more readily available.
[3] Uranus, Neptune, and Pluto would not be discovered for some time to come, and so they are not discussed here; but they would have had the same general issues of retrogression, at least in the case of Uranus and Neptune. The case of Pluto is more complex, as it does not lie on the same plane in space as the other planets and has a much more pronounced elliptical orbit, sometimes coming nearer the Sun than Neptune. There has been recent controversy about Pluto, and it is currently demoted to a sort of sub planet status.
[4] They do appear to reverse direction as they move back and forth near the Sun, but this does not look the same as typical retrogression.
[5] Renaissance humanists were completely different from the later secular humanists who arose out of the Enlightenment. The former were concerned with the study and spread of the nobility and the values and rhetorical practices of classical antiquity; they were also invariably practicing Christians, most of whom were serious about their faith. Secular humanism makes God at best optional and in many cases simply enthrones mankind and individuals, leading to agnostic and atheistic points of view.
[6] The equality and order of their motion were explained through the equal areas their paths took up per unit of time, when considered from the standpoint of the object compared to the focus of the ellipse that they orbited around. In other words, to get the same size area wedge in orbit per unit time, faster motion along its orbital path would be required when it was closer to its focus, slower motion when it was further away.
[7] I am indebted for confirmation of some of the detail in this section to the online article by Edwin Rose, "How important was religious affiliation to the reception of the Copernican account of the universe in the sixteenth and seventeenth centuries?" written for *Athens to Los Alamos: Science in the Ancient and Modern Worlds (HIH-260)*. Accessed September 2, 2016. http://gorffennol.swansea.ac.uk/wp-content/uploads/2014/09/Edwin-Rose-How-important-was-religious-affiliation1.pdf.