Wayne Pafko

History of Technology 1712

Midterm Question #2

Section 2

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Art, Science, and Technology

Introduction:

The Renaissance was a product of the social and technological changes occurring during the Middle Ages. Yet, despite this continuity the Renaissance represented something entirely new. It represented a phase change in the human experience which is evident in the art, science, and technology of the period. Individuals such as: Michelangelo Buonarrotti (1474-1564), Raphael (Raffelo Sanzio, 1483-1520), Andrea Verrocchio (1432-1488), Filippo Brunelleschi (1377-1446), Leon Battista Alberti (1404-1472), and Leonardo da Vinci (1452-1519) became known as "Renaissance Men." This is because these individuals, and many like them, excelled in all aspects of human understanding including art, science, and technology. In no other time have these three areas of the human experience been so obviously intertwined, and interdependent. The following discussion explores some of the relationships between art, science, and technology in the Renaissance.

Linear Perspective:

Europe got its first taste of perspective when Filippo Brunelleschi produced a perspective painting of the Florentine Baptistery (Burke, p.72). Brunelleschi, just as his good friend Leon Battista Alberti, was a "Renaissance Man." Brunelleschi was a sculptor, architect, engineer, and scientist, and inventor. He delved into optics, and Ptolemy's Geography (Layton, p.25). Alberti explored art, humanism, philosophy, mathematics, geometry, mechanics, music, economics, law, poetry, and architecture. He also revolutionized surveying, and wrote a work on Mathematical Games, which was later used by Galileo (Layton, p.32). It was Alberti that published the concept of linear perspective which radically altered art, science, and technology for all time.

Linear perspective changed art and the way the universe was viewed. Before this time figures had been painted with their sizes being proportional to their spiritual worth (for example; small sinners, big bishops, huge angels, enormous churches, and a gigantic Jesus). With linear perspective, figures and objects were painted with their true relative sizes. Suddenly viewing the world as it really was (very scientific), started replacing a religious interpretation of everything.

This new view of the world was enhanced with the rise of merchants, and the decline of the clergy. Wealthy merchants, and other secular powers, sponsored all manner of artistic expression during the Renaissance. Michelangelo, Raphael, and Leonardo all fall into this broad category. Whether or not linear perspective could trace its origins to the growing secular power is difficult to say, but it certainly resulted in the same humanistic, mathematical, and non-religious view of the world.

Being able to exactly replicate real world objects had immediate implications for technology and science. People began to think of objects proportionally and three dimensionally. Now the world could be described with mathematics. The mastering of spatial relationships allowed advances in the technology of architecture. Buildings could be modeled before being produced. Engineering, and science now had a mathematical basis. It is no coincidence that the Florence Cathedral, unequaled in engineering and architecture, was designed by Brunelleschi, the founder of linear perspective.

The artistic aspect of architecture was also altered by linear perspective. A new type of Renaissance church was developed using the principles of linear perspective to focus attention on the altar. Also buildings such as the S. Maria Novella, made by Alberti, were produced using the ideas of proportions, and ratios (Burke, p.82). Order had entered into city planning, as was evident in the new town planning found in the geometric fortresses of the time.

Cartography, and surveying also received a major boost with linear perspective. When combined with Ptolemy's Geography it could be seen how a round world could be mapped on a flat surface. The world was placed on a grid (just as a grid was used to get all the sizes correct in the painting of a scene) revolutionizing map making, and surveying.

Cannon and Military Engineering:

Cannon and military engineering also show the deep connectivity of art, science, and technology. Early cannon were endowed with elaborate artwork and sculpture. They were as much works of art, as weapons of destruction. The need for new military fortifications to combat cannon, resulted in changes in architectural style. The fortresses had to be engineered with thick low walls, and with cannon embankments built for mutual support. This resulted in a new artistic form of cities with radial streets, for quick reinforcement, and symmetrical designs.

Science was also coupled with the technology of cannon, and military engineering. Galileo Galilei (1564-1642) performed much work on ballistics, and even produced a gunners compass (Layton, p.84). Ballistics no doubt influenced his work on parabolic projectile trajectories, and the law of fall (thereby directly contributing to science). Galileo also did work on the strength of beams and materials, the pendulum clock, principles of inertia, and invented a thermoscope which latter became the barometer and thermometer. Galileo had been influenced by the work of Alberti (he read Mathematical Games), and so we even see a connection between linear perspective (or at least the mathematical concept of nature) and the work of Galileo.

Leonardo Da Vinci earned his living as a military engineer. His fame is however due to his few paintings (done with linear perspective), and his brilliant notebooks. Leonardo delved into art, hydraulics, chemistry, clockwork, anatomy, physiology, medical science, nature, mathematics, and many more subjects (Layton, p.35-36). He was influenced by linear perspective, and created exploded diagrams of some of his inventions. Leonardo also developed a miter-gate canal lock, and pointed towards a vast power revolution which was to be realized in the Industrial Revolution.

Another individual associated with military technology, but who effected other areas of science was Benjamin Robins. He used both experiment and theory to advance ballistics. He made a ballistic pendulum to measure the muzzle velocity of firearms, then developed numerical methods to solve (approximate) the scientific equations associated with resistive forces such as air resistance (Layton, p.94). He then used his scientific results to give suggestions on how the technology could be improved (caranades). Here we see science influencing technology. Others, such as the French, adapted his work to the resistance of water and used it to produce faster war ships.

Yet, despite his great accomplishments, Robins had just extended Newton's work on the subject of motion in a resisting medium. Newton held a mathematical view of the universe. This, along with his great aptitude for mathematics, had led him to develop his three laws of motion, make advances in optics, discover the differential and integral calculus, and essentially define our view of the universe.

Although individuals were beginning to become more specialized then their "Renaissance Man" counterparts, scientists, engineers, and artists still had a dramatic influence upon each others work. Military engineering and cannon therefore reveal the coupling of art, science, and technology.

Instruments and Inanimate Power:

The Renaissance also saw a drastic increase in the use of inanimate power. The water wheels, and wind mills of this age brought up questions of gearing and power transfer. Advances in these technologies in turn led to more efficient power generation, which led to the systematic scientific explorations of such concepts of work, power, and energy. Aerodynamic principles were applied to wind mill blades, vastly increasing performance. Instruments, such as the telescope, dramatically altered our place in the universe, and advanced science. Another piece of technology, the spinning wheel, led to textile industries, which started using dyes, which advanced the science of chemistry, which led to many additional technologies. Here we see science and technology contributing to each other.

The scientific instruments of the Renaissance (which themselves could be viewed as technology) were produced by skilled craftsmen. Their work was almost artistic in nature. The instruments of the time period often look more like works of art, than instruments of science. Clocks, which were vital to scientific discovery, were placed in massive towers and given moving figurines. Certainly, the clockwork in cathedrals takes on an artistic nature. These scientific instruments also aided navigation, and cartography.

The advances in mechanical gearing, and power transfer contributed to the mechanical and mathematical view of nature (just as linear perspective). The human body was thought of as a machine, and the solar system a gigantic clock. Many of these revolutionary concepts are still evident today.

Printing:

The Guttenberg Printing Press represents another union of art, science, and technology. This system of printing (which allowed one mold to make all of the standardized reusable metal type, and utilizing an easily available screw press) was a supreme piece of technology. It allowed the mass production of cheap books, and pamphlets.

This information explosion helped to spread scientific texts across Europe, enabling the diffusion of scientific ideas. It also encouraged accuracy as a work could be read by individuals more knowledgeable on the subject than the author. Another aspect of its aid to the scientific community was by encouraging scientific debate, something which is vital if science is to make progress.

Artwork could also be spread rapidly with the Printing Press. Scientific drawings (an aspect of both art and science) eased the understanding of difficult concepts. Advertising, and the artwork which supports it, was also born. For the illiterate a printed picture was worth a "thousand words." The printing press was viewed by the "Renaissance Man" as a work of supreme ingenuity, and was often pointed to when arguing the superiority of the "modern" civilization with respect to that of the Greeks, or the Romans. The printing press was surely a supreme technical feat, which brought together art, science, and technology.

Conclusions:

After examining the interrelationships of art, science, and technology in the Renaissance it is impossible to have a deterministic attitude of history. It is inaccurate to say that any given event was the exclusive result of an individual or action. This is because of the closely dependent relationships of many variables. Technology did not develop in a vacuum, but was instead influenced by the art and science of the Renaissance. The same statement can be made for both art and science.

With today's intense specialization in different fields, we think of art, science, and technology as separate independent entities. Yet, this is no more true now, than it was in the past. Experiment and Theory are as interdependent as they were in the days of Robins. Scientific drawings are as essential to understanding as they were after Brunelleschi's invention of perspective drawing. The lines between architecture and engineering are as blurred as ever. Even new technologies such as the automobile combine all aspects of art, science, and technology with form, function, and safety.

To the "Renaissance Man" there was no blurring of art, science, and technology. He utilized all aspects of each, and by doing so was able to change mankind's view of itself. We now look to the future, instead of the past, for answers. We hold onto the idea of progress which developed in the Renaissance. Nature is no longer explained by religious concepts which give little insight, but is instead explored rationally and systematically. This is only possible because of the confidence we have in art, science, and technology to answer, explain, and exploit. Our current society is a result of the complex dependence of art, science, and technology in the Renaissance.

Works Cited:

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