Leonardo Reviews

Leonardo Reviews is the work of an international panel of scholars and professionals invited from a wide range of disciplines to review books, exhibitions, DVDs, CDs, websites, and conferences. Collectively they represent an intellectual commitment to engaging with the emergent debates and manifestations that are the consequences of the convergence of the arts, science and technology.

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Beyond the Estuary Metaphor

by Jonathan Zilberg

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Introduction

In the two last issues of the Leonardo Reviews Quarterly, Michael Punt and Roger Malina initiated a discussion on the problems of “big data” and the definition of what constitutes trans-disciplinary research. While that debate on the definition of trans-disciplinary research is interesting in and of itself particularly in terms of the responses to it and how this is being variously pursued in doctorate and undergraduate programs as well as already practiced in the K-12 International Baccalaureate pedagogy, my purpose here is different. Instead, I will explore how this debate, as advanced in Malina’s last essay has a special relevance to the critique of the legacy of C. P. Snow’s notion of “Two Cultures” as given in the Rede lecture at Cambridge in 1959. Returning to Snow and the incisive but somewhat forgotten critique that followed, this essay extends the Leavis and Yudkin Cambridge critique by highlighting the alternative legacies of Vladimir Nabokov, John Steinbeck and Stephen Jay Gould. Their lives and works are exemplary of many of the artists, literary figures and scientists whose works defy Snow’s simplistic dichotomy and arguably render it specious despite its apparent truth-value and obvious salience.

With the Charles Dickens’ anniversary coming up in 2012, the C. P. Snow debate is it seems all the more timely a discussion. For instance, consider the introduction by Jane Jacobs in Hard Times where she wrote: “What alarmed Dickens was the divorce that he sensed was occurring between science and the realms of imagination, poetry, myth, and legend... He was identifying in its infancy the mutual alienation of science and the humanities, the alienation that C. P. Snow, for one, would deplore a century later as two separate cultures unable to understand or appreciate each other’s information and values” (2001: xvii). A decade ago as Jacobs viewed it then, “cross-disciplinary studies and cooperative research projects and instruction remain[ed] spoty...” By this date however, the fields of inter-disciplinary and trans-disciplinary projects are established practiced in the International Baccalaureate system, and let us not forget that these concerns have always been a foundational norm in cultural anthropology and allied disciplines such as ethnomusicoLOGY. Moreover, these connections between the arts and sciences, media and technology have enormously expanded as we learn daily through the Yasmin network. This is so much the case that recently positions have even become available in “anti-disciplinary studies”. I like to imagine how Dickens might have satirized this continuing creative ferment. But back to C. P. Snow.

To understand just how specious C. P. Snow’s thesis was we need to return to the damning critiques by F. R. Leavis (then an eminent literary critic) and Michael Yudkin (then a young scientist) in Two Cultures? The Significance of C. P. Snow (1962). Before doing so, I should first provide a brief personal ca-
and maintaining disciplinary boundaries and the later creating fusions between them. First, he notes the need for periodic synthesis in order to keep up with the constant deluge of data. Second, he clarifies the difference between what constitutes trans-disciplinary from inter-disciplinary or multi-disciplinary research. He describes how the defining feature of trans-disciplinary research is to make its results intelligible and relevant across the disciplines concerned rather than to create a synthesis. In contrast to Punt though, what follows is not a discussion about the challenges presented by networked e-culture upon which these Leonardo debates have centered. The context I am interested in is the classroom – university or otherwise, the seminar and workshop, both the studio and the laboratory, recognizing and participating in their enervating digital extensions and connectivity. I ask: How is the Two Cultures debate relevant today? And how does it provide a productive challenge for those working across the arts/humanities and sciences? Both of those simple questions are interesting and problematic enough, never mind the challenges presented by new-networked media and doing cross-sector collaborative work. In the end, as I conclude, we must rely on what I term Punt’s Proof.

In LRQ 1.03, Roger Malina argued persuasively for an estuary metaphor for working across this broad disciplinary divide. But, more recently, in the lecture “Second Culture?: From the Arts to the Sciences and Back Again” he presented an auto-critique of the estuary metaphor. There he argues rather differently that the notion of the banks of the river forming the estuary recapitulated a straw man problem introduced by C. P. Snow. Revisiting Malina’s estuary metaphor and his subsequent auto-critique of the Two Cultures debate provides an opportunity or extending the current debate here in Leonardo Reviews Quarterly and in the Transtechology Research Reader series. This debate over Snow’s hypothesis has become pervasive in discussions of literature and science as evidenced in The Routledge Companion to Literature and Science (2011). There, to return to lone’s earlier critique and balanced defense, the estimation of Snow’s legacy is not always positive. Indeed, as also noted above, Snow’s idea of Two Cultures was soundly rejected at the outset at Cambridge by Leavis and Yudkin - though it seems their essays have been forgotten. Regardless, Snow’s ideas have long since achieved enormous currency in the popular imagination and in American universities and have played an important role in promoting holistic approaches to science in an environment of ever intensifying disciplinary specialization.

Today, the debate is all over the place. Take for instance a peculiar instance, the “scientific” explanation for the gap in an online essay by Dan Dewey “C.P. Snow’s Two Cultures: Hardware and Software, Discovery and Creation”. There Dewey refers to E. O. Wilson’s study Consilience: The Unity of Knowledge. Dewey argues that Snow’s gap still exists “but that its very origin is unexplained”. Fortunately however, Amy lone, in Innovation and Visualization (2005) drawing on Sidney Ross’s “Scientist: The Story of a Word” (1991) and Richard Yeo’s Defining Science: William Whewell, Natural Knowledge and Public Debate in Early Victorian Britain (2003), deftly provides an overview of the nineteenth century origin of the term “scientist” as a Romantic reaction to rationalism and the Enlightenment as well as its antecedents in Bacon’s 1620 Novum Organum (1665) and Platonic thought. Questions of origins aside, recently, John F. Egger in The Huffington Post, responding to an earlier article “Curriculum Designed to Unite Art and Science” published in the New York Times (May 27, 2008) by Natalie Angier. There Angier provided a useful list of then current initiatives specifically designed to overcome the “problem”.

One of those “exercises in fusion thinking” was the New Humanities Initiative at Binghamton University, a program that was appropriately conceived by a professor in biology and a professor of English. As Angier records it, George Levine’s response (he being an emeritus English professor) to the NHI proposal was this: “I was struck by how it absolutely refused the simple dichotomy of [the humanities and sciences]”. Later the article concludes with Levine exclaiming in a perfectly C. P. Snow-like voice, and not without some basis: “There is a kind of basic illiteracy on both sides. . . I find it a thrilling idea that people might be made to take pleasure in crossing the border.” Indeed.

On the 50th anniversary of C. P. Snow’s Rede lecture, Seed Magazine ran an article “Are We Beyond the Two Cultures?” (May 7, 2009). It describes how John Brockman of the Edge Foundation, took up Snow’s proposal of a third culture in “The Two Cultures: A Second Look” (1963). However unlike Snow, Brockman is not proposing that scientists and “literary intellectuals"
should communicate. Instead he points out that scientists are now communicating directly with an "intelligent reading public". Accordingly, to explore Snow’s dichotomy and the idea of a Third Culture and Third Culture Intellectuals, Edge interviewed six thinkers in separate on-line discussions in The Two Cultures Video Series, namely E.O. Wilson, Janna Levin, Lazslo Barabasi, Steven Pinker, Marc Hummer and Rebecca Goldstein. If that reflective on-line activity is not enough, and it is a very small sample, there is Chris Mooney and Sheril Kirshenbaum’s Unscientific America: How Scientific Illiteracy Affects Our Future (2009). Then there is the most obvious and symbolic testament to the power of the Snow legacy, the prestigious C. P. Snow Lecture Series at Ithaca College that has been ongoing for 40 years. With the unsettling statistic in mind that virtually half of all US and UK citizens are not only ignorant of the science of evolution but dead set against it as I have previously bemoaned, coming out against C. P. Snow is in some ways counterproductive to the greater cause of trans and inter-disciplinary science education – but nonetheless necessary.

The Leavis and Yudkin Attack on C. P. Snow’s Notion of Two Cultures

Snow’s 1959 lecture has had a powerful impact on continuing discussions about the real and perceived rifts between the sciences and other disciplines and mutual illiteracy. In taking up on the evolution of Malina’s thoughts on an estuary metaphor and going against the main current, consider the early rejection of Snow’s argument by F. R. Leavis and Michael Yudkin in Two Cultures?: The Significance of C. P. Snow. The first part by Leavis was delivered as the Richmond Lecture at Cambridge in 1962. The second part by Yudkin was an additional essay from the perspective of a scientist.

In the context of a Malina Es
tuary debate in LRIQ, it is im
to the return to Leavis and Yudkin’s critique for two rea
ons. First, the evidence behind their scathing indictment of Snow’s argument is incontestable. Second, their critiques have a direct bearing on discussions of the relationship between the arts/humanities and sciences today and thus to the topic of trans-disciplinarity. Simply put, Leavis and Yudkin and all subsequent critics of Snow do not oppose his aim, that of the mutually enriching potential of all knowledge. What they oppose is his Philistine simplicity, the error of his argument and the nature or lack thereof of his evidence. Their criticisms are in fact so damning, that one wonders how it is that C. P. Snow is the one remembered while the Leavis and Yudkin critiques are lost to time except as campus legend at Cambridge.

As with Punt and Malina’s essays, rather than recapitulate the Snow and Leavis essays in depth, my aim is to draw those interested in the debate back to the 1962 Richmond Lecture so as to consider it in its entirety. While the Leavis critique remains legendary in its rare personal criticism of Snow, the criticism of Snow’s evidence and logic or lack thereof, Snow’s rank ignorance of matters of history and literature, is insurmountable. As to the value of Snow’s claims to eminence as a literary figure of merit and thus one with the self-proclaimed capacity authority to judge matters literary, Yudkin’s critique is more rhetorically measured but no less devastating, perhaps even more so.

Leavis takes particular umbrage that Snow threw virtually the entire history of modern literature from Dickens and Ruskin, to Conrad and Lawrence and beyond out of the canon. That critique aside, no less the critique of Snow’s unqualified notion of culture and the very nature of his argument, the merit of Snow’s attenuated scientific work itself remains to be revisited. But before investigating that at some point, what we need to keep foremost in mind here was that Yudkin, himself was a practicing scientist at Cambridge. And as many scientists are, contrary to Snow’s “statistical” impression, he was no stranger to literature and the arts and humanities. Yudkin was thus able to independently add a contemptuously precise critique of both the significance of Snow’s literary work and his thesis of two separate and mutually unintelligible cultures.

To conclude, Leavis and Yudkin’s combined critique (contrary to Snow’s 1959 Rede Lecture) show all the hallmarks of the studied intellectual, the disciplined academic. For instance, they pay careful attention to how Snow uses terms such as the all important word “culture” with so much imprecision as to be meaningless. The Leavis Richmond Lecture and the accompanying essay by Yudkin systematically took apart the entire edifice and the very details of the Rede Lecture. If that light, the fact that Snow’s lecture continues to have such a commanding presence in academia and especially in some literary circles owes more to the general importance of the problem.
in that historical context, and today, than to the actual substance rather than ideology of the lecture itself. Let us fast-forward to 2011 and LIRIQ 1.03.

The Estuary Metaphor and the False Dichotomy

Roger Malina’s thoughtful struggle in LRQ 1.03 moves from a Two Cultures discussion to an Estuary Metaphor. Subsequently, as noted above in the Shanghai lecture, he abandons both for the inherent binary tautologies involved. Malina’s Estuary Metaphor has a wonderful built in sense of change and complexity in time. But as he himself calls attention to - it still depends on the separation of the banks. This is Malina’s dilemma born of Snow’s false divide.

Malina’s engagement on the issue appears to have been inflamed by a radical antipathy to a recent minor treatise by Jean-Marc Levy-Leblond. Accordingly, perhaps it is best to provide a lengthy quote here of the problem. As Malina writes:

To avoid the trap of the false dichotomy that C.P Snow led many into, I would prefer to imagine a river delta. The river beds themselves move with time and silt can create new banks and territories. In a recent book, actually a pamphlet [La Science n’Est pas L’Art, 2010] of unusual vigor, Jean-Marc Levy-Leblond, has mounted an all out attack on some of the claims of the art-science field today... He decries the search for a new “synchronism” that would somehow help us create a “third culture” that melds the arts and sciences.

Building upon his earlier review Malina elaborates Levy-Leblond’s view. There “the arts and sciences are two different banks of a river as distinct and un-reconcilable as two ecologies that develop within different contexts, on un-mergeable continents, and have grown with differing survival mechanisms and goals.” Moving on Malina adds that the co-editor Jacques Mandelbrojt, in that issue of LRQ, had also reviewed the book and pointed out that Levy-Leblond is in the final analysis calling for special types of art-science interaction.

In the Shanghai lecture, Malina adds that for Levy-Leblond, artists as “others” can provide “creative friction” which can excite the scientific imagination. However, as he notes, ultimately what Levy-Leblond is arguing for is the re-establishment of the links between reality and scientific concepts, which were abstracted out of that reality. Malina’s concern, and that of most Leonardo readers I would imagine, seems however to lie with networked e-cultures, digital realities. There, the issue at hand is how to highlight the value of translation studies for current synergies between the sciences and humanities. My concern is however far more archaic. I find it important to first revisit Snow while gazing over the horizon in this new century towards future art-science interactions but always keeping the likes of Plato, Leonardo Da Vinci, Rembrandt, John Ruskin and J.M.W Turner, never mind Joseph Conrad and Leo Tolstoy in the rear view mirror. Consider then Malina’s conclusions: “the metaphor of our delta crossing begs the question of the nature and source of the river and the nature of the sea, and of the rain that feeds both the river and the land.”

Extending this in a note, Malina cautions: I am bothered by the river metaphor since it sets up a ‘strawman’ dichotomy between the arts and sciences. I would prefer somehow to have a network of water streams to carry the idea of ‘networked knowledge’ rather than trans-disciplinary practice as argued by David Goldberg and Kathy Davidsen in the report The Future of Learning Institutions in the Digital Age. Malina, returning us to Punt, concludes that “We are just at the beginning of the ‘translation’ to networked culture” and that in this context art-science collaborations provide opportunities for current problems. Networked cultures aside, the following section adds further unease to the unqualified use of Snow’s dichotomy through highlighting the work of authors who have wholly defied the distinction.

Steinbeck, Nabokov and Gould

If we turn to paradigmatic instances of mutual enrichment between science and the humanities, to the following illustrative instances in art and literature, we might gain a more nuanced and fertile view. This view is not concerned with governing metaphors for research or networked opportunities but with the nature of art, literature and science and their integrations. The case of Leonardo Da Vinci is so well known as to require no elaboration at all. In contrast, somewhat forgotten in modern times, is John Ruskin’s relevant Victorian period observation that “the dreadful discovery that war is the foundation of all arts as well as the foundation of all the high virtues and faculties of man.” There are no shortages of minds that defy the Snow Divide. Two authors and
one scientist whose collected works are of special interest to my own work on the conjunction of the arts, humanities and sciences are John Steinbeck, Vladimir Nabokov and Stephen Jay Gould. Their works show that though the humanities and the sciences in many fundamental respects are separate domains, they can and do inform and enrich each other.

John Steinbeck is an interesting case because of the passion he had for marine biology and how this became integrated into some of his writing. Anyone reading Cannery Row with a careful eye, would have noticed that the description of Doc, the marine biologist, of Doc’s laboratory and his collecting work in the tide pools must have been informed by a profound first-hand knowledge. It was. Besides the all telling details, the richness captured there, one learns in Robert Demott’s edited volume John Steinbeck: Working Days: The Journals of the Grapes of Wrath, 1938-1941 (1989) that one of Steinbeck’s most treasured goals was to write a guide to the marine ecology of the Bay litoral, the San Francisco Bay Guidebook (see note for Entry #106, pp. 172). The failure to do so was his greatest regret. He found himself simply unable to summon the discipline and rigor required. It was the darkest time of his life.

Steinbeck recorded this in his notebook on Thursday, January 4, 1940 with these perhaps prescient lines for some of us at Leonardo today. The dairy entry reads: “Came down here to try to work on the tide pool hand book. I discover that there are no easy books to write and that this may well be one of the hardest... I am attempting to find the foundation of some new discipline in this book” (ibid. p. 109-110). Instead, with Edward Ricketts (Doc), Steinbeck abandoned the project and went on to write Sea of Cortez: A Leisurly Journal of Travel and Research - With A Scientific Appendix Comprising Materials for a Source Book on the Marine Animals of the Panamic Faunal Province (1941). Whether or not Sea of Cortez constitutes a new discipline and the partial fulfillment of Steinbeck’s desire to create it, it is a wonderful combination of biology and reflection. The best parts, for myself having “been there” as it were, are his descriptions of the visceral differences between laboratory and field science and the challenges of an expanded sense of science, consciousness and the imagination. Does not Steinbeck, as with Nabokov discussed briefly below, provide us with instances of trans-disciplinary work at its best? For that matter, does not Thomas Hardy’s Under the Greenwood Tree do the same as a precursor to the combination of history, literature, anthropology and ethnomusicology? 17

Vladimir Nabokov is similarly interesting because he was a relatively eminent scientist working on the taxonomy of Lepidoptera before he became an author. His autobiography Speak Memory (1947), originally titled Speak Mnemosyne, and all his other work is replete with symbolism relating to butterflies and moths as with observations about ecology and human nature. And while more people are aware of his path breaking literary study of the nymphet Lolita (1958), far fewer are aware of his contributions to taxonomy, specifically to the study and classification of the Lycanaeidae through the meticulous observation of their sex organs. For reasons of space, rather than exploring Nabokov’s symbolism relating to butterflies or commenting upon his scientific work, I simply draw the reader’s attention to Joann Karges’ Nabokov’s Lepidoptera: Genres and Genera (1985) and to Kurt Johnson and Steve Coates’ similarly compelling but far more expansive subsequent study Nabokov’s Blues: The Scientific Odyssey of a Literary Genius (1999). To be acutely brief by way of enticement, consider Johnson and Coates analysis of the moment in a lepidopterist’s life when one’s imagination is seized by the passion for grasping the complexity of the butterfly itself, its ecology and this field of research (ibid. p. 40-41), that is Fyodor’s secrets as given in The Gift (1963). For many of us with scientific interests who hunted butterflies as children and especially who have conducted field research in entomology, for anyone entranced by tide pools and the nature of shells, this rings profoundly true. Simply put then, an awareness of Steinbeck’s and Nabokov’s sustained and meticulous interests in science deeply enhances one’s appreciation of their works and the significance of those works to both science and literature, never mind to our own lives and work. Yet it is true that some scientists I have worked with consider literature and philosophy, never mind art history and philology, even the philosophy of science, to be an errant waste of time, a complete irrelevance to their own work as well as to a graduate science education.

Fortunately Stephen Jay Gould presents a very different case. An extraordinary role model for would be scientists with lives enriched by the numinous, Gould was a pre-eminent biologist, one with a profound humanistic orientation and a great gift for writing. He was of-course by
no means alone but as a leading figure in the study of evolution is perhaps one of the better known biologists to have contributed to what we might term the trans-disciplinary quest. Take for instance his article with Richard Lewontin - "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme" published in The Proceedings of the Royal Society of London (1979 vol. 205 no. 1161, pp. 581-598). As A. L. Houston later documented in "Are the spandrels of San Marco really panglossian pendentives?" in Trends in Ecology and Evolution (1997, vol. 12 no. 3, p. 125) it was an enormously influential article.

In part this success was due to the article’s elegance, clarity, complexity and consequence for research and debate in evolutionary theory at the time. In other part, it was perhaps also due to the power of the organizing metaphor they chose and how they used it. Gould and Lewontin introduced the logic for their argument through discussing the structure of the roof of St Mark’s Cathedral in Venice and the integration of the paintings within that structure. Their point was that the organizational constraints of the structure determine the elements and integration of the design. They used this as a metaphor for critiquing the logic of the trait centered adaptationist programme as advanced by Wallace and scientists subsequently advancing that line of reasoning. Simply put they proposed a more plural Darwinist explanation focusing on integration, development and constraint.

Putting aside the centuries of work on form and change particularly in shells and butterflies, and the recent resurgence of interest in Wallace and reaction to that, topics for big data and synthesis in another time and place, I have drawn attention to this specific article and author here for a particular reason. Gould and Lewontin show how art can be useful to science, if nothing else, for metaphorical and descriptive purposes. There is a classic example just as Steinbeck’s descriptions of the nature of Doc’s work and tide ecology are in Cannery Row and just as is Nabokov’s adaptation of experiences, landscapes and symbols into his work, especially in Pale Fire (1962) and “Butterfly Collecting in Wyoming, 1952” (Lepidopterist News 7, pp. 49-52). Any students with an interest in both science and art, latent or not, would be immeasurably enriched by the cultivation of such awareness rather than the Philistine narrowing of their horizons in the name of a Science divorced from artistic experience.

Reading across the disciplines can only enrich future research and writing by expanding horizons and sensitivities, critical acuity. It can only enhance the type of questions posed and technical processes used and enhanced whether in art or science. This is of course what Snow proposed if in such an unfortunately flawed and crudely advanced manner. What Leavis and Yudkin make so abundantly clear is that discipline and complexity, rigor, logic and erudition, must be central. They also emphasize that the humanities and the sciences are neither internally cohesive, are certainly not unitary cultures, nor are as divided as in Snow’s caricature. Revisiting this over 50 years later, the Leavis and Yurkin requirements are nowhere more wonderfully immanent than in a few scientific texts worth mentioning here for the sake of emphasizing what makes the best literature and science “great”: Rebels, Mavericks, and Heretics in Biology edited by Oren Harman and Michael R. Dietrich with an epilogue by R. G. Lewontin (2008), From Embryology to Evo-Devo: A History of Developmental Evolution edited by Manfred D. Laubichler and Jane Maienschein (2007), and the blind biologist Geert Verniest’s A Natural History of Shells (1993). The list is endless.

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. Yet one likes to think I imagine that the cases of Steinbeck, Nabokov and Gould as extraordinary as they are stand out as beacons for trans-disciplinary work. With their work in mind, we might safely abandon but keep alert to the insidious reality of the Two Cultures debate. Finally, consider The Age of Wonder: How the Romantic Generation Discovered the Beauty and Terror of Science by Richard Holmes (2009) and Knossos and The Prophets of Modernism by Cathy Gere (2009), Donald Ault’s Visionary Physics: Blake’s Response to Newton (1974) and Page Stegner’s The Art of Vladimir Nabokov: Escape into Aesthetics (1966) and those mentioned below. The list, across the disciplines and the centuries, is endless.

To return to Leonardo and Roger
Malina, proposing a Three Cultures approach is not a useful solution particularly because it recapitulates Snow’s binary. And though Malina’s Estuary Metaphor is indeed compelling, perhaps we do not need such models though they are certainly good for thinking through these issues. Nor do we perhaps then even need the term trans-disciplinary for that matter. What we need, at least in my own view, is for social scientists who aspire to making a living out of criticizing science for a non-science audience to study science and the specific topic at hand in sufficient depth, so as to be able to ultimately contribute to the advancement of science. As Yudkin adds though, to truly appreciate and understand what science is so as to critique it, they will have to first do some. Finally, despite whatever reality the notion of two cultures might well have, Leavis and Yudkin also pointed out that you can hardly group together into one culture people who wouldn’t be seen dead in the same room if they could help it — unless of course it was a mandatory faculty meeting.

Northern California Dreaming: Current Events at Stanford

Before moving to a brief impressionistic account of some interesting things happening at Stanford, I should re-emphasize the above-mentioned closing point. While it is not uncommon for scientists to practice art, and while imagining science is aesthetically interesting in and of itself as illustrated in Imagining Science: Art, Science and Social Change edited by Sean Caulfield and Timothy Caulfield (2008), and while artists more and more are creatively collaborating with scientists, it is very much more difficult proposition for a non-scientist to contribute to science. As noted earlier, from the constant flow of notifications on-line YASMIN list serve about creative collaborations in the arts and sciences, this is a burgeoning field of interest. Science is sometimes advanced by art. Take for instance the case of how the film Star Wars inspired Ronald Raegan to transforming art into reality through the military-industrial complex, a two way ideas and technology imagination highway dating back to Jules Verne, Leonardo Davinci and the Cro-Magnon era. And don’t birds and molluscs do it too, if more instinctively? Ever tried to build a nest or work out the mathematical equation generating a shell?

To return then to Punt’s Proof - the ultimate challenge for those working in trans-technology is not participation in art-science collaboration as that is not such a difficult challenge. Take Eduardo Kac’s glowing bunny applications for instance as given in Simone Osthoff’s Performing the Archives (2007). The really serious work begins when the “outsider’s” analysis of scientific research becomes of practical and theoretical use to that “other”. To gauge a sense of how this might be, it will be interesting over time to gauge the reaction to Judith Roof’s study The Poetics of DNA (2007) from within the scientific community, if indeed it has any significant impact on geneticists. Similarly, I often wonder what botanists might have concluded about Michael Pollan’s The Botany of Desire (2001) in contrast to Jonathan Silverton’s An Orchard Invisible: A Natural History of Seeds (2009).

Towards that kind of debate and ultimately practice, the upcoming series for Stanford’s Continuing Studies program, “An Interdisciplinary Tour of the Human Condition in Three Stages: Time, Life and Mind” provides an interesting context for following this exciting experimental moment of convergences in the sciences and arts and humanities. Perhaps the creative frictions produced through those events and the LASER and DASER contexts in the Bay Area, Los Angeles, New York and Washington D.C. as well as the many exciting cutting edge art science projects especially in Europe will generate innovative new scientific research. If so, it will be important to track, document and analyze the outcomes. Though one can assume that art projects will emerge as a matter of course, and while these upcoming lectures and events certainly provide a wonderful public forum for sharing new developments in the humanities and sciences, I am above all left wondering what might be the consequences for science in the coming years.

Take for instance a recent LASER event on August 3, 2011 in Stanford’s old Geology Building, an artist and scientist, Cindy Stokes in a presentation titled “dynamic form” presented some of her photographic work and described the deeply embedded ethnographic contexts from which it emerged. What struck me about the intensely classical quality of her prints was that she seemed to be transferring the rigor and discipline of her scientific laboratory experience into the development process and thus into the power of images. For biologists, this sense of wonder in the image and the process is quite common of course to those working with microscopes, particularly electron microscopy. In Stokes’
case, there is both a simple scientific chemical process and an ancient alchemical mystery at work in the almost magical emergence of the image in the development process and in the exercise of the artist’s technical expertise and creative judgment. But my point is that while there is such great aesthetic pleasure to be had in the process and the product, what about the reverse equation? How might her work in the photographic lab and the ethnographic field ultimately inform and advance her science or her applications of science in the business sector? Now that is what I am really interested in for the purposes of any future relevance of this essay.

The long term results of projects such as the National Humanities Initiative and the current project underway in The Senior Reflection: A New Program in Biology, Bio 196 which began at Stanford in 2010-2011 present potential contexts for studying this possibility over time. In this new Stanford program, in a workshop context over the course of their final undergraduate year, students undertake a creative biology project of special personal interest. They are advised by one faculty member from the sciences and one from the humanities. Designed as a capstone experience, individual or group projects are equally allowed and students may work in any creative medium of their choice. At the end of each year, there is an exposition hosted by the Department of Biology and the art works are presented to the public by they performance, film, dance or what have you. In addition, students are required to produce a written reflection illustrating the value of the work to themselves personally as to the issues being tackled in biological science. As can be seen from the first Stanford projects posted on the web page, students find these programs attractive in that they allow for the personal development of the artist in the scientist and the scientist in the artist. We can be sure that some meaningful and interesting art will result, that the experience will be the highlight of their undergraduate work and ideally influence the course of their lives, but what of the science? How might science be significantly enriched in the longer term through their projects?

Another question occurs to me. If one closely reads the description of Bio 196, even in the condensed description given above, it reads very much like something out of the International Baccalaureate (IB) program. It might well then be interesting to conduct basic research on the emergence of such trans- and inter-disciplinary programs. One would want to determine the sources of inspiration for such projects. Is there any direct connection between the Two Cultures debate and the Stanford Senior Reflection, or for that matter with the New Humanities Initiative at Binghamton University? Are they perhaps outcomes of the rapidly expanding use of the International Baccalaureate program in the United States and elsewhere? For that matter, is the IB intellectual history born of Snow’s legacy? No doubt there must be any number of articles, books and dissertations on the subject!

No matter that there is the long term to consider for John Steinbeck’s legacy. Should you visit Cannery Row in Monterrey near Salinas and spend some time at the extraordinary aquarium there, naturally with Steinbeck and Doc foremost in mind, you might be lucky enough to see the performance for children held in the outside auditorium overlooking the bay. There you will observe young highly professional actors brilliantly inspiring children to become eco-activists, future guardians and scientists of the littoral, their intense fascination already engaged through the stunning exhibits of live jelly fish slowly pulsing across the aquariums illuminated in the dark. Cannery Row, and Steinbeck’s unrealized dream, thus turns out to have significant consequence to art and science, especially considering the marine research sponsored at the aquarium by Hewlett Packard.

Having had the good fortune to have recently spent some time at Stanford, it is seems a particularly interesting context to consider all these issues for many reasons outside of the act that Steinbeck studied English Literature there though all campuses will have their own tale to tell. Consider for instance, that the Stanford anthropology program had to be physically divided by the former President into two separate departments as a consequence of the academic war in the 1980’s and 1990’s, a war which literally tore many a department down the middle including my own. I know the intensity of the animosities well having crossed that divide myself from physical to cultural anthropology at that time. And or those at Stanford who do not know this important piece of campus history, consider that Steinbeck lived in Encina Hall. There today one finds a tendency for political scientists within the Center on the Development of Democracy and the Rule of Law (CDDRL) to assume a scientific and economic rather than humanistic perspective on
gauging and stimulating international development and history. Imagine the potential relevance of Steinbeck’s work for and in *The Grapes of Wrath* to that hall today. All universities have fascinating institutional histories too little written about or celebrated, sometimes of conflict and integration within and across the disciplines. Consider the conflict over Oscar Lewis and then his rightful memorial at the University of Illinois at Urbana-Champaign. Consider C.P. Snow at Cambridge! As for the Department of Transtechnology at the University of Plymouth. It is yet too young for any of this - but the bell doeth toll for us all!

Still at Stanford, consider the rare 16th through 19th century books in the Iris and B. Gerald Cantor Center for Visual Arts which illustrate the connections between the arts and sciences. Consider the fascinating collection of past art-science interactions as recorded in the student notebooks on exhibition there. Consider too the Rodin collection one of the most comprehensive collections in the world as elegantly presented in Bernard Barryte’s edited and revised version of Albert Elsen’s *Introduction to the Rodin Collection* (2003). Consider the value of this collection not only for art and art history students of all ages interested in process above all but for the medical students studying anatomy. As for the Burgers of Callais and other art works scattered across the campus, the relevance of these public art works to those interested in cross-disciplinary connections in history, art and engineering and religion, never mind biology, is endless. And as for dance and art and science, remember that for Renoir, Degas was the greatest sculptor of the 19th Century - not Rodin – and moreover, that Renoir saw dance as both art and science (Macauley 2011).23

Thus contrary to Snow’s predictions, and despite the fiscal and/or intellectual crisis in higher education in recent decades depending on the context, there has been a great deal of opportunity for expanding art-science interactions and inter-disciplinary horizons. Past and ongoing wars within departments and disciplines since 1959 aside, and keeping in mind the long history of work across art and science in classical Greece and from the 17th century on, we are it seems in an age of renewed synthesis. Take for instance, the cross-disciplinary anthropological study of medicine and art by Phillip L. Walker and Travis Hudson in *Chumash Healing: Changing Health and Medical Practices in an American Indian Society* (1993). At the same time take the illustrative art of Haeckel and how Kate McGowan reminds us of how and why he erred in her article “Drawn to Life: The glories and failures of Ernst Haeckel” in the popular journal *Evolution* (2011). Similarly consider one recent other example of this long history, Ella Reitsma’s *Maria Sybilla’s Merion and Daughters* (2008) which details the earliest combined scientific and artistic study of the butterfly life cycle during the 17th Century. Keep in mind only a very few relevant publications such as these, no less the story of the neuroscientist Charcot and his students crossing the art and science divide, and you will find that the current synthesis has long since been in place. From tool making and cave painting to weaponized micro-drone technology adapting the study of the biomechanics of insect flight and nano art, cyber-war fare and The Stream on Al-Jazeera, you name it. The range and the potential of this experiential history of art-science-technology-media synthesis and the attendant reading list and the political and pedagogical dimensions are as endless as the stars in the sky - as potentially peaceful and whacky as the Grateful Dead’s Micky Hart’s musical interaction with Active Galactic Nuclei and the fabric of the universe.

So to make the critique as blunt as possible, I have rarely met a scientist, a doctor or a physicist who did not have a profound interest in history and culture, art and music. In fact, the final question for extra credit in my undergraduate class on developmental biology was about the morals, or lack thereof, of the characters in the Italian opera Così fan Tuti. It appears to me that Dr. Freeman had a point to make that is directly pertinent to this discussion today though it was a mysterious one at the time. Perhaps then, if Snow’s critique is taken for its intention rather than substance, what we really need then is for scientists and scientists in the making to be reading such works which might not have been traditionally considered in the science curriculum, never mind taking more humanities electives simply for the joy and unanticipated consequence. But as for how art and the humanities might inform science? Now that is the real challenge because it is the more difficult one.

**Conclusion: Punt’s Proof**

To conclude, let us revisit how Michael Punt positions transdisciplinary study. For Punt, it is different to inter and multi-disciplinary studies in that the purpose is to accurately translate data and ideas such that
they can be transferred to and commented upon in other disciplines. In addition, he believes that the results of such analysis by the "other", the outsider, must prove to be of practical value to those working within the discipline being commented upon. Punt’s proof then establishes an important condition. We can test the validity of those in the social sciences analyzing work in the sciences for instance, if the analysis makes sense there and has a recursive productive function. If the analysis is useful, adaptive as Gould would have it, then it should advance work on that subject in the sciences. Then the analysis would not be mere cultural chatter, rhetoric, ungrounded or too loosely grounded philosophical musings, but of scientific merit in its reproductive effect.

To do so however one first has to have a sound basis for working across the art/science divide when the Other is science. If not, one’s interpretations will be unlikely to survive Punt’s proof. Second, Punt’s proof requires Malina’s caution. If it is true that this is something new, then it is only over the longer term that we will know whether new forms of knowledge are indeed emerging that can play a productive role in the sciences. Simply put then - it is one thing for art and social science to comment upon and draw from science, it is quite another for them to influence science and to be able to document this taking place. Perhaps this is something new for Simone Osthoff in Performing the Archive (2009) notes that even within the realm of the arts, combining research, writing and art practice, itself a recent phenomenon, is only now becoming more common. But as of yet she writes: “The question of what constitutes research in the fine arts studio education and the role of academic writing in such pursuit is open for debate while it also points to new connections to be explored among previously unrelated fields” (p. 174).

Towards that end, we might keep in mind Punt’s two-fold test for the definition of what constitutes transdisciplinary work. First, one’s writing must be intelligible outside of one’s own discipline. Two, it must have the capacity to produce new knowledge in the discipline being commented upon. Punt’s point is elemental. If the outsider’s analysis presents no new ideas or some form of productive value to internal debate and future research within the discipline and data being analyzed, then the analysis or art one creates is mere voyeurism. Otherwise we are merely recapitulating inter-disciplinary or multi-disciplinary studies or rather simply engaging in para-sitology. It ends up being cultural critique for the sake of internal debate within the humanities and of no value to the sciences empirically speaking. In Punt’s proofs, first we have to be able to translate, then rotate/reflect (as Malina would have it) and then transmit information worth considering on the other bank across the estuary.

Does this however ultimately entrap us in the two cultures metaphor and the associated inherent and insurmountable differences between the sciences and the humanities? Is there a problem at hand here? Or is it my imagination? And how might Punt’s test affect the study of knowledge as water? Is Malina’s aqueous hypothesis not too fluid? Don’t we need the banks and is the journey between the many banks of the shifting sands of the estuary not that which fer-

ilizes growth? Whatever the answers may be, sciences and the arts and humanities, and each discipline within, are diverse, changing and internally rifted, deeply conflicted. Yet within the humanities and within the sciences, all disciplines share practices and concerns. There scientists are often artists or at least interested in and inspired by art and some social scientists aspire to be more scientific than others whether or not they are successful. What is clear is that the scientists are at a great advantage in crossing over to work in the arts. It is very difficult to go the other way except for the most committed outsiders sufficiently capable and willing doing so. That being said more and more English majors have been finding their way into medical schools for many years now surely making a complete mockery out of Snow’s hypothesis.

Finally this brings us back to the problem of big data. Contrary to the doomsayers, as far as I am concerned, the more data there is the better though as Mike Punt rightly points out again, the challenge is availability, synthesis and transmission, something all scholars, writers and scientists including artists are constantly engaged in. So let us return to models, not conceptual models but role models. In the end, despite his literary name, Nabokov felt immense regret at not having written his book The Lycaenidae of Northern Europe or better yet, The Lycaenidae of the World. Yet in the long run he had a major impact on this scientific community and their methods. It was Nabokov who established the fundamental importance of studying butterfly genitalia in order to identify species particularly polymorphic forms. So what then would you prefer to
be known for - a study of desire for a nymphet or the study of a whole genus based on their sexual parts and habits? Frankly I suppose when all is said and done, I'd rather have done Lolita. But to be serious, let us end with Steinbeck.

Leaving aside his Nabokov-like failure to achieve one of his deepest desires, the scientific one, though East of Eden partially filled that niche, Steinbeck was a consummate historian and fieldworker, and more, one with a social conscience. He was an inveterate inter-disciplinary worker making films, writing speeches for President Roosevelt, horsing around with Charlie Chaplin, aspiring to convey the essence of his characters and their larger significance as archetypes - having been inspired by Carl Jung. I bet that most of you reading this who have a passing familiarity with Steinbeck, especially those who might read this at Stanford, did not know any of this, nor perhaps even that Steinbeck studied at Stanford and lived in Encinna Hall - never mind the fact that Nabokov had been a scientist at Harvard while writing Lolita. Big data indeed - whatever the subject. In all this Steinbeck and Nabokov are iconic figures of split-desire, two passions, art/literature and science. I think there is a bit of that in most of us on both sides of the river of knowledge.

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Notes


3 See LIRIO 1.03, May 2011, http://www.leonardo.info/reviews/LIRQ/LIRQ%201.03.pdf.


7 See: http://space.mit.edu/~dd/ ECON/two_cultures.html.

8 See http://www.huffingtonpost. com/john-m-eiger.

9 See http://www.edge.org/3rd_culture/.

10 See http://seedsmagazine.com/ twocultures/.

11 See http://www.ithaca.edu/hs/events/series/cpsnow/ archivespeakers/.


13 See: http://malina.diatrope. com/2011/04/17/isl-art-science- hogwash-a-rebuttal-tojean-

14 See: http://www.leonardo.info/ reviews/april2011/levykeblond_ mandelbr0t.php


17 While Hardy’s novel is a wonderfully rich literary study of musical change in England in the late 19th Century today's ethnomusicology is deeply scientific, see for instance Feld (1982). See Nettle (2010) on the evolution of this inter-disciplinary field par-excellence. It seems to me that ethnomusicology has however an inherent trans-disciplinary rather than inter-disciplinary nature though the former term is currently not yet in use in anthropology as far as I know, never mind the new notion of “anti-disciplinarity”.

18 See for instance my critique of Judith Roof’s fascinating study *The Poetics of DNA in Leonardo Reviews Quarterly 1.01* (2010, pp. 13-15). Available at: http://www.leonardo.info/reviews/LIRQ/LIRQ%201.01.pdf. Conversely, for a highly compelling instance of a scientist working across the disciplines of biochemistry and fashion, see the case of Anke Domaske's invention of Qmilche and the MCC fashion line (Eddy 2011).


21 See Rob Dunn in “How Plants Mate” with photographs of pollen by Martin Oeggerli in Natural Geographic vol. 216, no. 6, pp. 120-133.


23 See Alastair Macaulay in “Dance, and a painter, at work”, the International Herald Tribune, Friday September 2, 2011, pp. 10.

**Arnhem for Film and Media Studies**

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Is it safe yet to call Rudolf Arnheim a major media theorist, on par with Marshall McLuhan and Walter Benjamin? The question is important because Arnheim the film theorist can always be