

## Interdisciplinary Innovation, Collaboration and Learning Processes in Academia Paz Tornero, Ph.D.

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### Abstract

This article describes a transdisciplinary and educational experience at the San Francisco de Quito University in Quito, Ecuador. I was a member of the faculty and a researcher from 2014 to 2016. I was also a visiting artist at the Microbiology Institute of the University. As a researcher, my projects require of an intense collaboration with other scientists and the close relationships I developed with many of them allowed me to create a new subject, which was taught for the first time in Ecuador. The subject was called "Transdisciplinary Research Lab". This new course, which was 18 weeks long and was carried out during the second semester of the 2015-2016 academic year, was available to all students, regardless of their level or career.

On this paper, I will explain the work done during this experimental course and the conclusions obtained from it. I am also looking to highlight the importance of implementing transdisciplinary education as an enhancer of the creation of new knowledge, not only in the academic sphere, but in cultural and research centers too. Setting up new "hybrid" labs for experimentation, that work as a venue for two "opposite" fields like arts and science, enables the creation of bolder, contemporary, innovative and creative proposals which would better connected to the social demands of the XXI century.

### Keywords

Learning, Academia, Transdisciplinary, "Hybrid" Laboratories, Collaboration, Creation, Innovation, Knowledge.

### Introduction

In 1959, C.P. Snow, an English novelist and scientist, presented in a conference at Cambridge University (during the famous lectures called Sir Robert Rede's Lecturer or Rede's Lecture), the distance between humanities and science, a tradition established during the XIX century romanticism. *The Two Cultures and the Scientific Revolution*, as Snow called his lecture, explained the difficulties of creating bridges between the two types of knowledge, due to the specialization process and the impossibility of drawing a horizontal vision in relation to ontological studies (Vesna, 2001, pp 1212-125)

Later, in 1963, he published the second edition called *The Two Cultures: A Second Look*, where he predicted the birth of a new "third culture" as a new common space for the exchange of knowledge between both disciplines, just as it happened during the Renaissance: Science, arts and humanities were considered a "triangle of knowledge" thanks to historical characters like Leonardo Da Vinci or the famous painter and inventor of oil painting: Jan Van Eyck (Edwards, 2008, p. 143).

The position held in the aforementioned lecture by C.P. Snow (a remarkable and crucial fact in the formation of the current tendency reconciliation between humanities and sciences), commonly mentioned in the related literature, is not rare. For example, Lewis Mumford, who published his first book *The Story of Utopias* in 1922, accused the growing gap between science and art as responsible for social, cultural and spiritual ills (Mumford, 1922, pp. 282-284). As presented by the scientific historian, Paul Forman, the world of knowledge and the world of dreams have not always been separated: "Let's think of the time when the artist and the scientist, for all practical purposes, would look upon the 'exterior world' thru the same kind of lenses" (Forman, 2007, p. 280).

According to Forman (p. 299) Mumford denounced the absence of reference of its own research from his American critics: "I never accepted C.P. Snow's division of the 'two cultures'". He continues saying: "Though I find ironic that even American critics who discuss this thesis never refer to various contemporaries like myself who had already dissolved that false dichotomy in practice".

On his third book, *The Golden Day: A Study in American Literature and Culture* (1926), Mumford elaborates on a great story about the degeneration of thought, because of the separation of art and science. Moderns science accepts only that which is objective, abstract and quantitative as real, denying the existence of a mayor part of human experience, specially aesthetics.

Mumford lashes out against the success of the modern scientific method (which is based on the description of natural processes as the origin of new technologies) as a sponsor of a generalized conviction, based in a mechanized view of the world as the only true. The consequence of seeing the world with an inhuman and mechanized view was to achieve the inclusion of technology in the human body (man-machine): the creation of unsensitive automatism. Science meant all the supposed modernity that implies being the result of the most elevated and disciplined form of thought. Mumford places in the arts (composed of aesthetics) all the affective and subjective capacities and the human experience and lays them in front of the scientific community.

Paul Forman (p. 277), insists that Mumford's main demand (as a romantic) was to embrace the values of science and humanism. At the same time, he found common grounds between subjectivism and objectivism, arts and science. This common ground is defended by romantic poets like Novalis (Friedrich von Hardenberg) or Friedrich Schlegel, who states: "All art must become science and all science must become art" (Schlegel, 1991, p. 14). Goethe, German scientist and romantic writer, agreed. He considered that the most elevated forms of knowledge arise from the contact of two seemingly opposites approaches: arts and science (p. 276)

But Mumford was not the only one at his time defending the union between art and science. George Sarton, a Belgian chemist and mathematician, who is considered the founder of academic science, was looking for a new humanism composed of both disciplines. He stated in 1930 (paraphrasing the author) that the "scientific era" was far from being perfect since the elite was divided in two mutually hostile groups: humanist and scientist. This reveals the pressing matter of reducing the ever-growing gap separating them (p. (277).

Despite the considerable number of theoreticians favoring a transversal practice, divided positions arose in the scientific and humanist community during the XX century.

Nowadays, the "gap" denounced by Sarton, still exists in several academic systems in countries like Spain. This makes of the implementation and promotion of transdisciplinary research a pressing and urgent matter. This type of research can be used as an enhance method for the procurement of new knowledge in the field of union-incurion among artistic and humanistic disciplines with their scientific and technical counterparts. The demand for this kind of research was

reflected in Spain with the elaboration and publication of *El Libro Blanco de la investigación en Humanidades* published in 2006 (FECYT, 2006).

### **Experiences on Transdisciplinary Learning**

Ecuador is one of the least developed countries in Latin America when it comes to promoting contemporary art and art studies in museums and universities. This means an obstacle for encouragement of the transdisciplinary practice from the art side, either in cultural institutions or universities. The San Francisco of Quito University, one of the top Ecuadorian universities, is a private institution based on the American "liberal arts" teaching model. The advantage of working in this institution is that it allows an easy and very straight communication with different teachers and researchers. This specific environment makes collaboration accessible. Nevertheless, the biggest disadvantage, since it is a private university, is that there is no financial support for research and the study of the arts since they are not seen as a relevant discipline or a source of research and innovation.

After six months as a full-time professor at USFQ, I was permitted to attend microbiology, botanic and biology classes as an auditor, which allowed me to meet with different researchers and exchange views. I was also able to investigate at the Microbiology Institute as a visiting researcher. In the lab, they taught me the scientific method in the fields of clinical microbiology and food microbiology. Gradually, I got the attention of the scientific community and they started to take a serious look at the collaboration between disciplines (I was lucky that some of the researchers studied in the United States and they knew projects and synergies between artists, designers and scientists).

### **Transdisciplinary Research Lab**

A year and a half after I started working at the university and with the support of the Microbiology Institute, which had invited me on several occasions to participate in conferences to show my research. I managed to convince the Dean of the School of Communication and Contemporary Arts (where I was working at the time), to open a course to promote transdisciplinary practices.

The requisites imposed by the Dean were that the course would be available to all students from the first semester to the last year of their degree. We did not have a laboratory (just a small painting studio with a projector and no Internet connection) and there was no funding for

## Panels

purchasing materials.

Attendees were a total of 15 students from different careers such as art and performance, photography, painting, medicine, biology, engineering, psychology and film.

### Course and Syllabus Design

Contents were divided into the following parts: Practice and theory studies as well as two sessions at the microbiology laboratory, a visit to the Meteorology Institute, a field trip to help botanists collect photographic documentation, a design and biology experiment, and lectures from philosophy, medicine, art, microbiology, biology and environmental engineering professors with a great interest in transdisciplinary projects.

Students had to develop two projects:

1. A team work in collaboration with the Department of Environmental Communication: Environmental Protection & Sustainability initiative.
2. Groups of two to develop an Art-Science project. One from scientific discipline and the other one from humanities.

This course presented the following units:

- UNIT I: Contemporary Cultural Epistemology: An Unresolved Paradox
- UNIT II: Ecology, Art and Microorganisms: "Hybrid" Laboratories.
- UNIT III: Tissue Culture and Techno-Organic Ontology.
- UNIT IV: Astrobiology, Space Art and Exobiology: Expeditions to the Cosmos.
- UNIT V: Remote Landscapes: Ecological and Aesthetic Characteristics for Artistic Intervention.

Figure 1. Arts and Transdisciplinary research lab (subject students in their first Microbiology lab lesson coordinated with the Microbiology Institute of the San Francisco de Quito University

### Students' Transdisciplinary Projects

I would like to highlight the proposed projects of two teams formed by art and science students.

Figure 2. "Temperamental Skin" is a project that seeks to change people's perspective on the way life on the planet earth has evolved. Making use of smart materials, we have designed special suits that imitate the ability that certain animals have to change their appearance as a response to their environment.

Figure 3. "Engraving with Bacteria" is a new process of engraving using bacteria that produces acids that are very similar to the acids used in the regular process. This new technique is safe and an interesting way of using a non-toxic method.

### Conclusions

1-Establish a professional relationship with the scientific academic community was a very slow process and a real challenge. However, I developed an empathetic relationship with most of the scientific researchers at the university. They always helped me by using their labs and materials for my own use or my students'.

2 -I collaborated with environmental engineering, nano-electronics, and robotics researchers who were interested on my ideas to elaborate in their classes and asked me for different ideas to be developed by their students in their final dissertation (thesis).

3-Environmental engineering professors wanted to collaborate with some of my visual-digital art students to develop data visualization projects.

4 - Unfortunately, I never had the support of my own Art Department.

5 - When developing projects made by two students from different disciplines, I can conclude that the ones from the initial semesters were more enthusiastic and cooperative than the ones in their last year.

6 - The UNIT II was the most interesting for my students.

7 - Working without my art department support and with different scientific departments that helped us whenever they could, caused changes in the course's syllabus in several occasions.

8 - Most of the students said to have had a wonderful experience working with students from a different discipline.

9 - The Microbiology Institute's team allowed some of my art students to use their lab and helped them to develop their own ideas as they considered that some of these ideas could be registered as patents.

10 - Some scientific professors requested to participate in the following semester.

11-The Microbiology Institute's team showed interest to offer this course in their program.

12-At the end, the School of Communication and Contemporary Art rejected the continuation of this course, forcing the closure of some of the projects.

13-However, under these conditions it was a fruitful personal experience as a professor and an artist.

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### Author Biography

Paz Tornero has a PhD from Universidad Complutense de Madrid, her dissertation was a research into the fields of arts, science and technology. She has a B.A in Fine Arts from Universidad Politecnica de Valencia. M.A in Digital Arts from Universidad Pompeu Fabra. She was a visiting researcher at Harvard University at the school of Engineering and Applied Sciences and at MIT's Media Lab. She held positions as a visiting professor at Universidad Complutense de Madrid, full time professor at Universidad Técnica De Loja and

Universidad San Francisco de Quito, Ecuador. She is an Associate Professor and Researcher at the School of Fine Arts at the University of Murcia. Her projects have been showed in international festivals and galleries. She wants to continue collaboration with laboratories and Scientific professionals.