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Leonardo Timeshift

1959, 1969, 2004, 2029

Introduction

Ars Electronica is celebrating 25 years, addressing the mutations brought about by the introduction of the digital computer into the arts and society. The “shape” of Ars Electronica reflects the vision, personality and history of its founders but also the interplay with the role of a city in the emerging European landscape. Ars now asks us to shift forward another 25 years to 2029. To do this, I would like in this essay to integrate the story telling the way the *Leonardo* Network, a different but overlapping, community, came into being. Created in the mid sixties, over 37 years ago, *Leonardo* has co evolved with the artists, scientists and engineers then beginning to work in collaboration and interaction. They invested successively a number of new scientific technological terrains from digital computers, to communication networks, to bio technology, to nanotechnology and space technologies.

Both Ars Electronica and *Leonardo* have benefited from being new, and separate, from prior existing major institutions and as a result have been able to evolve, to change shape, on much shorter timescales than the major universities and cultural institutions. This outsider position is one that characterizes them today, even as slowly existing major institutions begin to invest in initiatives dedicated to interdisciplinary art / technology and art / science. At the same time this outsider position entails a certain fragility; re-invention is then a matter of survival. The Prix Ars Electronica and Festival successfully re-imagined themselves even as the pioneering work in computer graphics, animation and music in the 1070s became parts of new entertainment industries and no longer a cultural frontier. The *Leonardo* Network, whose first project was a scholarly quarterly print journal, has now mutated into a network with a variety of projects, workshops, prizes and scholarly publications and organizational resources at its disposal.

In 1967 the first priorities of the *Leonardo* Network were creating venues where the artists themselves could write about their own work, bypassing the sterilizing system of art criticism and reconnecting the two cultures of arts and sciences in a cultural world that was fundamentally Luddite at the time. Today the concept of the artists as researchers is more widely accepted and the new urgencies are related to coupling more closely the ethical, environmental and social crises that threaten an overpopulated planet which continues to accept inequities and injustice on a planetary scale.

The Network Metaphor

In this essay I will make use of the now popular network metaphor to describe the ecology of individuals and organizations that are the sources of new ideas, concepts and practice needed to respond to the changing social environment. This environment continues to have new science and technologies as important cultural drivers. The need to interconnect the arts, the sciences and technologies remains one of the important elements for creating the conditions for a more just and sustainable planetary society. The network metaphor allows us to avoid the reductionist and problematical dialogic terrain of art vs. science or art vs. technology. There are very good reasons why people with shared problem sets develop disciplinary approaches; "holistic" drives need to be counterbalanced with legitimate disciplinary narrowing to allow systematic (artistic integrity, scientific rigor)

problem solving to occur. Individuals "enter" the art / science / technology networks at different nodes, or roles, in different times in their own work. And often it is the creative friction between legitimately different disciplines that create the conditions for change.
At the same time today again we also see the emergence of "New *Leonardo's,"* individuals sufficiently fluent in both art and technoscience to make significant contributions to both fields. As we time shift to 2029 we can expect that these "New *Leonardo's,"* will play a more prominent role in creating inflections in the direction of future science and future technology. The "strong claim" is that as a result a "different" science and technology will emerge.

Timeshift 1959

When in May 1959 C.P. Snow gave his celebrated Rede Lecture "The Two Cultures and the Scientific Revolution"[1] he captured the latent anxiety about the two cultures; This schism probably began as we know it during the nineteenth century, as by product of the industrial revolution. But the central argument of his essay was addressing the "remediable suffering of most of our fellow human beings" and indeed he originally intended to title his essay "The Rich and the Poor". His concern was not creating conditions for better or more relevant art or better science, but creating the conditions for a just and sustainable world. He saw the reconnections of literary and humanistic culture, which often then dominated in government circles, with science and technology as part of an agenda for planet wide social change.
Forty five years after Snow's essay, ideas on social development have become far more complex and it is hard to buy today the "modernization theory" of the 1960s which saw "all societies progressing along essentially the same track but at different speeds"[2] although ghosts of these primitive ideas are alive and well in certain political circles. Network theory informs us that the articulation between universal rules and the local landscape can together lead to very different network behaviours (whether chaotic, unstable, and subject to paralysis, or dynamic, stable or growing).
It is also difficult to recover the optimism about the universals of scientific culture, the extinction of organized religions, and the expectation of an uncorrupted cornucopia of benefits from scientific advance that characterized much discourse in the 1950s. Snow argued that to create the conditions for a just world all that was needed was" … the spread of the scientific revolution all over the world."[3] Today governments equipped with ethics committees seek to balance risks and benefits of the rapid widespread introduction of new technology products such as genetically engineered food stocks. The "principle of precaution" now colors all discussions of scientific and technological advance and sustainable development. Not all science is the right science for the world of 2029.

Timeshift 1967 Cultural Roots of Globalisation

In the nineteen fifties and sixties a generation of artists and scientists, survivors of a second "world" war, grasped at ideas that might perhaps underlie a saner world. They built new cultural and scientific organizations and institutions that articulated an optimistic view of a scientific humanism. The *Leonardo* network, founded in 1967, was built initially by such survivors of the second World War and the founding of the *Leonardo* Network is marked by their experience of the trauma of war in the civilized world of the enlightenment. Frank Malina, the founder of *Leonardo,* assembled a group that included Lord Snow, Jacob Bronowski, György Kepes, C H Waddington, Lancelot Law Whyte, Joseph Needham, Richard Gregory, Buckminster Fuller, Rudolf Arnheim and others. It included artist-scientists and artist-technologists such as A.L.Copley, Anthony Hill, Roberto Matta, and Pol

Bury. In the very first volume Roy Ascott wrote about his first ideas coupling cybernetics and interactivity in the arts. Artists, scientists, theorists began to map out the terrain that has become a dynamic and innovative art/science/technology field today.

From the beginning the network was international in character with individuals from Europe, Asia, North, Central and South America and from the Middle East. This was coherent with their vision of creating new cultural connections between the arts and sciences in a planetary context as a strategy towards peaceful co existence. From its beginning Ars also staked out a position that was international in scope, inviting participants from around the globe. The electronic arts community from its inception has fought against the geographic constraints of culture that so often dominate the art world. It is notable that the artists of the electronic community have always been early adopters of all technologies that allow collaboration, performance and exhibition at a distance and from mail art to fax art to web art. They have explored how such technologies can be used not to create homogeneous cultural expression but the conditions for the emergence of diverse new planetary cultures where community is defined by the various kinds of situation, not only geographic or ethnic. The scientific community in the 1960s was also building international and planetary networks (scientific unions and federations) for collaboration and presentation of work, a strategy that relies on the universal applicability of scientific knowledge but was also motivated by the desire to create structures that promote world peace. Frank Malina was one of the founding team of UNESCO.

Leonardo has recently had a project called the "Cultural Roots of Globalization" that examine and make visible the ways artists and scientists have been drivers of globalization in ways that parallel but contrast with the economic and political drivers.[4] As part of this, two initiatives are under way: firstly the YASIMIN initiative seeks to put into contact artists, scientists and scholars around the Mediterranean Rim from the Middle East, North Africa to southern Europe; secondly there is the Pacific Rim New Media Summit, in connection with ISEA. Although these "rims" originate in economic and geo-political circles, they offer reframing that breaks the usual north/south debate and allows exploration of emerging planetary cultural communities that are occurring on the scale of regions, sub regions, or creative clusters.

Of particular interest today is how the inequities in social development introduce cultural variation into art-science and art-technology work and discourse. Inequities of access dominate the networked landscape not only because access to new technology is very restricted because of its very rarity even in developed countries, but because there are such large differences in production of new science in different locations within developed societies and across the north/south divide. The same work has very different meaning in a science producing and a science consuming community, or a technology importing society rather than a technology consuming one.

Attempts to bridge the "two cultures" confront very different historical situations, and different lineages, in the Arab world, sub Saharan Africa or on the Indian subcontinent. A given work, may be identical in its physical manifestation but radically different in its emergent meaning as a function of "situation," where situation may be linguistic, disciplinary, geographic, or level of connectedness. Whereas the *Leonardo* Network founders anticipated the spread of "universal" attributes of science and art, if we time shift to 2029, we anticipate rather protracted exploration of how situational specificities will contribute to a web of multiple emergent planetary cultures that are "locally" adaptive to the variety of "situations" of creator and interactive audience. Few in the electronic art community subscribe to the view that there are desirable universals that are the underlying goal of electronic art. This does not dispute the underlying genetic, and physiological, univer-

salities of the human perceptual and cognitive system but rather seeks to use the methodologies of interactivity to make artworks sensually adaptive to each person's "situation." We are beginning a period of social experimentation probably unprecedented in human history because the time constants of connectivity, and the range, are incommensurate with those that drove prior social reorganizations. Howard Rheingold and others have described some of the new phenomena enabled by this new situation. Time shift 2029: it is unlikely that our political structures will respond on the timescale of a human generation, so we can expect a growth of parallel structures and a continuing importance of the roles of NGOs. Network theory tells us that it is often not the "best" or "oldest" solution that dominate in a growing network, but the new actors that quickly establish the role of "hubs." If organizations such as Ars or *Leonardo* are to exist in 2029 it will be because they are able to negotiate the conflict between their situation, as defined by their connectivity, and the homogenizing, and innovation reducing, tendencies of planet wide network structures.

Timeshift: 1997
A Better Science, a Different Science

As mentioned above one of the first priorities of the *Leonardo* Network was to establish venues where artists could write about their own work, describing their conceptual frameworks and technological inventions. This was in response to the tyranny of the art critics that served as intermediary between artist and institutional evaluation. The scientists in the *Leonardo* Network argued that scientists were also not writers by avocation, but in the system of science the scientists were always the first articulators of their own ideas through texts even though the text themselves were not their primary area of creative work. In science there were no science critics (though the sociology of science has since developed as a discipline). The first project of the *Leonardo* Network was the founding of the *Leonardo* Journal, a scholarly peer-reviewed journal patterned on scholarly publishing in science and engineering. The *Leonardo* network now publishes *Leonardo, Leonardo* Music Journal and CD Series, *Leonardo* Book Series, the peer-reviewed electronic journal LEA and numerous web sites.[5]

More fundamentally however they articulated the idea that the role of artists in society was changing and that many artists were functioning as researchers and the results of their research, as well as the artworks, were of interest in themselves. Steve Wilson[6] in his *Leonardo* book "Information Arts" has documented the case for the work of artists as researchers systematically exploring the cultural connotations of all areas of scientific and engineering research. By the mid nineties a number of "artist in residence" and "art-science collaboration" programs were housed within science and technology institutions, descendants of the pioneering Experiments in Art and Technology (EAT) Programs of the 1960s. It is now possible to identify two cases for encouraging art-science and art-technology interaction. The first case, which I will call the Weak Case, is that by promoting interaction between artists and scientists, or artists and engineers, there can be new contributions to the resolution of scientific or engineering problems; perhaps better science, faster results and better solutions. Such contributions can be through the usual processes of creativity and innovation that rely on cross disciplinary introduction of new ideas and techniques. In the case of new technologies, artists can be viewed as proxies for social use and adaptation. The area of computer-human interface design is one area where a number of technological research labs have invested in involving artists in new product development and testing.

However if we look forward 25 years, then I would argue that the relevant challenge is

the Strong Case. There is nothing inevitable about the way or direction that science or technological inventions occur; they are deeply embedded in social and institutional contexts that define what problems are considered interesting, what solutions are judged successful, and which areas are priorities for funding. The history of science and technology research organizations since the second World War is one of increasing institutional isolation from society at large. Organizations like space agencies or fundamental research laboratories have found themselves increasingly divorced from popular and political support, and in reaction have created large "education outreach" programs to try and reconnect to popular imagination, and political priorities. Large science popularization programs seek to reverse the trends of declining interest among students for careers in science or engineering. This is a very different situation from the growth in science education in the "post sputnik" era.

The strong case argues that by such initiatives a "different" science or engineering will emerge: that is different scientific problems or technological directions will appear of interest and more urgent than would be the case without such interaction. And new methodologies will modify the scientific method to treat this new kind of problem. With the emergence of scientific visualization, large scale simulation techniques, and "virtual observatory" approaches to analysis of massive heterogeneous databases, we already see evolution within the scientific method itself. Artists have been very present in these three areas. Paul Fischwick, a computer scientist at the University of Florida, has initiated programs in "aesthetic computing," arguing that ideas and techniques from art and design need to be introduced into computer science to re orient the direction of such research and provide new methodologies.[7] Whereas computer art is the introduction of the ideas and methods of computer science into the arts, aesthetic computing is the reverse process of introducing ideas and techniques from art and design into the computer sciences. Perhaps 25 years from now we will see "inflections" in the direction of certain scientific and technological fields due to the success of the artist in residence and art-science collaboration programs currently being established.

Timeshift 2029: And perhaps we will see new "scientist in residence" programs within art labs to accelerate the process of shifting science in new directions connected to the social needs of 2029.

The Five Culture Metaphor

I would like to argue that fifty years on the "two cultures problem" will be usefully discussed as a "five culture problem." There is a new dynamic in the tension between the "holistic" quests of art-science-technology integration and the valuable exploration of different starting points in building an understanding of the world around us, and our place in it. Rather than articulating binary oppositions, it is perhaps more productive to fall back again on our network metaphor and view art, science, technology as a continuous network of "ways" to understand and act upon the world.

Snow himself hesitated. Early in his lecture[8] he stated "The number 2 is a very dangerous number: that is why the dialectic process is a dangerous process. Attempts to divide anything into two ought to be regarded with much suspicion." He provided the arguments why science and technology could be usefully considered as sharing the same basic conceptual culture even though socially they formed separate if connecting social communities. Here I decompose the problem then into five cultures because I think it helps pin point some interesting areas of debate and new work today. But consistent with our network metaphor, we emphasize that this is not a "unique" decomposition (these 5 cultures are not an "orthogonal" set, either) and that individuals may flow between the cultures play-

ing different roles within the disciplinary "shared assumptions" of the connected community within that sub region of the network.
I think also it helps to examine the many "asymmetries of discourse" that impact the way that ideas and collaborations flow within the network. Noise may become meaning in different contexts. Real networks have directionality and complexities; not all connections are bi-directional with the same time constants or strength. Asymmetries may be cultural (language, geography), but also tied to the depth of knowledge needed to enter into meaningful discourse. Many sciences tied to mathematics require significant investment in prior knowledge in the same way that many artistic traditions require deep knowledge of a variety of metaphysical and historical contingencies of particular contexts. I like to emphasize that "interdisciplinarity is not a discipline" and regrettably there is much loose talk on connecting everything to everything.
With this pre-amble, then, we can list five "cultures" whose specificities play an increasing role in the "two culture debate":
The first is the art, design and entertainment culture. Here I specifically want to tie the arts more closely to the applied arts and the rapidly growing complex of entertainment (and communication) industries that are rapidly becoming the largest employers of graduates of most art and technology programs. I think this coupling is structural and has represented a significant evolution since Snow's essay. At that time the film and television industries were beginning their rapid development but a discussion of the arts, and even more so the literary arts in Snow's essay, was always closely coupled to the academic world, the emerging art market, the humanities and academic scholarship. Today the art market and museum world are becoming rapidly irrelevant to the electronic arts. The computer game industry, the special effects studios, the web design industries can trace lineage to artists who won prizes at Ars over the past 25 years. Very few of the Ars winners are in major museum collections or are sold in the art market.
The second node in my 5 culture network metaphor is Science, very much as Snow described it in the 1950s, but I want to emphasize the connection of science to government even more so than was the case in Snow's time. Snow made, I think, a compelling case for coupling science and technology together, into what was known as technoscience in the 1970s, but over the past 50 years government has played an ever growing role in which basic science is being developed. The most notable recent example is the human genome project, a project with strong ideological underpinnings and background of commercial exploitation. More recently the US government has decided that the next priority for NASA is the exploration of the solar system leading to human colonies on the Moon and Mars. This decision will determine in a basic way what space science is developed over the next fifty years. Scientific research does take place of course in industrial settings but the "customer" is so different that there is a growing gulf between scientific and technology research (a gulf that governments are seeking to counterbalance). It is very rare for the majority of scientists, dominantly in government funded organizations, to share cultural fundamentals with the research engineers (who use the same established scientific knowledge). This resulting divorce of "science" from "technology" is one that has had major consequences such as the rapid drop of students following science diplomas in the west and the relative decline of funding for "fundamental" research. Some universities are even closing their physics departments.
The third culture then is technology within an ecology that is dominated by funding in the corporate world. I want to insist on separating science and technology and tying technology much more closely to industry. Snow wrote at a time when the coupling of nuclear science to nuclear bombs and industry was a key area of science-technology coupling.

Snow's historical analysis looked at the industrial revolution (factories), followed by the scientific revolution (industries based on scientific knowledge, e.g. biotech). Today we talk of the "information society" because of the mutation in the corporate world that has taken place. The cell phone industry, and computer game industries, have become an important employer of artists from art and technology programs, but their products are not driven by advances in scientific knowledge, and only secondarily by breakthroughs in technology (there are thousands of unused technological inventions in the files of the academic and corporate R and D labs). The drivers are those of social acceptance and use, marketing, global redeployment. Artists in some cases are viewed within such R and D environments as "proxies" for social use, not just redesigning the "skins" of devices to make them seamless in their adoption, but re-orienting the design goals to respond to new patterns of human use community development.

The fourth culture is actually a set of cultures tied to a number of "world views" within which science and technology will develop. As I have described earlier the discourse of the 1950s and 1960s was suffused with the expectation that "science" would spread universally and with it the pre requisites for development and social stability. Even though science remains universally applicable, the social optimism does not seem to have been confirmed. Indeed in a well connected world the differences between a variety of world views become more determinant. Such world views may have science as a component, but metaphysical systems, histories of religious practice, ethnic and linguistic specialization play important and determining roles in the direction of change, as most recently made evident in the post 9/11 period. Different societies emphasize different areas of science as priorities in their government funding structures both for economic and societal, world view, reasons. Within the electronic arts community there is a long history of working in a variety of cultural contexts. Electronic artists as a social group seem to be transnational and yet have emphasized explorations of "identity" and cultural difference. Few electronic artists, as stated above, subscribe to the search for art universals as one of their goals. There are a number of different world views in co-existence, and there will continue to be, but there is leakage between worlds.

Finally, consistent with our network metaphor, I want to separate out "Situation" as the fifth cultural determinant—the truisms about the articulation between global and local take on specific meaning within network theory. As emphasized before, at the individual situation point, links in networks are not bi-directional with the same strength. The "asymmetries of discourse" referred to earlier are useful and important factors in understanding the way that problems are defined as interesting, what solutions are considered successful and what methods are to be used in approaching a particular question. Language, ethnicity, discipline membership, social grouping, locality all come into play. Work at boundaries can employ a variety of strategies from collaborative teams (pooled resources for a shared outcome), Consortia (coordinated resources for parallel or diver-

gent outcomes) and Collectives (shared resources for a multiplicity of outcomes). The appropriate strategies are very contingent on situation. Electronic artists have been at the vanguard of exploration of a variety of collaborative, interdisciplinary strategies. Collaboration, network and management theory indicate that smaller groupings than 300 individuals are optimal (open source software is maybe a counter example). Even in a very well connected world, the "cluster" of over 300 individuals is a particularly important actor in adaptation and evolution.

Timeshift 2029

At the time of the founding of the *Leonardo* Network in 1967 you could fit all the artists using computers into one living room; most of them would have been musicians. When Ars was founded, the nascent computer graphics and animation industries were present at Linz, serving later on the Prix juries and festivals. Today they have their own venues. Today you can fit all the artists who have manipulated genetic material, and all the artists who have created art in zero gravity, into one conference room. But in Bangalore, Beijing, Seoul, Talin new institutions are exploring art-science and art-technology collaboration within their very different situations and world view frameworks. This is a new and encouraging development and our expectation is that a very "different" electronic art will result. Electronic Art making within the context of the coming ecological and environmental crisis and social conflict is again at the forefront of artistic exploration. But now we take on the strong claim, and seek over the next 25 years to change the direction and methodology of science, not just to use science and technology for artistic ends.
At a *Leonardo* Editorial Board meeting in the 1970s, artist Max Bill identified "ethics" as the key issue for *Leonardo* in the next 25 years. This was the survivor of one world war talking to the inheritors of a false peace. In 1969, around the time Snow participated with Frank Malina in the founding of the *Leonardo* Network, Snow, as mentioned above, wrote around that time,[9] "One hears young people asking for a cause," he went on to say, "Peace. Food. No more people than the earth can take. That is the cause."

Timeshift 1959. Timeshift 1969; Timeshift 2004. Timeshift 2029.

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2 Collini, Stefan. "The Two Cultures in Historical Perspective", in Snow, C.P., *The Two Cultures,* p lxvii
3 Snow, C. P., op. cit., p 78
4 "Fondements Culturels de la Mondialisation" project is directed by Julien Knebusch. See *http://www.olats.org*
5 *http://www.leonardo.info*
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7 Fishwick, P. *Aesthetic Computing,* MIT Press, Cambridge, MA, 2005
8 Snow, C. P. op. cit, p 659 Snow, C. P., op. cit, p 78