The Arts & Humanities/Science & Technology: Historical Bedfellows

Peter A. Giscombe, Associate Professor of Art (adjunct), Thomas Nelson Community College, Hampton, VA and The Art Institute of Virginia Beach

Abstract

The arts and humanities are not and have never been fields of study and practice that exist in vacuums. Throughout history they have always been influenced by technological and scientific developments, sometimes resulting in changes of seismic proportion. The arts and humanities have always been linked to and connected to other fields: with special relationship to branches of science and technology.

The connections that exist across disciplines are many though they appear to be so different. They actually belong together. As difficult as it would be to name items not influenced by the arts or by science, it would also be difficult to disengage science and technology from the arts and humanities.

Introduction

History marks the beginning of sculpture, as occurring during the Paleolithic period around 25-20,000 B.C.E. It was around that same time that we believe human kind first began using stone tools. In the caves of Charvet, Lascaux and similar sites in France and Spain a multitude of soot/charcoal drawings and paintings have been discovered. We know these works were done by torch light (also during the Paleolithic) probably not long after the mastery of fire. The use of stone tools closely followed by the appearance of stone sculptures and the regular use of fire followed by soot/charcoal drawing and other paintings deep within caves: These occurrences are but early parts of patterns that are not unusual in the way they relate. Similar linkages over centuries and millenniums can be identified to make associations. Even if we start out theoretically, we are bound to be conclusive in their relationships.

There are countless stone sites, carving and constructions throughout the world that we know were made with the aid of some type of technology: though in a lot of cases we haven't a clue what those technologies were. Whether these sites take the form of cromlechs in Southern England, the menhirs in Brittany, the Olmec heads in Mexico, the Moai of Easter Island, or the pyramids of ancient Egypt and Meso-America the arts and the humanities have historically been bedfellows with various branches of sciences and technology.

Just as it is nearly impossible to identify a non-nature created item that did not involve the input of an artist or designer, so too is it difficult to disengage the science and technology from the arts and humanities. The connections that exist across these seemingly different disciplines are quite profound when closely examined.

The end of the thirteenth into the beginning of the fourteenth century in Europe: that time of transition from what is referred to as the "Middle Ages", ushered in an era of social, economical and political stratification in western culture as the Gothic and the Reformation eras ended. The age of pilgrimage was also on the wane with many of the former travelers choosing to remain where they 'found' themselves, rather than re-embarking on long journeys back to their place of origin. Bad harvests led to famines: the Hundred Year War (1337 – 1453) erupted between France and England: the plague swept across Europe "wiping out as much as forty percent of the population". [1] Agrarian based economies became transformed into those centered on trade, manufacturing and (later) industry. As a result, European society was to have in its midst a new and powerful entity; one that, as more changes took place within the newly forming societies, would push for even greater privileges and increased material acquisitions. This new group which emerged at the dawning of fifteenth century Europe will forever be referred to as the "middle class": that socio-economical group bridging the gap between the rich and the poor.

From the onset of their emergence the middle class longed to enjoy what was historically reserved for the nobles and clergy: literature, disposable cash and access to the arts. As more and more people left their farms in search of new opportunities, the cities grew and became even more important as centers of trade and banking. With more entrepreneurs and merchants more lawyers and bankers became available to serve their needs.[2] The exploration of new territories for markets and materials was also encouraged and supported by the various monarchies (i.e. Ferdinand and Isabella of Spain who financed Columbus's voyage to the 'new world' in ships owned by the Medici)[3] as a way to satisfy the influx of new willing investors. This would give rise to the Age of Exploration, Imperialism, Colonialization and Slavery as institutions.

Secularism spread across early fifteenth century Europe, primarily in the north, although it was not view in such a way because religion and the church continued to play an active role in the lives of the people. For the first time since it's formation (during the fifth century AD) the all mighty and all knowing status the Catholic Church claimed was beginning to be questioned.[4] While the rewards of heaven were still sought the push for the rewards of the newly acquired middle-class status did not close the people to the needs and concerns of their fellow countrymen. On the contrary, the ending of the Middle Ages in Europe saw the beginning of a then unprecedented concern of man for the "dignity of man".[5]

---

[1] Stokstad, M. *Art History, Portable Edition, Fourteenth to Seventeenth Century Art.* Third Edition. 2009a. New Jersey. Pearson Prentice Hall. 554.
[2] Davies, P. E., F. H. Hofrichter, J. Jacobs, A. M. Roberts and D. L. Simon. *Janson's Basic History of Western Art.* Eight Edition. 2009. New Jersey. Pearson Education, Inc. 286.
[3] Adams, L. S. *Art Across Time*. Third Edition. 2007. New York. McGraw-Hill. 481.
[4] Davies, P. E., F. H. Hofrichter, J. Jacobs, A. M. Roberts and D. L. Simon. *Janson's Basic History of Western Art.* Eight Edition. 2009. New Jersey. Pearson Education, Inc. 286.
[5] Adams, L. S. *Art Across Time*. Third Edition. 2007. New York. McGraw-Hill. 480.

The patronage of the new human emphasis met with an explosion in creativity and learning that would later come to be called the Renaissance (French for "rebirth"). It was a period of observation and development propelled by scholars, writers and artists all working under the heading of "humanist", that was at the forefront of this rebirth of the way in which the western world viewed itself through its arts (paintings and sculptures), architecture, literature and science. It was a time in human history when the Arts & Humanities led and encouraged developments of the Science & Technologies. Humanism, the word from which the word "humanities" derives, prompted, if not encouraged questioning and investigation on all levels: Of the arts, the sciences and to the Catholic Churches' chagrin, religion.

The call to investigation was sounded and quickly taken up throughout Europe. The consequences would be ever lasting. It would be a formidable task to mention, let alone document all the areas of notable work the humanist movement inspired and led to. Consequentially, this paper will only address and highlight life changing technological processes and artistic developments. Within that "small handful", documentation will be limited as each topic, in and of itself, is worthy of much deeper and wider investigation and scrutiny that would require volumes.

Perspective

It is commonly accepted that linear perspective, that system of accurately representing the distance and size of objects and environments in a manner that accurately create the illusion of depth, was first developed by the Florentine sculptor architect Filippo Brunelleschi (1377-1446).[6] Linear perspective is a mathematical based system that engages the viewer on a single 'point of view' at each moment in time from a fixed position. Unlike attempts by earlier artists in earlier times, the Egyptians for example, whose imagery was based on what we call "fractional representation": That is showing different points of view or angles of a object (or subject) at the same time within the same, single picture plane.[7]

Brunelleschi's development was quickly adopted by his contemporaries. It was used to perfection by Masaccio (Tommaso di Ser Giovanni di Mone) (1401-1428) in his fresco *The Holy Trinity with the Virgin*, done in the church of Santa Maria Novella in Florence, c. 1425. In the work Masaccio presents a forcible and persuasive architectural illusion created via a skillful use of one-point perspective. The single 'vanishing point' is located at the base, in the center of the top step.[8] It aligns with the eye level of the viewer, as they would be standing in the church. Masaccio also does other innovative things in the Holy Trinity, for instance his depiction of Brunelleschi's rethinking of previously established architectural forms. But as noteworthy as they are, they falls second to his perspective work.

---

[6] Ibid., 490.
[7] Ocvirk, O. G., R. E. Stinson, P. E. Wigg, R. O. Bone and D. L. Clayton. *Art Fundamentals, Theory and Practice.* Eleventh Edition. 2009. New York. McGraw-Hill 230.
[8] Ibid., 233.

Masaccio's adeptness with this new way to depict space is also evident in his work in the Brancacci Chapel, also in Florence. In *The Tribute Money*, ca. 1425, he used multiple single-point perspective to depict an outdoors setting with figures and buildings on and against the landscape. Masaccio also incorporated the long know method of representing nature (developed in Asia) know as atmospheric perspective.[9] [10]

In the fresco *Flagellation*, ca. 1460 (located in the Ducal Palace in Urbino, Italy), Piero della Francesca (1420-1492) used linear perspective to show an indoor /indoor scene. The effect is every persuasive: So much so that it is possible to easily recreate it as a floor plan, as was done by artist Thomas Czarnowsky.[11]

Technology was an early benefactor to the economic boom reverberating throughout fifteenth century Europe. Ways were sought to do things better, faster and for less money. There was a growing demand for knowledge. Books were in high demand but out of the financial reach of the majority of the people. The invention of the printing press by Johannes Gutenberg in 1436 was one of the most noteworthy technological developments that emerged in time to satisfy this demand. Prior to this invention written materials were restricted to the clergy and the nobles, as they were the only ones with the funds to purchase them. Text and manuscripts were hand written, usually by the monks, and likewise so illustrated. Although movable types had been in existence and used in China and Korea as early as the eleventh century (C.E.)[12], because they were usually made from clay they permitted limited usage and were not suitable for mass production. Nevertheless types with whatever image (on blocks) were "pulled" one at a time in the same manner as would a "relief" print.

Gutenberg did not "invent" the press. It would be more accurate to state his accomplishment as an adoption of existing press technology. The Gutenberg press (completed in 1440) borrowed from and improved upon the screw-based press technology used by/in the olive oil and winemaking businesses throughout Europe.[13] Gutenberg's genius was in foresight and planning. He, with the aid/partnership of a gem cutter named Andreas Dritzehn, developed movable wooden and metal movable types.[14] Gutenberg used an alloy of lead, tin and antimony. Gutenberg also invented a method to quickly and precisely mold these new type blocks from a single template.[15] This reduced printing/production time significantly. Each type was manufactured in reverse as were words and sentences. The types were set and bound together in "signatures" and inked with a cloth, then later, to reduce time, a leather dauber. (The roller

---

[9] Stokstad, M. *Art History, Portable Edition, Fourteenth to Seventeenth Century Art.* Third Edition. 2009a. New Jersey. Pearson Prentice Hall. 637.
[10] Davies, P. E., F. H. Hofrichter, J. Jacobs, A. M. Roberts and D. L. Simon. *Janson's Basic History of Western Art.* Eight Edition. 2009. New Jersey. Pearson Education, Inc. 311.
[11] Adams, L. S. *Art Across Time*. Third Edition. 2007. New York. McGraw-Hill. 490.
[12] http://printing-machine-india.net/invention-printing-machines.html
[13] Ibid.
[14] http://www.statemaster.com/enclyclopedia/Printing-press (2.)
[15] Ibid., 3

wasn't introduced until the nineteenth century.)[16] Gutenberg experimentations also led to him being the first to use an oil-based ink. The oil version turned out to be more durable than the water-based version and did not dry out during extended printed runs.[17]

For printing: A sheet of parchment or paper was placed over the set and inked signature block (which could include image block or blocks) and the top of the press was brought down under great pressure forcing the paper onto the inked surfaces. This is also a relief method of printing, but because of the "in place" bound type blocks, which can be repeatedly and fairly quickly re-inked, multiple copies of the same text/image could then be printed in a fraction of the time it would have taken to do so manually.[18]

Gutenberg's invention of the printing press caused a revolution in the production of books and the in the dissemination of information in general. This new and "easy" method of printing also pushed development in the sciences: Articles, observations, theories and such could be published and shared amongst peers with more frequency and ease. The religious world was also to be severely affected: As a direct result of the ease in which information could now be expressed via the dissemination of printed material Martin Luther was able to propagate his Ninety-Five Theses and related works which eventually led to the Protestant Reformation.[19] In time hand written and illustrated religious texts were all but abandoned. The world of literature was revitalized and flourished. The works of many long forgotten Greek and Roman scholars were re-printed and re-investigated.[20] Latin, as the "lingua franca", went into a decline as writer began to write and publish in their local/native tongue[21], aiding in the eventual rise of nationalism and the formation of states. The public press, which had their beginnings as printed and posted pamphlets (i.e. Martin Luther) because of Gutenberg, would eventually grow to be the daily newspapers of the cities of the futures. For the visual artist the Gutenberg press and its subsequent variations allowed for the ability to produce relief prints (woodcut and wood or metal engravings) quickly and inexpensively to satisfy the wants of an ever-growing audience. At the same time they used the ability of the "press" to promote themselves.

Of any during the fifteenth century, one of the most keen to take advantage of this new technology was Albrecht Durër (1471-1528). Durër made multiple copies of his many engravings. He traveled widely throughout Europe spending a lot of time in Italy and sold his prints as he went. He is credited as being the first artist to successfully market himself by taking

---

[16] Saff, D. and D. Sacilotto. *Printmaking, History and Process.* 1978. New York. Holt, Rinehart and Winston. 48.
[17] Ibid.
[18] Ibid.
[19] http://www.statemaster.com/enclyclopedia/Printing-press (1.)
[20] Ibid.
[21] Davies, P. E., F. H. Hofrichter, J. Jacobs, A. M. Roberts and D. L. Simon. *Janson's Basic History of Western Art.* Eight Edition. 2009. New Jersey. Pearson Education, Inc. 286.

advantage of printing press technology. Prints are easy to transport and Durër took them with him, almost like a business card that he sold.[22]

Later artists took advantage of other printing processes as presses became more widely available. The intaglio process grew out of the etching techniques used as early at as the beginning of the fourteenth century to decorate swords and armor.[23] Artisans would coat the metals with wax through which they then drew their designs with needles. The metal (the plate) would then be dipped into acid which "etched' the exposed lines. The wax acted as an acid resist. When done on flat plates, etched images can be inked. The word "intaglio" could be translated to mean "below the surface". The etched lines hold the ink 'below the surface' of the plate allowing the excess to be wiped off. The inked plate is then covered with dampened paper and ran through a press to produce an intaglio print. During the mid-seventeenth century Rembrandt van Rijn (1606-1669) produced over three hundred works using the intaglio process.[24] Not only did he master what was known of it up to that time, he pushed its limits to remarkable heights.

Intaglio as a medium was also used very successfully a century after Rembrandt by Spanish artist Francisco Goya (1746 – 1828). As a printmaker, Goya's (with the aide of assistants) adeptness is best evident in the folio of eighty prints entitled Los *Caprichos.* [25] Goya's notoriety as a printmaker came about as a result of a technological refinement in the intaglio process: aquatint. [26]Aquatint, as the name suggests, enable printmakers the opportunity to create tones akin to the "look" of water or clouds without having to revert to cross-hatching, as was the case with Rembrandt. Goya was a major contributor to the transformation of the medium.[27] According to Hughes: "What Rembrandt did for line etching, Goya and his colleagues did for aquatint…"[28]

In 1798 another technological advancement occurred to radically influence the art and print world. Alois Senefelder (1771-1834) was an actor and playwright having a difficult time supporting printing the costs of his career.[29] This prompted him to find ways to do this work himself. After numerous experimentations, included attempting to make direct etches into limestone, which he then printed in relief, he came upon a practical and efficient way to duplicate his work. Senefelder had intended on experimenting with a copper plate. His idea was to write (reversed and backwards) on the plate that he intended to etch and then print it as one

---

[22] Kleiner, F. S. *Gardner's Art Through the Ages, A Global History.* Thirteenth Edition. 2009 Boston. Thomson Wadsworth. 629.
[23] http://www.science.jrank.org/pages/2515/Engraving-Etching-Origins-history-intaglio-printing.html
[24] Schwartz, G. ed. *The Complete Etchings of Rembrandt, Reproduced in Original Size.* 1988. New York. Dover Publication. 6.
[25] Stokstad, M. *Art History, Portable Edition, Eighteenth to Twenty First Century Art.* Third Edition. 2009b. New Jersey. Pearson Prentice Hall. 998.
[26] Hughes, R. *Goya*. 2003. New York. Alfred A. Knopf. 178.
[27] Ibid., 179.
[28] Ibid.
[29] Saff, D. and D. Sacilotto. *Printmaking, History and Process*. 1978. New York. Holt Rinehart and Winston. 183.

would a woodcut, that is, as a relief print.[30] Since copper was too expensive to use in his experiment Senefelder decided on using a limestone instead. He drew onto the limestone with a grease pencil then etched the stone with nitric acid. The non-etched portion of the stone was ink, covered with a sheet of paper and the back rubbed to make an impression.[31]

Senefelder was pleased and confident in the worth of his discovery. He abandoned his unpromising career as a playwright and actor to devote all his time in the pursuance of a commercially viability use of his invention. He went on to discovered ways to refine the process, bit by bit. It took him near two years of refinement to develop a way to "etch" the image on the stone. This would be what became known as the "planographic" method of printmaking. Technically Senefelder was already making "lithographs", which is in fact derived from the Greek and means "stone writing". What Senefelder did next in his development is still what (non-literally) defines the process. Rather than treating the limestone like a "relief", he would pay attention only to the surface.[32]

After the drawing was completed, Senefelder "etched" it with varying mixtures of nitric acid and water (the strength of the mixture would be determined by the density of the greased areas within the drawing. Gum arabic was then applied over the entire top surface of the stone and allowed to dry. The gum arabic was washed off. Senefelder found that he could take advantage of the simple principle that "water and oil don't mix" to better his printing process. He found that the ink applied to the stone would stick to the grease crayon drawing and not to the wet stone/ the areas that absorbed the water.

Senefelder later developed a press suitable for his "chemical printing", as he called his process. The "pole" press that he invented was fashioned to have the paper and stone to working in tandem without slipping from each other. The blade portion of the press applied a vast amount of pressure onto the paper, forcing it onto the inked surface of the stone. Senefelder patented his printmaking method in Munich in 1799.[33]

Because of the ease in which lithographic images could be apply and the ease with which the prints could be pulled, Senefelder's "chemical printing" quickly became popular with artists and later with the commercial printing industry. Artists including Benjamin West, Francisco Goya, Eugene Delacroix and Honore Daumier would be among those instrumental in making lithography the medium of choice for all who wanted to produce quality graphic works at very low cost in a fairly short time, as compared to other media. French artist Henri de Toulouse – Lautrec devoted the major portion of his career working in lithography and achieved unprecedented results with the medium.[34] He was among the first to explore its color potential

---

[30] Ibid.
[31] Ibid., 184.
[32] Ibid.
[33] Ibid.
[34] Adams, L. S. *Art Across Time*. Third Edition. 2007. New York. McGraw-Hill. 804.

and he did much to further the medium's popularity, with both fine artists and the offset printing industry. The argument could be made that what Lautrec did for the color lithography was equivalent to what Rembrandt for line and Goya did for aquatint intaglio.

Images

As much as the tricks and rules of linear perspective aided artists represent the world as they saw it (in a more accurate and convincing manner on the two-dimensional surface): As much as the printing press and the various print making techniques enabled artists and scholars to reproduce and/or even to create original works with new speed and accuracy, it seems as if artists have always been on a quest to find a way, a mechanically aided way or ways to precisely record images. One of the earliest of such devices is known as a "camera obscura", Latin for "dark chamber". The oldest of these camera obscurae date back to 1000 A.D. and was invented by Abu Ali Ibn Al-Haithan (965 – 1040 AD), better known to us in the west as Alhazen. Ibn Al-Haithan is considered the 'father' of modern optics for his comprehensive works on optics, physics and development of the scientific method among other things.[35]

Ibn Al-Haithan studied Euclid and Ptolemy's theory of vision but came to disagree with their views. Both early Greeks theorized that the eye sends out visual rays to objects. Ibn Al-Haithan offered an opposing theory, one that identified the objects as the generator of the light that travels to and into the eyes. His invention of the earliest camera obscura (more like a pin-hole) camera demonstrated that process very well.[36]

Camera Obscura

In his 1525 woodcut *Draftsman Drawing a Nude*, Albrecht Durër depicts a device, a grid or glass screen used by fifteenth and sixteenth century artists to record the effects of foreshortening and perspective from a fixed point of view.[37] By the seventeenth century more 'sophisticated' versions of the camera obscura were in use throughout Europe. The best amongst the artists of the times are suspected of having taken advantage of its benefits (in addition to using other optical devices) to aide in their creation of "photo" accurate works at a time well before the age of photography. Artist David Hockney devoted his book *Secret Knowledge: Rediscovering the Lost Techniques of the Old Masters* on this issue.[38] Hockey presents a very strong argument

---

Stokstad, M. *Art History, Portable Edition, Eighteenth to Twenty First Century Art.* Third Edition. 2009b. New Jersey. Pearson Prentice Hall. 1056.

[35] http://www.geog.ucsb.edu/~mleary/alhazen.htm

[36] Ibid.

[37] Ocvirk, O. G., R. E. Stinson, P. E. Wigg, R. O. Bone and D. L. Clayton. *Art Fundamentals, Theory and Practice.* Eleventh Edition. 2009. New York. McGraw-Hill 236.

[38] Hockney, D. *Secret Knowledge, Rediscovering the lost Techniques of the Old Masters.* 2003. New York. Viking Studio. 35.

pointing to the role that then existing technologies (mirrors and the camera obscura) had on the production of many of the masterpieces of art history.[39]

In the 2003 feature film *The Girl With a Pearl Earring*, based on the novel by the same name by Tracy Chevalier, the painter Johannes Vermeer (1632–1675) as portrayed by actor Colin Firth, is seem accepting delivery of an object that turns out to be a camera obscura. The Vermeer character later proceeded to demonstrate the use of his new acquisition to his maid and model Greit (played by Scarlet Johansson). At the end of the demonstration she asked him:

"Does the box show you what to paint?"

He answered: "It helps."[40]

Vermeer did have ready access to lens technology. According to Hockney his neighbor was a microscopist and lens maker, "the great…Van Leeuwenhoek" who was also the "executor" of Vermeer's will.[41]

It wasn't until the summer of 1827 before anyone was able to successfully affix an image directly onto paper via a camera obscura. That person was the Frenchman Joseph Nicephore Niépce (pronounced 'Nee-ps') (1756-1833).[42] Niépce had a fascination for lithography but having no talent for drawing, began to experiment on ways to capture the image he saw in the camera obscura. He made repeated tries over many years with varying degrees of success. At first Niépce coated sheets of paper with silver salts, which was already known to turn black with daylight. He positioned the coated paper at the back of the camera obscura and exposed it for a period of time (some eight hours). Once removed from the camera obscura Niépce did find an image on the paper. These and subsequent like images he called "retinas".[43]

The "retinas" were a major scientific breakthrough, but they had a troublesome 'flaw': They had to be kept out of daylight (because of the silver salts) to avoid the blackening of the exposed images. Niépce was undeterred and continued experimenting and researching new methods to expose and to obtain a "positive" image. His solo experiments were not successful.

During December of 1827 Joseph Niépce's work would move forward in ways even he had not envisioned. Niépce met painter and stage director Louis Jacques Mande Daguerre (1787–1851) by way of optician Vincent Chevalier. Chevalier supplied both men with camera obscurae. In time Niépce and Daguerre developed a partnership, suggested by Niépce, intended on

---

[39] Ibid., 58.
[40] *Girl with a Pearl Earring*. DVD, directed by Peter Webber. 2003. Lions Gate Home Entertainment. Scene 7.
[41] Hockney, D. *Secret Knowledge, Rediscovering the lost Techniques of the Old Masters.* 2003. New York. Viking Studio. 58.
[42] Legget, R. *Niepce, Joseph Nicephore: A History of Photography.* 1999. http://www.rieggat.com.photohistory/history.niepce.htm
[43] http://www.nicephore-niepce.com/pagus/pagus-inv.html (1.)

developing the invention of "heliography", as Niépce called his process: "Helio" after the Greek "of the sun". In 1832 the two men invented a new process they called the "physautotype", which was also not too successful.[44]

Joseph Niépce died in 1833 and under the terms of the contract he signed with Daguerre his son Isidore succeeded him in the company. Creatively and personality-wise Isidore was not an equal to Daguerre. He was unfamiliar with the business and unable to replicate his father's processes. Daguerre manipulated these traits. He took advantage of Isidore's ignorance and secretly worked independently of him. A few years later, in 1835, he perfected a new process, one that began as the physautotype, and named it the "daguerreotype" after himself.[45]

The daguerreotype set the standard for what was to become modern photography (drawing with light), taken from the Greek words "phos" meaning "light," and "graphe" meaning ""drawing" or "writing".[46] Daguerre got a positive image using a much shorter exposure time than both the heliography and the physautotype. Two years later he learned how to "fix" the image; that is how to make the exposure permanent. Daguerre succeeded in doing what artists had been attempting for hundreds of years: How to capture and keep the image one sees in a camera obscura. Once it was made public Daguerre's daguerreotype was an immediate success.[47] Over the next twenty years improvements in lenses, camera sizes and reduced exposure time resulted in better quality photo processes being developed. Soon daguerreotype was replaced by "albumen print" then by "silver print" processes.

Photography was taken up as a creative medium by many who were or had previously considered themselves painters or other types of visual artists. In time there was a movement to "legitimize" the new medium. Photographers, like Oscar Rejlander (1813 – 1875) of Sweden, who created very involved multi-layered compositions through the overlaying of multiple negatives, began to argue for acceptance of their works as "fine art"[48]: Something that was not to happen until the early part of the twentieth century.

Painters and other visual artists were also drawn to photography, if not as a medium for their creative activity then as a means of investigating their subjects in a more "up close" manner. During this same time period, in the nineteenth century, it appears as if a renewed interest in humanist attitudes and ideals resurfaced amongst artists and writers in Western Europe and the United States. Labeled "realism" this time around, this movement attracted painter and writers who weren't shy about "showing" the 'unvarnished' truth of the lives of the common

---

[44] Ibid., 1-2.
[45] Ibid.
[46] Kleiner, F. S. *Gardner's Art Through the Ages, A Global History.* Thirteenth Edition. 2009 Boston. Thomson Wadsworth. 815.
[47] Ibid.
[48] Stokstad, M. *Art History, Portable Edition, Eighteenth to Twenty First Century Art.* Third Edition. 2009b. New Jersey. Pearson Prentice Hall. 1010.

people within their societies. The camera helped them do so as photographs were of (undoubtedly) taken "in the field" from which the artists would then work from in their studios.

Of the French realists Gustave Courbet (1819 – 1877), Jean-Francois Millet (1814 – 1875), Rosa Bonheur (1822 -1899), Honoré Daumier (1808 – 1879) and Edouard Manet are often the most frequently noted. Each works are infused with the detail, the attention to the workings of light and the attention to individual caricature that photographs allow: All with the precise workings of the elements of art and design done by the best that the profession had to offer during this era. The same can be said of the works of American artist Thomas Cowperthwait Eakins (1844 – 1916), Winslow Homer (1836 – 1910) and Henry Ossawa Tanner (1859 -1937). Eakins is credited as being the first American artist to seriously experiment with photography. He had a particular interest in human anatomy and used the camera to explore "kinesthetic", the science of motion.[49]

Following the realist movement in the mid-nineteenth century, the camera and two-dimensional art would not become intertwined again until the mid-twentieth century when the pop art and later conceptual, performance and photorealistic movements came into vogue. Photo technologies would also become infused with fine art printmaking. In each of the three primary printmaking areas: intaglio, planographic and serigraphic (silk-screening) photo processes were to become almost common place in some circles. The pop artists in particular had a special likeness for photographic serigraphy techniques. Andy Warhol, James Rosenquist and Robert Rauschenberg were extremely prolific in that medium. However, in between the years of the French realist movement and the pop/photorealist years, the camera and its offspring's would link with other technological inventions and advancements that would result in major changes in the visual arts

Computer

The development of the computer during the first half of the twentieth century had already had major impacts on the arts and humanities just as it had on the rest of the world. Not since Gutenberg has a technology been so far reaching in its influence. As with the Gutenberg press the arts and humanities have undergone severe changes as a result of this leap in science and technology. For visual artists, while there have been some procedural changes, computer technology brought about new ways in which imagery can be created more so than it caused changes in the ways that images are made.

For speed, ease of use and reduction of cost, the same three issues confronted by the fifteenth humanists, computer technology has outdone previous printing methods on every level except within the fine arts. Fine arts prints are still being pulled as they were for hundreds of

---

[49] Stewart, M. *Launching The Imagination, a Comprehensive Guide to Basic Design.* Third Edition. 2008. New York. McGraw-Hill. 102-103.

years, one at a time, but with substantial scientific changes occurring within other parts of the various processes. Still, computer technology has brought changes to the world of fine arts. The arts, visual arts included, are absorptive disciplines. Artists take what society has to offer and includes "it" into their work. Computer technology and computer aided imagery and design works were inevitable.

In the early 1960s artist Charles Csuri, then Professor at Ohio State University began to make what is accepted worldwide as the first computer generated artworks.[50] His images weren't "art works" in (what was then) the usual sense of the phrase, in fact there was, literally, nothing like then ever before. Csuri's computer generated images were an instant success and as a result a new medium was inaugurated to go with the new times.

Coincidentally, that same year that Csuri first showed his computer works, (it was in 1964a) the US Corporation IBM made public a system they called DAC-1. DAC-1 was the first of many CAD systems. CAD (Computer Aided Design) is a computer program (now the industry "standard") that is used by architects and designers to facilitate their designs. DAC-1 was originally developed in 1959.[51]

Within one hundred and fifty years after Joseph Niépce produced his first heliograph and thus launched the age of photography, photographic imagery was to become linked with twentieth century computer technology. Film, chemical based photography has already been overtaken by digital, computer generated technology. The digital era is already here and a new genre, (actually many different genre related by their dependency on digital/computers technology), combined under the single heading "New Media" has been on the scene since the early 1970's. Within a year of Csuri's first computer works there were exhibits of computer artwork in Europe and the United States.[52] A year after he started making the two-dimensional works he began working on the first generation of computer-animated films.

As it is now, art works created by or that utilizes any digital technology falls within the framework of new media. Such works can be totally computer generated, algorithmic or fractal art, for which programs are written, or from other sources. "Other sources" includes works that are scanned or drawn using a mouse; through bought and installed vector/graphic software or any other software – The Adobe Creative Suite, Corel, MS-Publisher for example or works done via a graphic tablets.

Media

Media has always dictated the manner and level of sophistication in which artists work. Artists, not unlike practitioners in most other professions must and usually will adapt to the availability

---

[50] http://www.design.osu.edu/Carlson/history/timeline.html (4.)
[51] Ibid.
[52] Ibid.

and ability of the technology of the day. In the painting genre wall frescoes was the "gold standard" for thousands of years, from the Sumerians through to Renaissance Europe. Fresco, in particular "buon fresco" (meaning "true" "fresh" (the water based paint is applied onto wet plaster; as opposed to "fresco secco", "dry" fresco, when the paint is applied onto the dried plaster) is known for their durability. But buon frescoes are time consuming in execution and are not movable, making then suitable for only limited places and audiences.[53]

For works not done on walls tempera was the medium of choice. In Flanders in the early fifteenth century, painters perfected the technique of working with oil based pigments. Oil allowed greater flexibility than tempera. It can be applied in very thin layers (glazes) thus producing very luminous surfaces and making it possible to work with the subtlest of color and to capture minute changes in light. Oil also dries slowly, allowing the artist to make changes at junctures that might have been problematic with tempera or impossible with buon fresco.

It wasn't long before oil became the medium of choice for Europe's painters and as a "support" for the new medium they applied it onto wooden panels. It was the Venetians, people accustomed to materials that are use to navigate their vessels about the seas, who were the first (in Italy at least) to use oil and then together with canvas as a surface on which to apply it.[54] The Venetians had long before been using large expanses of canvas as surfaces for wall decorations. Many Florentine artists painted 'tempera on canvas': Sandro Botticelli and Andrea Mantegna among then. In their humid environment the Venetian had long found canvas a more suitable material to use as a backdrop for decorating instead of plastered wall frescoes. Canvas also has the added advantage of being light and portable. Additionally, as long as it was kept dry, it also has an extremely long life spam.

Oil paint reigned unchallenged for half a millennium. The challenge, when it did arrive, came from a most unconventional but not surprising source, science. In 1901, in Germany, Otto Röhm (1876–1939) received his dissertation from the University of Tubingen. He wrote on the topic: *The Polymerization Products of Acrylic Acids*.[55] Acrylics had been known and synthesized since the middle of the previous century, but until Rohm's writing and invention of the polymerization process there was no practical use for the compounds. Otto Röhm was also the inventor of "plexiglass" (1933), a product that enjoys extensive use in many industries including the arts.[56] Of all his genius however, of interest to the arts community this scientist's greatest contribution was the emulsification of acrylic resin. This resin, when combined with pigments, becomes the starter for acrylic polymer paints.

---

[53] Kleiner, F. S. *Gardner's Art Through the Ages, A Global History.* Thirteenth Edition. 2009 Boston. Thomson Wadsworth. 504.
[54] Stokstad, M. *Art History, Portable Edition, Fourteenth to Seventeenth Century Art.* Third Edition. 2009a. New Jersey. Pearson Prentice Hall. 682.
[55] http://www.rohmhaas.com/history/whoswho/rohmotto.htm (1-2)
[56] Ibid.

Otto Röhm went into partnership with one Otto Haas in 1906, naming their company Röhm & Haas.[57] The company began large-scale production of the first acrylic products in 1933.[58] The next decade, in 1949 a company headed by Leonard Bocour (1910 – 1993), Bocour Artist Color Inc, now known as Golden Artist Colors, produced acrylic paints under the brand name "Magna". These were oil-based acrylics which had to be thinned with turpentine and could be combined with "regular" oil paints.[59]

Röhm and Haas introduced the first "true" acrylic paint in 1953 as interior wall paint. Today such pains are know as "latex" paints. Two years later, in 1955, a company called Permanent Pigment introduced Liquidtex ("liquid texture") paint. Liquidtex was the first water-based acrylic paint to appear on the market. At the same time Liquidtex made its appearance, painting supporting mediums, all acrylic; Matte and gloss mediums and varnishes were also introduced. Other companies, M. Grumbacher, Daler Rowney, Windsor Newton and others would introduce their versions of acrylic polymer paints in subsequent years.[60]

Acrylic polymer paints' debut coincided with a time of re-questioning and (some would say) upheaval in our time and world that was not restricted to the arts. Comparisons and contrasts could be drawn between that time, early to late twentieth century in the United States and Europe and during the beginning to middle/latter fifteenth century Europe. During the fifteenth century as in the twentieth the artists and writers were questioning the status quo. They were also seeking new ways to work more efficiently and in some venues with more speed. For the fifteenth century painters the development of oil paints and canvas opened up numerously more possibilities for them, it was much the same for a generation of twentieth century artist with the development of acrylic polymer paints.

As early as the 1940's American artists, including Mark Rothko, Barnett Newman and Kenneth Noland, were using the new paints produced by Bocour to explore the theories of abstract expressionism as they sought to break with their past and become more efficient with what they had at their disposal.[61] Their successes with the new material have been well documented, as has been their effect on early twentieth century culture. Still none have been as influential as that of another of their contemporary, one who made what is considered the visual art version of an earthquake caused tsunami – using the least "fine arts" of materials. Jackson Pollack, in 1947, began working on what became known as his "action paintings'. These works were produced on canvas laid out on the floor onto which he poured, dripped, splattered and splashed synthetic resin based alkyd enamel paint, the house paints of the time. Although

---

[57] Ibid.
[58] http://www.watercolorpainting.com/acrylics.htm
[59] Ibid.
[60] Ibid.
[61] Ibid.

Pollack's methods and even his ideas may not have been all "original" (whose are), the path he chose and what he attained was groundbreaking nonetheless.

Another two (plus) generations of American artist: The color field painters (Helen Frankenthaler, Robert Motherwell and Morris Louis for example), the pop artists (Andy Warhol, Bridget Riley, Victor Vaserely, James Rosenquist, Roy Lichtenstein…) among others have contributed to the growth of acrylic emulsion paint's legitimacy. The commonly accepted name for the medium is now "acrylics". Because of its ease of use, (now) wide availability, lack of chemical presence and odor, these paints have become as popular and in some cases more popular than oil paints.

Since its appearance on the commercial market artist has had but one complaint about acrylic paints: the shine. Some do complain about the drying time: That because it does dry so quickly it can be difficult to rework areas as one may find necessary. The introduction of drying "retarders" have dispensed with some of those drying complaints. The "shine issue continues. Artists have experimented with the addition of a variety of "things" to reduce" the varnish like luster that is inherit with the medium: pumice, matte medium, sanding. Few things work to levels that could be classified as "completely successful."

Conversely gouache, another water-based medium (pigments suspended in gum arabic) that is essentially an opaque water-color, is disliked by many because it dries to a totally matte finish. Ironically designers favored gouache for that very reason.[62] There has not been a way to add luster to gouache, except to spray the dried surface with a coating of varnish. What the scientists have done instead was to formulate a way to dull the finish of acrylic paints. They have inserted an additive into the base formula of acrylic polymer, re-branded and are now marketing it under the new name "acrylic gouache".

Conclusion

What is clear is that none of our individual fields of concentration are static. The arts and humanities are continually changing as developments in science and technology are opening new possibilities for change. After the influence of the fifteenth century humanists on the world's creative disciplines along with the advances in the arts resulting from breakthroughs in the sciences and technology, a claim can be made that the majority of "life changing" materials and processes have developed from artistic ingenuity and science and technological discoveries. There is yet to be another Renaissance in the manner in which we think and look at our world, at least not from a humanistic point of view. Today, unlike at the dawn of the Renaissance when humanism was pursued for the betterment of humankind, the preservation of the environment ranks as the driving force in this - our age of questioning, observation and inquiry: Our search that we hope will lead to numerous positive technological and scientific breakthroughs.

---

[62] Hornong, D. *Color, a workshop approach*. 2005. New York. McGraw-Hill. 9.

The quest we have today is the "green/ecology" movement. The "greens" and the ecologists have long been questioning some of the rampant ways science has been using (some would say misusing) our world in regard to the negative and destructive effect that damage us and our world. It is a consequence of the green movement's call of alarm that so many carcinogens have been identified and subsequently removed from artist's materials, and arts' environments. Technology has affected (primarily) the fine arts printmaking industry, as more than a few colleges and universities have chosen to shut down their print shops rather than spend the money required to update to "non-toxic" standards. It is not ironic after all that the "green movement" also looks toward science, but in a humanistic, earth-sustaining manner. The arts and humanities are supportive of such efforts, because the result will be beneficial to the creative and scientific cultures as well as all segments of humanity. It may be that the technologies and sciences are to continue in the forefront of this 'cultural relationship', at least for the foreseeable future, but it will be up to the arts and humanities side to ensure that balance is maintained: not only due to the concerns pertaining to health hazards, but for lasting preservation of all we hold dear.

References

A Brief History of Computer Art. The Pioneers (1950 1970). http://www.vam.ac.uk/collections/prints_books/features/computer-art/history

Adams, L. S. *Art Across Time*. Third Edition. 2007. New York. McGraw-Hill

Belcher, L. *The Invention of Lithograph and Offset Printing. Alois Senefelder's Biography and the Life and Times* of *Alois Senefelder.* January 17, 2006. p. 1.

Davies, P. E., F. H. Hofrichter, J. Jacobs, A. M. Roberts and D. L. Simon. *Janson's Basic History of Western Art.* Eighth Edition. 2009. New Jersey. Pearson Education, Inc.

Gaddis, R. *The Impact of Photography on Art. The Realist Movement of the 19th Century.* August 22, 2007. pp. 1-4. http://www.associatedcontent.com/article/351797/the_impact_of_photography?cat=37

Girl with a Pearl Earring, DVD, directed by Peter Webber. 2003. Lions Gate Home Entertainment.

Hockney, D. *Secret Knowledge, Rediscovering the Lost Techniques of the Old Masters.* 2006. New York. Viking Studio.

Hornung, D. *Color, a workshop approach.* 2005. New York. McGraw-Hill.

Hughes, R. *Goya.* 2003. New York. Alfred A. Knopf.

Kleiner, F. S. *Gardner's Art Through the Ages, A Global History.* Thirteenth Edition. 2009. Boston. Thomson Wadsworth.

Legget, R. *Niepce, Joseph Nicephore: A History of Photography. 1999. http://www.rieggat.com/photohistory/history/niepce.htm*

Ocvirk, O. G., R. E. Stinson, P. R. Wigg, R. O. Bone and D. L. Cayton. *Art Fundamentals, Theory and Practice*, Eleventh Edition. 2009. New York. McGraw-Hill

Saff, D. and D. Sacilotto. *Printmaking, History and Process.* 1978. New York. Holt, Rinehart and Winston.

Schwartz, G. Ed. *The Complete Etchings of Rembrandt, Reproduced in original Sizes.* 1988. New York. Dover Publication.

Stewart, M. *Launching the Imagination, a Comprehensive Guide to Basic Design.* Third Edition. 2008. New York. McGraw-Hill.

Stockstad, M. *Art History, Portable Edition, Fourteenth to Seventeenth Century Art.* 2009a. New Jersey. Pearson Prentice Hall.

---. *Art History – Portable Edition, Eighteenth to twenty First Century Art.* 2009b. New Jersey. Pearson Prentice Hall.

, and M. W. Cothren. *Art, A Brief History.* Fourth Edition. *2010.* New Jersey. Prentice Hall.

http://www.associatedcontent.com/article/18575/the_invention_of_lithography

http://www.design.osu.edu/carlson/history/timeline.htlm

http://www.geog.ucsb.edu/~mleary/alhazen.htm

http://www.nicephore-niepce.com/pagus/pagus-inv.html

http://www.printing-machines-india.net/inventor-printing-machines.html

http://www.rohmhaas.com/history/whoswho/rohmotto.htm

http://www.science.jrank.org/pages/2515/Engraving-Etching-Origins-history-intaglio-printing.html

http://www.statemaster.com/enclyclopedia/Printing-press. pp. 1-8.

http://watercolorpainting.com/acrylics.htm

Published by the Forum on Public Policy