

Towards a Transdisciplinary Culture: Bridging the Gulf between Art and Science

By Julia Buntaine

“All religions, arts and sciences are branches of the same tree. All these aspirations are directed toward ennobling man's life, lifting it from the sphere of mere physical existence and leading the individual towards freedom.” – *Albert Einstein, 1937*

“Isn't it time we began? The danger is, we have been brought up to think as though we had all the time in the world. We have very little time. So little that I dare not guess at it.” – *C.P. Snow, 1959*

The sciences and the humanities are two sides of the coin of our culture. Together they provide the technology that enables our medicine, the paintings that enrich our senses and surroundings; the sciences and humanities hold our species' greatest intellectual and creative achievements, rooted in the human desire to investigate the big, ontological questions. While unaware of each other, it is no coincidence that as Einstein was working on his groundbreaking theory of special relativity, Picasso was investigating the relationship between space and time in his own revolutionary piece, *Les Femmes d'Alger (O. J. R. M.)*.

In the case of Einstein and Picasso, it is as if the idea that space and time had a specific relationship to be discovered was in the air in the early 20th century, and this example of the convergence of art and science on the same topic is not an isolated incident¹. The sciences and the humanities have always been interested in the same things. E.O. Wilson, notable American biologist and author, refers to the sciences and humanities as two of our “great branches of learning,”² and when thought of this way, it is easy to see how the same topics crop up in both disciplines. Gauguin's infamous painting *Where Do We Come From? What Are We? Where Are We Going?* encapsulates the fundamental ideas that have driven the investigations in both the arts and sciences throughout the ages; these questions are as central to biology, neuroscience, physics, astronomy, geology, and ecology and they are in classical art, medieval art, realism, modernism, and postmodernism.

Arthur I. Miller, noted physicist and author on science and art, wrote, “Art and science at their most fundamental are adventures into the unknown.”³ Despite such a fundamental commonality, these two branches of learning are exploring the same frontier of knowledge in separate buildings, talking in separate journals, sharing insights at separate conferences. As Wilson would say, “They are indeed creative siblings, but they lack a common language.”⁴

The arts and sciences were not always separate, however, which prompts the discussion of their separation and its implications. An intellectual culture in which there is a free exchange of knowledge and ideas across disciplines is a culture lost to us. Whether for a personal gain of the practitioner, a gain within the given field, or a broader cultural gain, the arts and sciences should communicate, and more. Imagine what could have been gained had Einstein and Picasso known each other, shared their ideas? Operating blindly of each other, two of our great modes of investigation are acting alone—but that may be changing. In order to adequately discuss the importance of last point, however, how our intellectual culture came to be divided, and why, must first be explored.

¹ Leonard Shlain, *Art & Physics: Parallel Visions in Space, Time and Light* (William Morrow Paperbacks 2007).

² Edward O. Wilson, *Consilience: The Unity of Knowledge* (Vintage, 1999), 12.

³ Arthur I. Miller, *Insights of Genius: Imagery and Creativity in Science and Art* (MIT Press, 2000), 432.

⁴ Edward O. Wilson, *Consilience: The Unity of Knowledge*, 126.

THE TWO CULTURES

So what does it mean—that the two “siblings” of our intellectual culture are largely unable to communicate? In 1959 C.P. Snow delivered his now infamous lecture entitled “The Two Cultures and the Scientific Revolution.”⁵ Snow, British scientist and novelist, was one of the first to write on the stark division of our intellectual culture (as separate from practical, quotidian life) into the sciences and the “literary”—or the humanities—and he saw this divide as a tragedy. (While the “sciences” he refers to are the natural sciences, the “humanities” was meant to encapsulate the creative humanities and the social sciences. This essay will largely center on the relationship between the sciences and the creative humanities, or “the arts,” as they commonly represent the humanities at large.) “The degree of incomprehension on both sides is the kind of joke which has gone sour,” he wrote, lambasting scientists for not being able to make it through a Dickens novel and artists for being “tone deaf” to science. Snow went on to say, “To us as people, and to our society... It is at the same time practical and intellectual creative loss.”⁶

Typical of any speech making claims about something as complex as culture, Snow received his own dose of criticism. Nonetheless, these words struck a chord across the global intellectual sphere, reverberating through time to today. Fifty years later the two cultures persist, and people like Wilson and others are still writing about it. But what is the big problem with intellectual culture being split into two? What are the consequences of this tragedy?

THE ONE

To fully understand the consequences of the split in our intellectual life, a discussion of the time when there was no such divide must be had. The Renaissance was for the arts what the Enlightenment was for the sciences; each were able to break free of middle-aged traditions, reach back into history, and cultivate the genius handed down by the Greeks and Romans.⁷ The 300 years spanning these periods gave birth to the modern course that the arts and sciences have followed. Some of the greatest scientists and artists of history are from this time including Galileo, Giotto, Leonardo da Vinci, and Isaac Newton. As the Renaissance was a rebirth from the Church into the free art world in the 15th century, the Enlightenment served as the rebirth of science, beginning in the late 17th century.

While the Enlightenment was shaped by many great figures all across the Western world, the words and works of philosopher and scientist Francis Bacon provide a clear window on the zeitgeist of the Age of Reason. As Wilson writes, “The grand architect of this dream was... Francis Bacon. Among the Enlightenment founders, his spirit is the one that most endures.”⁸ Wilson also included a quote of Bacon’s, speaking on how the culture at large must recover from the repressive force of the Middle Ages:

⁵ C.P. Snow, *The Two Cultures and the Scientific Revolution* (Cambridge University Press, 1959).

⁶ C.P. Snow, *The Two Cultures and the Scientific Revolution*.

⁷ E.H. Gombrich, *The Story of Art* (Phaidon, 1995), 223.

⁸ Edward O. Wilson, *Consilience: The Unity of Knowledge*, 23.

“And whilst men agree to admire and magnify the false powers of the mind, and neglect or destroy those that might be rendered true, there is no other course left but with better assistance to begin the work anew, and raise or rebuild the sciences, arts, and all human knowledge from a firm and solid basis.”⁹

Bacon, embodying the Enlightenment values, believed in a sort of unity among all branches of learning, considering it crucial to improving the “human condition.” The Enlightenment, therefore, was the distinct historical time in which all branches of learning, all modes of inquiry, were considered equally important in that each kept the others in perspective, and each helped the others to stay whole. Professionally contributing to a number of fields was common during this time, as evidenced by figures such as Isaac Newton, John Locke, Diderot, Leibniz, and Rousseau.

THE GULF

Today, the gulf between the sciences and the humanities (especially the arts) is best felt by those who are involved in both fields. To split time between the laboratory and the studio, for example, is to experience a double-life where the conventions, conversations, and expectations of each are vastly different. While in one, it is often fruitless to speak of the other; the attitude of one field is indifference to the other, their view of the other distorted with ignorance and prejudice. This is revealed in the common caricatures of our culture; scientists are dry, heartless, and disconnected from the human condition while artists are misanthropic, existential drunks. For anyone who moves between these two cultures, these attitudes are doubly troubling.

An intellectual culture divided is one that operates in an incomplete context. As Wilson wrote, “Only fluency across the boundaries will provide a clear view of the world as it really is...”¹⁰ and it is this sentiment which lies at the heart of the matter: with an unbalanced view, how can the meaning of any of our discoveries be wholly devised, or understood by either side? It is a loss that cannot be quantified, because it is loss of opportunity.

EDUCATION

Snow, among the many to succeed him, have pointed their fingers to education as the foundation for the formation of the two cultures, and thus, the place for their reunion to occur. The Western educational system is one geared towards specialization; in the sciences, the combining of subjects into hyper-specific fields is becoming more and more common, such as “biophysics” and “neuroaesthetics.” While this enables individuals to become experts in fields that require extreme specificity, this specialization has the byproduct of creating experts in the sciences and humanities who have little or no knowledge of the other, because they are not required to. Specialization also leads to

⁹ Edward O. Wilson, *Consilience: The Unity of Knowledge*, 23.

¹⁰ Edward O. Wilson, *Consilience: The Unity of Knowledge*, 13.

intradisciplinary experts who may know everything there is about an atom, but have never heard of RNA. It is a modern day version of the oft-quoted Indian parable about the six blind men who describe an elephant in six different ways due to their vantage points, unaware of each other's perspectives.

Similarly, education in the arts has become more specialized, sparked by post-WWII funding to attend BA and MFA programs provided by the G.I. Bill. Those who pursue careers in the arts are expected to go to graduate school now, unable to teach at the college level—the most standard career path for those in the arts—without a graduate degree. And with the advent of institutions dedicated to only the arts, young and emerging artists alike easily elude a multi-disciplinary educational setting, replacing science and math with the texts of theorists like Lyotard, Derrida and Foucault.

THE POSTMODERN EFFECT

While the structure and aims of our educational system helped form the gulf between our two cultures, the sciences and the arts have also suffered from another force that has only complicated the matter. Beginning to appear in the creative humanities and social sciences in the late 19th century, this movement gained cultural prominence in the 1980s and 90s after Jean-François Lyotard coined the term in 1979¹¹—Postmodernism. Rejecting the “pure form” of modernist ideal via parody, ironicism, and deconstructivism, postmodernism mixes high art with pop culture, insists on a plural over singular meaning, and seeks to flout old conventions through shocking new forms. In postmodernism everything becomes self-referential, and every text a language game the author constructs and the reader plays with himself. There is no truth, because there is no “real” reality, only social reality. Beauty is a construct to stand against, and the multiplicity of meaning in a work is as endless as the image in two opposing mirrors.

As with every cultural movement, it is not particularly productive to deem postmodernism a “good” or “bad” thing that happened to the humanities at large. It was what it was. What is productive is to talk about the specific ramifications postmodernism had. At best, postmodernism introduced the idea of the artist being the authority who claims their work a work of art (thank you Duchamp, and his *Fountain*). At worst, art of the postmodern variety led to the drastic cuts of the National Endowment for the Arts' governmental funding (thank you Andre Serrano, and his *Piss Christ*). Indeed it was unfortunate that Senator Jesse Helms crossed paths with Serrano's work. Paired with a few other similar incidents during this time (including Dread Scott Tyler's *What is the Proper Way to Display an American Flag?*), 1989 was the last year the government, and the general public, trusted art enough to fund it seriously.

The National Endowment for the Arts is one of two federal funding sources for those in the humanities in the U.S. (the other being the National Endowment for the Humanities which focuses on institutional funding), providing grants in all artistic fields including the visual arts, literature, media arts, music, opera, dance, design, and theater. In 1989 the NEA had 320 million in funding (after inflation conversion), a number that

¹¹ See: <http://plato.stanford.edu/entries/postmodernism/#9>

was generally rising before that year, but began to generally decrease following that year. The ramifications of the 1989 controversies came to a head seven years later, and funding was cut from 250 million in 1995 to about 148 million in 1996. Today the NEA's appropriations budget is hovering around 146 million.¹² Individuals pursuing careers in artistic fields in the United States—most of who wouldn't identify with the postmodern movement—desperately feel this funding cut.

CULTURAL MARGINALIZATION

The ideas that postmodernism propagated were not restricted to the arts and humanities, however; the cultural marginalization of science is postmodernism's other tragic consequence, which Snow saw forming back in 1959:

“...I believe the pole of total incomprehension of science radiates its influence on all the rest. That total incomprehension gives, much more pervasively than we realize, living in it, an unscientific flavor to the whole ‘traditional’ culture, and that unscientific flavor is often, much more than we admit, on the point of turning anti-scientific.”¹³

Claiming all knowledge as the product of a narrative that it rejects, postmodernism undercuts the very seeking, testing, and transcribing of knowledge which science commits itself to pursue. Indeed, like Snow asserts, as postmodernism crept its way into the general humanities, the subversion of science crept its way into our culture and Congress via their largely social-science education.¹⁴ With 535 members of Congress only nine members are research scientists by degree¹⁵. Jonathon Zilberg, contributor to *Leonardo Review* and researcher in the department of Transtechnology at Plymouth University, wrote on this subject:

“No doubt the problem of specialization is a constant challenge as are the unique barriers to becoming scientifically literate and the importance thereof particularly for government policy making. Some scientists might well be ‘culturally’ illiterate as regards ‘great’ and other literature and most scholars in the humanities and social sciences, and especially citizens in the ‘public’ sphere, are to varying degrees scientifically illiterate.”¹⁶

Today the attitude around science has enabled a culture in which half of the U.S. population does not believe in, or is not worried about climate change¹⁷. As with the arts, the postmodern attitude towards science shows up in the numbers. The National Science Foundation, a main source of funding for research scientists, has an annual budget of \$7

¹² See: <http://arts.gov/open-government/nea-budget-planning-information/national-endowment-arts-appropriations-history>

¹³ C.P. Snow, *The Two Cultures and the Scientific Revolution*.

¹⁴ Edward O. Wilson, *Consilience: The Unity of Knowledge*, 126.

¹⁵ See: http://www.huffingtonpost.com/bill-lucey/113th-congress-by-the-num_b_2737382.html

¹⁶ Jonathon Zilberg: http://www.academia.edu/2513650/Beyond_the_Estuary_Metaphor

¹⁷ See: <http://www.weather.com/news/science/environment/more-americans-dont-believe-global-warming-happening-survey-20140117>

billion. While this is about 48 times more than the arts' budget, it is miniscule compared with the \$625 billion for military, or \$851 billion for Medicare and Medicaid.¹⁸ Who knows how much more funding the arts would see, or the sciences for that matter, had one senator not taken offense to the “mood swing”—to borrow Wilson’s phrase—of postmodernism.

BRIDGING THE DIVIDE

Divided, the sciences and the arts are suffering similar fates; after the dream of Bacon fizzled out, our educational system created specialists who don’t speak the same language, and because postmodernism undercut the legitimacy of the arts and sciences, each have been marginalized by the systems they’re housed in, and in turn they have marginalized each other even further. While each has its own battles to fight, surely they are not better off apart.

So, what is to be done about the two cultures? Four years after Snow published his essay he revisited the topic with an addendum; as he wrote in *The Two Cultures: And a Second Look*, “It is probably too early to speak of a third culture already in existence. But I am now convinced that this is coming. When it comes, some of the difficulties of communication will at last be softened...”¹⁹ Snow envisioned the building of a bridge of communication between the sciences and general humanities, closing the “communications gap” which kept each ignorant of the others’ achievements.

THE THIRD CULTURES

Indeed, a third culture has arisen, but it is not what Snow had in mind. The third culture, as it stands today, describes the communication of science not to the humanities, but to the public at large, in the form of popular science books. Brian Greene and Richard Dawkins are two names that heavily populate the science section of the Barnes and Nobles bookshelf. John Brockman, founder of The Edge Foundation and author of the popular science book *The Third Culture: Beyond the Scientific Revolution* (1995), wrote on the third culture he’s helped to form:

“The third culture consists of those scientists and other thinkers in the empirical world who, through their work and expository writing, are taking the place of the traditional intellectual in rendering visible the deeper meanings of our lives, redefining who and what we are.”²⁰

Circumventing the humanities altogether, scientists and science writers now publish books about their own their colleague’s research, and Brockman is the first to admit this: “Although I borrow Snow's phrase, it does not describe the third culture he predicted. Literary intellectuals are not communicating with scientists. Scientists are

¹⁸ See: http://en.wikipedia.org/wiki/File:U.S._Federal_Spending_-_FY_2011.png

¹⁹ C.P. Snow, *The Two Cultures: And a Second Look* (Cambridge, 1964).

²⁰ John Brockman: <http://www.edge.org/conversation/the-third-culture>

communicating directly with the general public.”²¹ Whether his statement about communication was an observation or an agenda is unclear, but what is clear is that the sciences and humanities are still not communicating. While it is great that one can now pick up a bit of astrophysics while riding the subway, this does not move our cultures toward any kind of unification.

Aforementioned scientist and author E.O. Wilson proposed another brand of third culture in the late 90s in his book *Consilience: The Unity of Knowledge* (1998). In *Consilience*, Wilson argues for a unity of the two cultures. “The strongest appeal of consilience,” he wrote, “is in the prospect of intellectual adventure and, given even modest success, the value of understanding the human condition with a higher degree of certainty.”²² Wilson ends *Consilience* stating, “A united system of knowledge is the surest means of identifying the still unexplored domains of reality. It provides a clear map of what is known, and it frames the most productive questions for future inquiry.”

While Wilson offered a few ideas of how to apply to the branches of learning consilience principles in a non-artificial, ad-hoc way, what he offers is much more applicable within the sciences themselves (a unity among physics and neuroscience, for example). Wilson essentially argues to unite the creative humanities and social sciences with the natural sciences via adopting a reductionist approach across the board—because everything is made up of atoms, after all. With the passionate heart of a scientist, what Wilson misses is that atoms are only one level of description, and is not necessarily the best level in every instance, especially for the arts, which speak to human experience (human experience being a subject described poorly by atoms).

A FOURTH CULTURE

Jonah Lehrer, noted science writer and author of *Proust was a Neuroscientist* (2007), has had a special focus on the overlaps between the arts and sciences. Taking a cue from Snow, Brockman, and Wilson, Lehrer proposed his own solution, a “fourth culture,” to fix what the third cultures got wrong. In the final segment, his *Coda*, Lehrer described the nature of this fourth culture as,

“...one that seeks to discover relationships *between* the humanities and the sciences. This fourth culture, much closer in concept to Snow’s original definition... will ignore arbitrary intellectual boundaries, seeking instead to blur the lines that separate. It will freely transplant knowledge between the sciences and the humanities, and will focus on connecting the reductionist fact to our actual experience. It will take a pragmatic view of the truth, and it will judge truth not by its origins but in terms of its usefulness.”

Proust was a Neuroscientist put Lehrer on the popular science book map, offering fascinating insight into the work of eight artists (visual artists, writers, a poet, a cook, and

²¹ John Brockman: <http://www.edge.org/conversation/the-third-culture>

²² Edward O. Wilson, *Consilience: The Unity of Knowledge*, 9.

a musician) whose work conceptually illustrated aspects of neuroscience yet to be discovered. It is his above-quoted *Coda*, however, that contains Lehrer's core message: in today's world art and science can, and should exist in the same intellectual sphere because, "Both art and science can be useful, and both can be true."²³ Indeed, Lehrer's fourth culture seems much closer to what Snow envisioned, where the sciences and the arts communicate, share ideas, pair scientific method with artistic experience and leave behind old prejudices. Whether because it came at the end of his book, because the interest-factor for readers lied in the chapters about the artists, or because it is simply a difficult job, Lehrer's fourth culture largely began and ended in his *Coda*.

SEMANTICS AND SYNCRETISMS

In this essay, and throughout the literature regarding this topic, there are a number of terms used to describe the two cultures problem. There is the "intersection," the "crossover," the "overlap" between the sciences and arts. The arts and sciences "collide" and "meet." To fix the "problem" of the two cultures we can "bridge the gap," "bridge the divide," or "gulf." In the "bringing together" of the arts and sciences we will "fuse" them, "unite" them, there will be a "synthesis" into a "third culture," "fourth culture," or a "consilience."

While the sentiment is sure, language can be problematic when trying to devise a solution to a cultural problem. Each of those phrases means something a little bit different, and while all are talking about the same general thing, the effort to "unite" the arts and sciences is an effort not united. This point is important to linger on because in trying to bridge the gulf between the sciences and arts, there are many ways one can go about it. The above phrases span everything from providing a link between the two to throwing them in the big cultural blender together, to lose all boundaries and distinction. So fixing the problem of the two cultures, one must consider what this could mean, and take careful steps in doing so.

There is also the question of if our culture should return to the days of "The One" culture, where the boundaries between the sciences and arts were so fluid as to be indistinguishable? While the days of the Renaissance and Enlightenment were some of the most important in our cultural history, the sciences and arts then were whispers of their own potential. In his latest book Arthur I. Miller writes, "We may question whether we can ever become Renaissance men and women. It's important to remember that during the Renaissance...when Enlightenment, the Age of Rationalism, began—there might have been less to know, but what was known was often vague... Today the amount of knowledge is comparatively huge, bogged down with highly specialized, complex subjects."²⁴

Despite the problems that specialization has created in intellectual society, it would be a mistake to fuse the arts, humanities and sciences as some have suggested. In

²³ Jonah Lehrer, *Proust was a Neuroscientist* (Mariner Books, 2008), 197.

²⁴ Arthur I. Miller, *Colliding Worlds: How Cutting-Edge Science is Redefining Contemporary Art* (W. W. Norton & Company, upcoming 2014).

his 2011 speech “Third Culture?: From the Arts to the Sciences and Back Again,” Roger Malina, executive editor of *Leonardo Journal*, spoke of physicist Jean-Marc Levy-Leobold’s book *Science is Not Art*, saying “He argues that there are very good reasons that the arts and sciences have separated, that we need disciplines and we don’t want a syncretism.” While the sciences and arts may ultimately be concerned with the same topics, they do not go about their concern in the same way, and that is what makes each of them important modes of investigation. To lose the deep, rich tradition of the scientific method and the ruthlessly independent spirit of art for some watered-down combination of the two would be devastating. Thankfully, a syncretism is not the only option for the future reunion of our branches of learning.

ARE WE READY YET?

With 55 years since the discussion of the two cultures began, the rise of the third cultures which did nothing to bridge the divide, and the proposal of a fourth culture which offers hope of reconciliation between the arts and sciences in the form of free exchange of knowledge—is it time to stop talking and start changing?

However small, there is a tangible change occurring, as evidenced by a few emerging movements in the educational system and governmental funding. The STEM Education Coalition is an initiative that has set out to actively raise awareness in Congress and the administration about the importance of STEM (Science, Technology, Engineering, Mathematics) driven-learning to keeping the U.S. technologically and economically dominant.²⁵ The STEAM movement is a Rhode Island School of Design initiative in response to STEM, adding in “Art/Design”²⁶ to the acronym (commonly referred to as “STEM to STEAM”). The National Science Foundation and the National Endowment for the Arts have started conversations about funding across disciplines (and have begun to do so).²⁷ There are also a growing number of artistic residencies at scientific institutions such as CERN, as well as organizations that have devoted themselves to bringing the arts and sciences together, such as Leonardo/The International Society for the Arts, Sciences and Technology, Art & Science Collaborations, Inc, and *SciArt in America*.

Given the growing number of these cross-disciplinary presences, some would go as far to say that the two cultures don’t exist anymore²⁸, but the fact of the matter is that for anyone not actively engaged in these groups, the idea of the sciences and the arts in the same sphere sounds odd, if not intriguingly so. Although there are people who operate at the intersection of the sciences and the arts, it doesn’t mean they haven’t remained disciplines with a veritable gulf between them.

²⁵ See: <http://www.stemedcoalition.org/>

²⁶ See: <http://stemtosteam.org/>

²⁷ See: http://www.huffingtonpost.com/john-m-eger/art-based-learning-gets-n_b_1867277.html

²⁸ Roger Malina: <http://malina.diatrope.com/2014/03/29/c-p-snow-proved-wrong-malina-says/>

A TRANSDICIPLINARY CULTURE

While these connections between the sciences and arts are a sure start, they are mere beginnings of what needs to be a major cultural shift towards transdisciplinarity. Michael Punt, professor of Digital Art and Technology at Plymouth University and Editor-in-Chief of *Leonardo Reviews*, importantly points out that in transdisciplinary research, as opposed to interdisciplinary research, one "...extends the scope, methods and perspectives of existing disciplines whilst at the same time respecting and using the existing disciplinary framework..."²⁹ Additionally, Punt argues that transdisciplinary research "...must be intelligible outside of one's own discipline... [and] must have the capacity to produce new knowledge in the discipline being commented upon."³¹

In a transdisciplinary culture, echoing the sentiments of Snow and Lehrer, there would be a free exchange of knowledge between disciplines—one could jump between the branches of learning with ease. Those in the humanities would have institutional access to scientific journals like *Science* and *Nature*, while those in the sciences would read the Arts section of the New York Times and the latest Pulitzer Prize winning novels. The specialization that enables specific disciplines could continue to thrive in an educational setting which puts emphasis on crossing disciplinary boundaries by housing them in the same buildings. There would be mutual appreciation for modes of investigation other than one's own, and transdisciplinary collaboration would go from a rare occurrence to become a normal part of research. This cultural shift would be felt on all levels from education, to policy-making, to the individual practitioners. With a mutual air of respect the humanities and the sciences would stop being needlessly ignorant of one another and in turn, each could become whole again.

THE ARTS ON SCIENCE

At the heart of this transdisciplinary culture are, and will be, those in the arts who have turned their creative gaze towards science. Artists (in the broadest sense, spanning visual artists, writers, musicians, actors, etc.) are the ones who are going to reach the general public with transdisciplinarity and will do so no matter the cultural, political, or monetary climate. The arts have always served to communicate ideas, and like any subject matter, science is a subject more and more artists are dedicating themselves to as science has moved its way toward the center of daily life. Science-inspired art is in fact the only way that Levy-Leobold could envision a true, and productive connection between the arts and sciences, as Malina summarizes his words as relating to the act of translation:

“I want to argue here that these ‘goals’ of art-science may be viewed as tasks of ‘translation studies’... Artists who visit or work in the world of science, through the journey from art to science and back, can not only

²⁹ Martha Blassnigg and Michael Punt: <http://trans-techresearch.net/wp-content/uploads/2010/11/Punt-Blassnigg-2013-Transdisciplinarity.pdf>

³¹ Jonathon Zilberg. http://www.academia.edu/2513650/Beyond_the_Estuary_Metaphor

notice aspects of the landscape ignored by the scientist, but also translate in ways familiar to the [public]... one of the tasks of the translator then is to find ways to transfer certain ‘translatables’ while acknowledging that much is untranslatable.”

Malina goes on to say, “Levy-Leobold’s second general argument relates to how artists help scientific ideas become culturally re-appropriated, and then fed back into the imagination of scientists.”³³ While there is clearly more room than for only science-related art in a new, united transdisciplinary culture, artists are in a way pioneering this effort, and have been for the past 40 years or so.

Due to its transdisciplinary nature the science-related art community, while small, is made up of individuals who are brilliantly creative and endlessly passionate, pushing boundaries of how one can talk about science through an aesthetic lens, and bringing science to the general public. Be it through dance, fiction, or sculpture, artists can give form to abstract data, color to statistics, experience to description. As Lehrer notes,

“While science will always be our primary method of investigating the universe, it is naïve to think that science can solve everything by itself... We now know enough to know that we will never know everything. This is why we need art: it teaches us how to live with mystery. Only the artist can explore the ineffable without offering us an answer, for sometimes there is no answer.”

As stated above, this focus on science for creative practitioners is happening across artistic fields. In the world of fiction there are authors like Kim Stanley Robinson who explores both prehistorical and ecological themes in his books including the *Mars Trilogy* and *Shaman*. There is the poet Lynn Schmeidler who rhymes experiential descriptions of maladies from the DSM. Canadian rapper Baba Brinkman tours internationally with his *Rap Guide to Evolution*, framing evolutionary principles as analogous to principles of rap culture. The Deconstructive Theatre Project of New York incorporates ideas of consciousness and memory into the story and structure of their productions, while dancer Jody Oberfelder choreographs an immersive dance/theater production based on the concepts and architecture of the four chambers of the human heart.

SCIENCE-BASED VISUAL ARTISTS

One area of the arts has especially taken to science as a subject matter, however, and that is the visual arts. While the visual arts are in a sense the furthest from the natural sciences on the humanities/science spectrum, science-based visual art is an emerging force in the art world, residing in the Avant-garde fringe. Either through the exploration

³³ Roger Malina: <http://malina.diatrope.com/2011/08/10/third-culture-from-the-arts-to-the-sciences-and-back-again-in-shanghai/>

of scientific topics or in the use of new-technology³⁴, artists have found fertile ground for transdisciplinary interaction in the visualizing of science.

To end this essay, a few examples of current science-related artists in the United States who are fulfilling Snow's dream of bridging the gulf is called for. Artist Brandon Ballengée is a classic example in the science-based art world, where art has the potential to call attention to and inspire new questions in the science it's giving form to. Holding multiple degrees, Ballengée is also a biologist and eco-activist, who is best known for his scientific and artistic work on the deformities found in amphibian populations. In a recent interview Ballengée shared his approach as a transdisciplinary artist:

“Underlying my practice is a systemic methodology, which posits art practice as a means of realizing research science, and vice-versa. While conducting primary research biological studies, scientific methods, and standards are rigorously followed... The art is an expression derived from experiences with animals in natural or artificial conditions and from the primary scientific research... While making art, I work through mediums based on intuitive decision-making and reflect on the science questions in a different less objective way. This looking from a different viewpoint inspires new questions, experiments, and more science.”³⁵

Jonathon Feldschuh, data scientist and science-based artist, recently showed a large-scale photographic series called “World Egg” comprised of altered, oval-shaped images of cosmic radiation captured by NASA. His series touches upon the notion of how artists can contribute to the field of scientific visualization and relaying findings to the public:

“...this time I started with the actual data and made a new visualization from it. In that sense, [this series is] completely scientifically valid... One of the things that I like to think about and show in my work is that the colors that we use to display scientific images are arbitrary. Scientists know and acknowledge this, but, what they don't spend a of time thinking about is that when you color an image, it resonates in the world of images, which is an incredibly rich, nuanced, and sophisticated way of communicating information.”³⁶

Lorrie Fredette is an installation sculptor whose work interprets the epidemics that have plagued our species throughout history. In speaking on her work, Fredette mentioned another function of science-art—that of the embodied experience of science. In speaking of one of her pieces in which a bottom-up view is offered, Fredette explained:

³⁴ Victoria Vesna: <http://vv.arts.ucla.edu/publications/publications/0001/ThirdCulture/ThirdCulture.htm>

³⁵ *SciArt in America*, February 2014: <http://read.uberflip.com/i/253207/18>

³⁶ *SciArt in America*, December 2013: <http://read.uberflip.com/i/220128/18>

“I’m interested in offering the viewer a choice: the ‘best experience’ of the piece is also the less accessible one. The fact that the most potent way to engage the installation is on your back, ‘belly up,’ accentuates your submissiveness and susceptibility. Participation is not too dissimilar from real-life exposure to contagion... By selecting the appropriate partnering venue, taking the time to research and understand the underpinnings of the epidemiology and social history of disease, and employing a sense of beauty, I create installations that are like a conversation with each viewer. I believe in the power of conversations, one person at a time.”³⁷

CONCLUSION

In a transdisciplinary culture, this kind of work would exist in an intellectual environment geared towards the pursuit and sharing of knowledge no matter the discipline. That disciplines as different as biology and sculpture, for example, can find a fruitful common ground bodes well for the potential of other productive interactions between the sciences and humanities at large. In, and through, a transdisciplinary culture, Bacon’s ideas can live on while the distinctions that disciplines have flourished in can be maintained. In such a culture united, one could move easily between the branches of learning, and the sciences and the humanities could not only share in communication, but could be actively collaborating as well. Questions would be asked and answers sought on whatever branch of learning suited best. The sciences and humanities would not exist on a set spectrum but in a dynamic, dimensional culture. The sciences and humanities would know each other, as siblings do. In such a culture, the wound of the divide could finally be healed, and the sciences and humanities could move forward together into the exploration of reality known and unknown. In a transdisciplinary culture, the modern-day Einstein and Picasso would know each other.

In his original speech Snow noted, “It is bizarre how very little of twentieth-century science has been assimilated into twentieth-century art.” He would be pleased with the promise that the 21st century holds.

³⁷ *SciArt in America*, April 2014: <http://read.uberflip.com/i/287619/30>

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