Art and Science: Seen as Dichotomous Practiced as Dependent

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Abstract:

Art and science have an undeniable connection. Many artists and scientists work with or in both fields, however, public discourse and educational structure has created the notion that the subjects are completely disparate. Art and science are divided in classes, majors, and degrees. Furthermore, science is typically required from elementary to collegiate levels of academia, whereas art is optional. Both fields, however, work through creativity by analyzing and critiquing the world. In my thesis work, *Death Becomes Us*, I have collected flora and fauna, which I later scanned on high-resolution scanners. The resulting large-scale prints (24” wide) reveal complexities of the specimens that evade 20/20 eyesight. The bees and flowers are all dead thus indicating the major colony collapse of pollinators that play a fundamental role in the world from ecology to economy. My work treads the line between the subjects of art and science and aims to bridge the divide that the public sees in the subjects by appealing to both fields, conceptually and aesthetically. By looking at artists and scientists it is clear that the separation that has occurred comes from a change that needs to take place from the bottom up. In other words, art and science need to be integrated in order to eliminate the hierarchy that has become mainstream thought.
Art and science, two seemingly disparate studies that many tend to separate: right-brain vs. left-brain, creative vs. logical, objective vs. subjective. Rarely do the two subjects mix, especially in the academic world; however, art and science are not opposing subjects. In fact, they are inherently linked. Science uses art to visualize formulas and theories, while art uses science to develop new processes, techniques, and tools. In education, however, the arts are overlooked and underfunded because of common misconceptions on the value that art holds. These misconceptions can be refuted by the simple fact that artists and scientists work in similar methods.

Through research and observance of the two fields a fundamental connection forms between the two subjects: a way for humans to understand nature. Through similar processes of creativity, art and science can innovate new ways of shaping both human perception of the natural world and what we are able to contribute as a major component in nature. In my recent work I have struggled with the polarization of art and science through my series *Death Becomes Us*. My images are direct representations of flora and fauna scaled to hundreds of times their actual size. Through art critiques I have received mixed feedback that I find to be a perpetuation of this dichotomy between science and art; as an artist I have the freedom to manipulate anything as much as I want, but the scientific observer would ask why alter something that is inherently beautiful and complex?

**The Dichotomy**

Art and science are two different expressions, “Science gives truths about nature; art gives truths about the meaning of life.”\(^1\) Leonardo da Vinci is the epitome of the intertwining of the fields. His works were curious explorations, sketches, and ideas that cannot separate the art

from the science. As time went on, however, specialization of occupations created a divide. In his 1959 lecture, writer and scientist CP Snow coined the “Two Cultures” theory. He stated that the humanities and science had become so separated that the two could no longer communicate. But he points out the fundamental flaw was the separation of the subjects in education. Schools often teach art and science as opposing and separate subjects. From elementary through collegiate levels of academia people are forced to choose between the two subjects as if they are un-relatable, but no scientist and no artist can argue the inherent interdisciplinary aspects of each subject. That being said many schools require science courses, yet art is not a requirement until you choose to get a degree in it.

Another major separation of art and science comes in the presumption of the former being strictly subjective and the latter strictly objective. People tend to assume that science is a clear-cut field as hypotheses are used to determine if something is right or wrong, if an experiment works or does not. Art, on the other hand, is said to be free from any restrictions with no right or wrong. These assumptions though are just constructed limitations. As I looked up how the dictionary defined the terms I found myself arguing in defense of the indefinable because to define is to confine. Artists and scientists both observe, analyze, and intensely research their studies. The only limit is what their mind is willing to ask, test, and create. In Blurring Art and Science: Synthetical Moments on the Borders, reiterates this relation between methodologies in art and science, “We contend that the mental constructs and creative ideas of scientists are not only linked to a process of scientific methodology and experiences, but to

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3 Ibid.
aesthetic moments emerging from their experiences with the arts.”⁴ While the objectivity that is often applied to science, implies lack of emotion Slattery and Langerock claim that emotion itself is the result of “philosophical and social constructs of aesthetics and science that have historically surrounded them.”⁵ Additionally, scientists’ manipulation of variables attempts to reach a predicted result much like an artists’ choice of form, concept, and composition relay certain messages to the viewer.

Leonard Shlain, in *Art & Physics: Parallel Visions in Space, Time, and Light*, explains Niels Bohr’s revolutionary statement that light is both a wave and a particle (not one or the other) depending on “the subjective act of deciding which measuring device to use.”⁶ Science too then has subjective qualities. For artists, subject matter, concept, shape, form, etc. are all subjective decisions although, a certain objectivity arises when aesthetics are questioned. For example, the rule of thirds in photography, is a technique to objectively achieve a pleasing composition, while it is often broken, it remains a principle building block for photographers. Likewise terms that can be changed and interpreted subjectively in both science and art are also objective terms to describe the appearance of something (i.e. color, quantity, light, dark, shadow, etc).⁷ Science gives us the structural, mechanical answers to how things work whereas art shows cultural developments through trends and media. Additionally artists are often good critics of science, its use, effectiveness, and innovativeness as it advances.⁸ Art is one of the most inclusionary subjects, pulling from every possible field of study and every possible human

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⁵ Ibid., 363.
⁷ Ibid., 20.
experience. Art is tied to emotion as well as logic, individuality as well as collaboration. While science may provide math skills and greater monetary compensation in terms of occupations, art teaches people to think critically on all mental levels. Rather than looking at a photo and saying that’s pretty, art teaches you to question it, observe yours and others’ reaction to it, and what value could or should be held in it.

**Science as Art, Art as Science**

One primary function of art in science is the ability to illustrate things that cannot be seen, or are constantly changing. Richard Feynman said about what he sees in a flower versus an artist, “I could imagine the cells in there, the complicated actions inside, which also have a beauty at smaller dimensions, the inner structure, also the processes.”⁹ In contrast, botanical artists have long held the realm of illustrating flora that would otherwise fade with the seasons and I would bet see just as deeply into the plants. Additionally art allows a certain preservation of elements like plants that are constantly in flux. Sara Lawrence-Lightfoot draws a parallel of the unseen in her essay, *Reflections on Portraiture: A Dialogue Between Art and Science*. Lightfoot explains that a portraitist is much like a researcher in the pursuit of “truths, insight, and knowledge projected by the imagination”.¹⁰ The root, she states, of our learning comes from the ability to visualize, or to “imagine”, to “make an image”.¹¹ Artists make images, scientists contribute the information to form the image.

Leonard Shlain claims that revolutionary art is a precursor to future science explorations (something not yet seen), “the preverbal stage of a civilization first contending with a major

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¹¹ Shlain, 18.
change in its perception of the world."\textsuperscript{12} Art and science both seek to innovate and revolutionize thinking. The epitomy of this claim today are the artists that depict the changing environment as it concerns humans. For instance, James Balog (Figure 1) uses time-lapse imagery in his \textit{Extreme Ice Survey} to literally show glaciers shrinking before our eyes. The headline for the survey is “Art meets Science…an innovative, long-term photography project that merges art and science to give a ‘visual voice’ to the planet’s changing ecosystems.”\textsuperscript{13} Chris Jordan is another example of an artist that utilizes data about the changing climate in his work to visualize the science of human pollution (Figure 2). Mel Chin is another artist working to not just document the changing environment but attempting to change it himself in his work \textit{Revival Field}. In a former toxic waste site, Chin planted certain plants that would leach the toxins out of the soil thus converting the useless land back to arable land. The environmental sentiment is echoed long before the scientific and political environmentalists existed, thinking back to the photos of Ansel Adams and earlier landscape architects such as Frederick Law Olmsted and even earlier landscape paintings by Thomas Cole. Marshal McLuhan, in \textit{Understanding Media}, stated, “‘I am curious to know what would happen if art were suddenly seen for what it is, namely, exact information of how to rearrange one’s psyche in order to anticipate the next blow from our own extended faculties…’.”\textsuperscript{14} In other words, art much like science, hypothesizes on what will happen based on intuitive and analytical observation. Shlain further reiterates the ability of art to unveil what is not yet seen even by scientists through the work of Kant, “we can know the nature of things only by what filters through our senses and is processed by our mind, but we can never directly

\textsuperscript{12} Ibid.
\textsuperscript{13} James Balog, “Extreme Ice Survey”, \url{http://www.extremeicesurvey.org}, 2014.
\textsuperscript{14} Marshal McLuhan, \textit{Understanding Media: The Extensions of Man} (California: Gingko Press, 2003), 78.
experience the Ding an sich: the thing in itself.”15 Art is an expression of the senses that are unfiltered and un-tethered. Science describes these senses, while art expresses them.

One downfall of science seems to be its inability to make sense of things that do not make sense, whereas artists use this to their advantage. Formulas, experiments, etc. tend to pick apart things in order to figure out patterns, but when the expected results are inconsistent scientists become dumbfounded. In fact, the chaos theory attempts to define this seemingly inexplicable phenomenon. In Fractals: The Patterns of Chaos, John Briggs explains, “Chaos theory and fractal geometry extend science’s ability to do what it has always done: find order beneath confusion...Artists have perennially discovered in the doubt, uncertainty, and haphazard of life a harmony that goes straight to the essence of being.”16 Creativity is the basis for understanding chaos and learning to work with it, not against it. Briggs brings up an artist, Eve Laramee, who works through science and confusion. She states, “I am interested in the ways in which cultures use science and art as devices or maps to construct belief systems…I speculate on how human beings contemplate and consider nature through both art and science in a way that embraces poetry, absurdity, contradiction and metaphor.”17 Uncertainty and questioning fuels art and science. Critically looking at the world and being able to observe the chaos and, even if there is no answer, just be able to wonder why.

An increasingly important role of art is in its psychological ability to enhance people’s lives. Art therapy is becoming a more consistent mode of rehabilitation for people in hospitals and outpatient clinics. In The Development of Modern Art Therapy Ernest Harms states, “The patient can express being forced to communicate to someone. He can express emotions and the

15 Ibid., 21.
variety of unclear and half-conscious experiences as they come up.”18 While therapists, psychologists and psychiatrists can analyze mental health issues, there is much that people do not express verbally. In 1860, Florence Nightingale, the founder of modern nursing, recognized the importance of art, “The effect in sickness of beautiful objects, and especially of brilliancy of color is hardly appreciated at all...People say the effect is only on the mind. It is no such thing. The effect is on the body, too. As little as we know about the way in which we are affected by form, by color and light, we do know, that have an actual physical effect…Variety of form and brilliancy of color in the objects presented to the patients is an actual means of recovery.” Nightingale thus proves that art in the medical sciences is a very important medicine and therapy.

In comparing art and physics, Shlain’s biggest claim is that “revolutionary art and visionary physics attempt to speak about matters that do not yet have words.”19 Science looks at invisible particles the way art looks at invisible emotions. Even more remarkable is the ability for both areas to raise issues that are actually visible, yet blatantly ignored. For example if it weren’t for science we would not know about the greenhouse gases that are changing the climate--let alone, where they come from. Artists similarly raise issues on both scientific and cultural scales. Vik Muniz, as documented in Wasteland, raises the awareness of the people in Brazil living on, working for, and living off of the landfill Jardim Gramacho. The portraits of the individuals made out of trash raise a multitude of issues from poverty to first world privileges and our role as consumers (Figure 3). Additionally the visualization of science can be seen as an art form. For example, illustrating the different rhizomes and molecular cellular structure that would otherwise be invisible is a direct intertwining of art in science. Fractal art is an example of a visual art form that is derived from scientific and mathematical algorithms. In fact, many algorithms, paint

19 Shlain, 20.
pigments, computer programs, cameras, etc. use equations found in nature, therefore making science an intrinsic part of art.

Intermingling science into art one can see the technological advances of scientific and artistic pursuits that lead people to different forms in both fields. In photography for example, science was the main impetus in its development. The mechanics of the camera, the chemicals involved in producing an image (or at least making a negative), required a systematic and scientific approach in making the process become reliable and functional. The artistic part comes in what to use the camera for. In printmaking, different etching techniques resulted out of a very process of refinement in the sense that an experiment (which is what many artistic processes are) could be repeated like a hypothesis. Today new artistic processes are coming about everyday from science such as the internet art of the past decades, to 3D printing.

A long held combination of artists as scientists is that of work dealing with botany, which I am using as the historical foundation of my thesis work. Artists have long predicated their art on the use of flora and fauna. From the still lives of painters to the beginnings of photography plants have long been a subject matter for artists. Anna Atkins was one of the first to utilize photography for her botanical studies in the 1843 publication *Cyanotype Impressions: Photographs of British Algae* (Figure 4). It was the first time a book was published with the photographic medium, in addition to her being among the first (if not, the first) female photographers. Atkins said “The difficulty of making accurate drawings of objects as minute as many of the Algae and Confera, has induced me to avail myself of Sir John Herschel’s beautiful process of Cyanotype, to obtain impressions of the plants themselves.” Botanical artists are illustrators of science. They document plants as accurately as possible, a form of phenological observation. The plants are generally separated from their surroundings (a white background) in
order to further the focus on each individual phase of growth (Figure 5). Botanical illustrations combine a level of skilled craftsmanship on the part of the artist and an eye, literally, for botanical science. Karl Blossfeldt is an artist that uses botany as a resource, but not with the purpose of acting like botanical studies. In the publication of Blossfeldt’s images (Figure 6), Working Collages, the editors state that his work, while using plants as the subject of his images, “his interest in botany was marginal”, rather he was looking for an “archetypal art”. Plants combine form and function, “Blossfeldt,” the editors state, “used the medium of photography to break down this unity.”

For my own series Death Becomes Us (Figure 8-17), I am taking actual plants and bees and scanning them in. I have always held an interest in botany, but the collection of plants began after my mom passed away. It provided a sense of preservation to theses aspects of beauty, much like photographs preserve the memory of my mom. I scanned them in and it was not until I printed them out that I realized the beauty of the minute details. I have explored different routes in using the images (i.e. abstracting, manipulating, etc.), but none have brought out the truth I sought in representing nature. This is why I am taking a scientific approach to this work by leaving the images unaltered. Today we are bombarded by altered images. Photos of space are colored and brightened with Photoshopped stars and sometimes are entirely fictional, power lines and unsightly garbage can be erased from images of landscapes despite that being a reality. All of these manipulations begs the question, can we really believe what we see? In representing nature I want the answer to be yes. Just as in portraiture where people want to portray the true

identity, personality, and persona of the individual subject, here I want to portray the true essence of nature.

Like the botanical artists, I separate the plants and bees from any surrounding context in order to emphasize their aesthetics. In *The Interaction of Art and Science*, Sheldon Richmond stated that, “Rationality in science aims to eliminate error and so destroy false theories. The aim of science is the discovery of truth. However, rationality in art points out the weaknesses of imagination to create worlds that momentarily defy (rational) articulation.”\(^{21}\) My images are scientific in that the “truth” is discovered, whereas they “defy rational articulation” in scale which is meant to heighten awareness and really make someone look. I use the scanner as a tool to create these images. It is the variable that is held constant. Scanography (or scannography), the term used as a method of photography via scanner, has hundreds of artistic variations, many focused on botany. On his website dedicated to the art form, Christian Staebler states, “One of the most interesting things about scannography is that it is a new way to see the things around us. It’s not macro but can be! It’s not drawing but has something similar to those documentary drawings done to capture the essence of plants or animals! It’s not photography but it reproduces the reality with extraordinary precision.”\(^{22}\) The shallow depth of field due to the large aperture of the lens, which is essentially the entire width of the scanner bed, yields dramatic effects. Most scanography artists, however, keep the top off the scanner (usually to make room for large three dimensional objects) resulting in a black or dark colored background. In contrast I prefer the white background for the negative space that allows the image to feel tangible through the shadows cast on the white background. The high resolution of the particular scanners I use

\(^{21}\) Richmond, 83.

produces hyper-macro images. The next step in getting close to the items I scan would be to engage a microscope—an inherently scientific instrument.

Conceptually my images are based on prevalent environmental (or scientific) issues. I am taking the images of flowers and plants, not just because they are aesthetically pleasing but also in relation to the bees (Figures 13-17) address the significance of the lack of pollinators and what could be lost in the future. All of the flora and fauna I scan are dead—thus representing a state of peril that the earth lays in—an apocalyptic vision that is now reality, hence the title *Death Becomes Us*. Beauty exists in death, but death is imminent. My images are documentations, not unlike other artists such as David Maisel (Figure 7) or Anna Atkins, meant to depict the world as it is found. If you have read Orwell’s *1984*, or Huxley’s *Brave New World*, the worlds may seem so far fetched yet there is something that leads us to question what if that is where we are headed. Looking at the species I scan with such detail and beauty shows that we not only have to appreciate what is right in front of us but because they are no longer living, we must acknowledge that time is fleeting and can easily be taken for granted. The color, rather than a black-and-white image, is vital as again Richard Feynman stated, “The fact that the colors in the flower evolved in order to attract insects to pollinate it is interesting; it means that insects can see the color. It adds a question: does this aesthetic sense also exist in lower forms? Why is it aesthetic? All kinds of interesting questions which the science knowledge only adds to the excitement, the mystery and the awe of the flower.”

23 A world without bees could mean a world without flowers, “…important negative ecological and economic impacts that could significantly affect the maintenance of wild plant diversity, wider ecosystem stability, crop production, food

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security and human welfare.” Representing nature in this series combines my own artistic inclinations with scientifically based concerns.

Clearly, art and science are irrefutably linked. To separate, to define to make exclusive either field is impossible. Yet somehow stereotypes exist that the two are unrelated. A change needs to occur at the base level of education. Art and science need to be combined. Additionally change needs to occur in what our society holds as valuable—and this comes primarily via the government. Funding for the arts continues to decline as standardized testing increases the demand of math and science teachers. This goes back to the aforementioned requirement in every level of schooling for math and science courses, yet art remains optional. Our capitalist society rewards any educational and professional route that can reap the greatest monetary reward. However, many students get left behind because they may be less than inclined to regurgitate formulas and practice tests. Everyone learns differently, and for myself I can say that I have used very little of the physics and math formulas of the classes I was required to take.

Society as a whole tends to not value the “artist” as a legitimate profession. Throughout my time in college I have been asked what I want to do after school, and if I say artist people chuckle, perhaps at my own naivety. This negative reaction is the product of years of the stereotype of the “starving artist”. Of course artists need to support themselves, just they might not work the typical nine to five job, but ones that allow them the flexibility to continue their creative practices. One example of an institution engaging both the arts and sciences is the Exploratorium in San Francisco. The basis for the museum is “to make science education more equitable and more accessible.” Montessori schools are becoming more prevalent as a way for people to be

taught by learning in a less standardized way; but as long as the testing exists—these methods will remain the minority.

Schools divide art and science which leads to a gap between not only monetary value, but the value that the government and different institutions place on the subjects (science often seen as more valuable than art). Although, these subjects are so similar that once you begin to compare them it is evident there is very little difference. Both fields use creativity to look at things in new ways. Observing, analyzing, questioning, creating, experimenting, researching are words that both science and art thrive on. Truth seeking on levels from biological to philosophical is imbued in each subject. Critical thinking plus creativity—that is art and science.
Figure 1 James Balog. 7.15.06 | Aerial view of meltwater lakes and streams on Greenland Ice Sheet east of Kangerlussuaq. (Courtesy: extremeicesurvey.org/gallery-greenland/)
Figure 2 Chris Jordan. Cigarette Butts, 2013 "Depicts 139,000 cigarette butts, equal to the number of cigarettes that are smoked and discarded every 15 seconds in the US. Cigarette butts are the number one littered item found in America’s public spaces including parks, beaches, waterways, and urban environments. This form of litter has far-reaching impacts on the environment: littered butts leach numerous toxic chemicals and carcinogens, contaminate water sources, and poison wildlife. The filters are made of cellulose acetate, a type of plastic that does not biodegrade. (Courtesy: www.chrisjordan.com)"
Figure 3 Final Magna photographic print entitled "The Gypsy Magna--Pictures of Garbage" photography Vik Muniz (Courtesy: www.wasteland.com)
Figure 4 Cyanotype from Anna Atkins' 1843 book *Photographs of British Algae: Cyanotype Impressions*
Figure 5 Botanical illustration of carnations. Ulisse Aldroandi, medieval Italian artist.
Figure 6 David Maisel. Terminal Mirage 1 (Courtesy: www.davidmaisel.com).
Figure 7 David Maisel. Terminal Mirage 1 (Courtesy: www.davidmaisel.com).
Figure 8 Detail of *Papaver Rhoeas* (*Poppy*), 24” x 24” Archival Inkjet Print.
Figure 9 Detail of *Lotus Corniculatus (Bird’s Foot Trefoil)*, 24” x 36” Archival Inkjet Print.
Figure 10 Detail of *Lavandula (Lavender)*, 24” x 41” Archival Inkjet Print.
Figure 7 *Calliandra haematocephala* (Powder Puff), 24” x 28” Archival Inkjet Print.
Figure 12 *Arabis alpine* (*Alpine Rock-cress*), 24” x 31” Archival Inkjet Print.
Figure 13 #1, 24” x 24” Archival Inkjet Print.
Figure 14 #2, 24” x 24” Archival Inkjet Print.
Figure 15 #3, 24” x 24” Archival Inkjet Print.
Figure 16 #4, 24” x 24” Archival Inkjet Print.
Figure 17 #5, 24” x 24” Archival Inkjet Print.
Bibliography


