QUADERNO

HIDDEN CURRICULUM E FORMAZIONE
HIDDEN CURRICULUM AND EDUCATION

Bio-techno-practice: personal and social responsibility in the academic work

Bio-techno-practice: responsabilità personale e sociale nel lavoro di ricerca

Marta Bertolaso[1], Giulia Frezza[2]

[1] Institute of Philosophy of the Scientific and Technological Practice. Campus Bio-Medico University of Rome; [2] Department of Medico-Surgical Sciences and Biotechnologies, Sapienza- University of Rome

The new challenges posed by biomedicine and biotechnologies ask for a deeper consideration on the relationship among science, knowledge and social responsibility. On one hand, in fact, technologies seem to shape our idea of human progress and scientific understanding of the natural world and of life in particular. On the other hand, a thoughtful consideration on the philosophical foundations of science as human enterprise is required. This also opens important questions about the new emerging paradigms of 'excellence' in the academic, social and market fields and on the role that universities play in training the future leaders and professionals of our society. After a short review of the contemporary philosophical reflections on the unity of knowledge, which is the origin and the goal of academic work, we argue that adherence to our current challenges through the bio-techno-practice prism is a fecund driving force of the academic activities. Moving from the experience of an international project, we also discuss the impact that such interdisciplinary activities have on what we call hidden curriculum, i.e. the embodied style of (skills that allow) people in taking care of each other in their physical, social, professional and scientific needs.

Key words: Education, university, research ethics, interdisciplinary research, epistemological values, public engagement, bio-techno-practice

Le nuove sfide poste dalla biomedicina e dalle biotecnologie richiedono una più profonda riflessione sulla relazione tra scienza, conoscenza e responsabilità sociale. Da una parte, infatti, le tecnologie sembrano condizionare la nostra idea di progresso umano e della comprensione scientifica del mondo naturale e della vita in particolare. Dall'altra, invece, diviene indispensabile riflettere più attentamente sui fondamenti filosofici della scienza come attività umana. Si delineano importanti interrogativi riguardo ai nuovi paradigmi emergenti di "eccellenza" negli ambiti accademici, sociali e di mercato, e riguardo al ruolo che le università giocano nella formazione dei futuri leader e dei professionisti della nostra società. Dopo una breve rassegna delle riflessioni filosofiche contemporanee sul tema dell'unità della conoscenza, che è l'origine e il fine del lavoro accademico, argomenteremo che l'aderenza alle nostre attuali sfide, tramite il prisma della bio-techno-practice, è la feconda forza motrice delle attività accademiche. Partendo dall'esperienza di un progetto internazionale, tratteremo inoltre dell'impatto che tali attività interdisciplinari hanno su ciò che chiamiamo hidden curriculum, i.e. lo stile incarnato (competenze che lo permettono) delle persone nel prendersi cura l'un l'altro nei loro bisogni fisici, sociali, professionali e scientifici.

Parole chiave: *Istruzione, università, etica della ricerca, ricerca interdisciplinare, valori epistemologici, impegno pubblico, bio-techno-practice*

Indirizzo per la corrispondenza
Address for correspondence

Marta Bertolaso
FAST, Istituto di Filosofia dell'Agire Scientifico e Tecnologico
Università Campus Bio-Medico di Roma
Via Álvaro del Portillo 21, 00128 Roma
e-mail: m.bertolaso@unicampus.it

Introduction

The European Commission has recently organized a meeting in order to discuss new trends in science. The topic of the event is of particular interest for the objective of our contribution to this special issue: "The challenges of quality" and their effects on the trustworthiness of science, as knowledge, in applications and in policy (https://ec.europa.eu/jrc/en/event/workshop/challenges-quality). The forum has acknowledged that the challenges of quality have originated from the transformation from community-based 'little' science to industrial-scale 'big' science, which had effects on research-incentives and thus commitment and morale. In an age that has been called the 'information-age', science is a driving force of development, shaping future societies through technology and through the dissemination of scientific results. On the other hand, the forum discussed what "governance of quality" is emerging and why we need to go beyond the excellence paradigm. 'Excellence' has been, in fact, largely considered the top of a ladder of quality. However, as the usage of the term grows, it seems to be anything but. The point was made in the European meeting that the growing policy obsession with the under-defined notion of 'excellence' acts against efforts to improve the governance of science and innovation.

At the crossroad of these issues, the European forum has been giving great relevance to transparency, responsibility, uncertainty management, sustainability and transdiciplinarity (synthetized in the acronyms TRUST afterwards; *ibidem*). These keywords imply a change in our understanding of science and of its relationship with society. We have to acknowledge an important cultural transition that is shaping our perception of human progress and scientific knowledge. In this new vision, science is not just an abstracted truth-machine, but rather a complex social-technical-cultural activity, deeply embedded in society, and sharing all its triumphs and pathologies, so that the "crucial concept becomes Quality, rather than the traditional Truth" (*ibidem*).

Avoiding a theoretical discussion of such separation or even contrast among quality, excellence and truth, in the following pages we want to defend the thesis that *quality* actually has its own foundation in *practical truth*, and that training in such practical truth endorses researchers with high *quality* work. By *practical truth* we mean the human beings' capability of knowing and shaping the world by imposing new constraints in their surrounding (culture) and in their own behaviour (virtues) thus increasing further their capability of semantically change the world and themselves for a wider and deeper harmonization (*quality*) of their living in the world[1]. Our thesis is consistent with -and could expand- a conclusion of the abovementioned European meeting: "if the science we want is including social responsibility among its ethical foundations, then this approach is short-sighted. We want ethical reflections in dialogue as a characteristic of the future scientist" (*ibidem*).

From the more general notion of practical truth, in this paper we focus on *scientific practice*, on its pivotal role in ensuring flourishing and innovation of our future societies, and on the role that universities have in facilitating a quality oriented attitude in young researchers. We will take as an example the approach we have adopted in a recent research program promoted and coordinated at Campus Bio-Medico, and we will present a concrete project we have been involved in during the last years. After reviewing some philosophical reflections on the role of university in developing knowledge (Section 2), we argue that adherence to reality is the most important driving force of research activities and of academic training, that such 'realism' currently relies upon –and finds its main challenge in- the intrinsic relationship existing between the biological and the technological dimensions of scientific inquiry and practice (Section 3). We therefore present a project that was promoted by the University Austral and involved the Campus Bio-Medico University (Section 4). This project shows the fecundity of the dimensions of academic work that we hold as characterizing. Such dimensions ground the possibility for students, professors and researchers to grow in what we call the *hidden curriculum* (Hc) (Section 5). With this term we refer to those skills and values that motivate and enable people to take care of each other in their physical, social, professional and scientific needs; skills and values that are especially required for people who will bear social, economic, legal responsibilities at national and international levels.

Universities and knowledge

In the Seventies Enrico Cantore wrote that: "science constitutes an essential factor of the historical development of man as a cultural being" (1977, p. xv). It was in those years that biotechnologies reached one of their most important results, making the manipulation of biological material possible in a way that was never seen in the history of the human beings before. Important genetic sequencing projects, generously sponsored both by local governments and private foundations, were launched in order to disclose the information contained in the genetic code. Physics and chemistry got progressively subordinated to biological sciences and the hope to control life justified the enthusiasms of the first steps in the development of Human Enhancement Technologies (HET) too (Bertolaso, 2011). However, "the human genome, like a good teacher raises at least as many questions as it answers" (Abbs et al., 2004). Our possibility to manipulate human beings at the genetic, physiological and emotional level from

[1] We have found a similar definition in Brague and Grimi 2015 that actually encourages a further development of this concept in the practical and philosophical field.

their conception to their death raised important concerns as well.

This century began with widespread evidence for the huge complexity of biological systems and with an increasing awareness that uncertainty is the rule more than the exception in the natural world and in our ordinary life (from medical treatments and drug therapies to the markets and the ecological changes). Scientific work found itself far away from the premises of empiricism and positivism developed at the beginning of the twentieth century. Since then, paradigm shifts had been characterizing our educational, technological and social investments. Interestingly, we moved from the development of Systems Biology to the research programs promoted in the USA that privileged the conceptual convergence among disciplines to create interdisciplinary teams in which the huge amount of data collected were eventually to be understood in some kind of satisfactory (at least for the industries that were funding such projects) explanatory framework and translational results. New developments in bio-engineering (e.g., the creation of new devices to model biological processes and to integrate human physiological functions in a mechanical or informatic environment) are actually opening scientific practice to an unexplored field of integration of the natural with the artificial. The emerging field of so called 'In silico medicine' (Bertolaso and MacLeod, 2016) expands our possibilities to avoid the use of animals and in vivo tests in the clinical trials of drugs and devices. Clearly these new technologies are changing our concept of medicine and clinical practice as well as the role of hospitals and, for example, of health insurances.

At the crossroad of these scientific and technological issues there was – and still there is – a question about the kind of training and culture that universities should provide. Should universities be subordinated to the technological progress and train specialized people? Should the academic work, instead, facilitate the development of a critical attitude that helps students asking the right questions more than looking for the 'right' answers and guidelines? These issues are especially crucial in the bio-medical sciences.

The dream of a unified theory (cf. Dupré, 1993) has given way to pluralism of models and perspectives on human and social sciences. Within this framework, what kind of unity of knowledge can the academic environment actually endorse and empower? Let us consider the commitment of universities in pursuing an educational environment able to train people whose main interest might be the common good and social development. This is not new in the history of the universities. Over time, various attempts targeting the unitary character of knowledge have been made. As Lodovici's classic survey highlighted (Lodovici, 2007), in medieval times when Universities were initially founded, theology, the *sacra doctrina*, emphasized the universal trait of all knowledge within the "architecture of knowledge". The Renaissance then would abandon the project of a unitary design for all knowledge but it kept the human dimension at the center of the image of the world and of knowledge. During Illuminism, instead, a novel-unifying trait would spread through the notion of (internal) rationality, *interiore homine*, which was at the core of the "Encyclopedie" project. Later on, (external) attempts at unifying knowledge came from the conception of science (meant in its purely pragmatic and functional sense) as well as from the Hegelian-Marxian approaches emphasizing the idealistic-historical trait of knowledge. More recently, the "myth of inter-disciplinary research" loomed in. According to Lodovici's analysis, each of those perspectives ended up by identifying itself into its own specific trait, adopting what we dub here as "metonymic vision". Accordingly, all these standpoints miss, for one reason or another, the very "unity-trait" they were initially targeting. In other words, as Lodovici (2007) highlighted, the issue of University and of its decadence can be traced back to the systematic failure of clarifying its fundamental purpose.

The topic is vast as it was addressed in capital works from Humboldt's, to Newman's, Jaspers', and Ortega y Gasset's (see e.g. Tanzella-Nitti, 1998 for a thorough review). Some authors consider it also as a promising field of studies yet to come (Paoletti, 2010; Barnett and Di Napoli, 2008). Traditional analyses of the importance of the unity of knowledge have highlighted values that should shape and build University; most of these values still hold true, but today they impact on a more global and complex perspective (Tosi, 2007; Tanzella-Nitti, 1998; Mayor, 2007). The interdisciplinary vocation should become pivotal, rather than being dismissed, in designing universities. The very practice of science is, in fact, an objective-built practice deriving from a subjective-based process. Science is a creative and controlled practice, which, by definition, should be constantly verified by scientific communities. Moreover, every scientific community designing inquiries and making knowledge progressing is responsible and committed towards individuals. Individuals, on the other hand, are bound to, actively build, the wider communities and environments they live in. Along these lines, sociological and biological studies reveal a parallelism between the key notions of "nesting" and of "scaffolding": we are ecologically relying on environments made of nested communities (Odling-Smee et al., 2003; Gilbert & Epel, 2009)[2].

If, on the one hand, the scientific methodology is built on a trial-and-error procedure, it is also a cultural result – i.e. historically based. Nonetheless it is the best available (Joannidis, 2015) tool we have to design, drive and test our own biases and errors at all levels: cognitive (structural limit), pro-

[2] This applies both at the natural and at the cultural levels (Laland and Brown, 2006) making also our conceptual scaffolding ecologically driven (Caporael et al., 2013) in a complex of nested network that is subject to further necessary investigations (Capra and Luisi, 2014). A different perspective which is in line with what we are arguing for here is going to be presented in Brambilla and Serrelli, 2016 too.

cedural (limit of knowledge), and practical (limit of measurement). Along these lines, science is by definition in-progress: it confines, or at least should confine, itself to the limits determined by the advances it makes along the way. Therefore, science is increasingly suffering from a boundary problem that is, it is dealing with the opposite issues of disciplinary specialization and of interdisciplinary crossovers. Both issues show the difficulties at stake in the communication within similar sectors of research and between heterogeneous fields too. Moreover, the increasing and upsizing amount of data and knowledge impinge on the broadening of the topics and on the consequent level of complexity of the issues included (Leonelli, 2013).

This ethics of progress without an inbuilt purpose, which is inherent to scientific practice, highlights some crucial elements that can be of help when reflecting on new educational proposals (Meyer and Sandøe, 2012). At a first level, the scientific method -as intended above- is eminently a human practice that reveals our human nature: it shakes our prejudices, and makes us face and experience our limits: *structural, procedural* and *practical*. As a consequence, it brings down to Earth every attempt to proceed upstream in the process of science and knowledge following ideological/dogmatic attitudes (Giuliani et al., 2016). Moreover, from an epistemological point of view, the scientific method has continuously re-defined its very borders that made it alive for nearly four-hundred years. We may even say that science's most living testament is the practice of shaping and reshaping its borders.

The best answer to a specific problem, therefore, doesn't necessarily come from a two-fold/three-fold dialogue, such as the simple sum of three individuals' perspectives. As underlined by Tanzella-Nitti, when aiming at the unity of knowledge the "unity" we are looking for is not a sum, but a *habitus* (Tanzella-Nitti, 1998). Individuals reach unity when their intelligence and their will are integrated and intertwined in theory *and* in praxis. In other words, unity blooms from individuals' actions. When an individual is mature she/he is capable of judgment and will, affirming her/his own intelligence, spirituality and affection while executing their personal choices and public actions. These choices and actions would be sounder when grounded on solid knowledge, thus allowing claiming and justifying one's own assertions and firmly confronting with others' creeds and opinions.

Social responsibility in the educational training

Some universities were conceived and founded precisely with the goal of promoting the unity of knowledge by educating people in the abovementioned *habitus* based on a unitary vision of human being, society, and our role in the world at work and in our ordinary life. Science, within this framework, is clearly oriented to the common good and put to the service of the person. Such universities avoid the abovementioned dichotomy between science and society, between truth and quality by understanding scientific practice as a human enterprise, a particular form of work that allows us to know and deal with aspects of the natural world in quantitative terms. Campus Bio-Medico University of Rome is one of those universities. Its web page says: "Campus Bio-Medico promotes integrated teaching, research and healthcare structures, pursuing as the main end of all its activities the good of the human person. The University offers students an educational environment aimed at stimulating their cultural, professional and human growth, proposing the acquisition of skills in a spirit of service. It promotes knowledge, interdisciplinarity of the sciences, and research in all fields that contribute to the overall good of the human person. Patients are cared for in the unity of their material and spiritual needs, in accordance with a view of life open to the concept of transcendence"[3]. Training in the sciences is thus a way to a human society. A humble and balanced behavior of the experts in their own field and in their collaboration with others in order to promote the common good is the natural outcome of these training and teaching programs. Similarly, in the web page of the Universidad Austral (Argentina) the mission of the university is expressed in these terms: "To serve society by pursuing truth, creating and disseminating knowledge, educating on virtues, and catering to every individual's transcendent destiny, providing intellectual, professional, social and public leadership"[4].

Campus Bio-Medico University of Rome, Universidad Austral of Argentina, and other universities with a similar spirit directly take over the challenge that was made explicit by the EU framework program for research and innovation (Horizon, 2020) for which the increasing complexity of all issues has changed the nature of the relation between science and society: citizens are more dependent on science and vice versa. Following the main objective of Horizon 2020 section "Science with and for society" we thus aim to "Building capacities and developing innovative ways *of connecting science to society*" (our emphasis, https://ec.europa.eu/programmes/horizon2020/en/h2020-section/science-and-society), helping our researchers and students to invest in their own virtues beside their practical and technical skills. This will "make science more attractive, increase society's appetite for innovation, and open up further research and innovation activities" (*ibidem*).

Acknowledging all these multifaceted issues, the "University-experience" should be grasped firstly as education in its broadest meaning and centered on the ethical ground, as a humanist-scientific practice of research and study. Secondly, it should be organically structured, that is it should aim at addressing the individual in her/his whole dispositions, capabilities and potentialities. In this way, the "University-ex-

[3] http://unicampus.it/eng/about/mission-and-background

[4] http://www.austral.edu.ar/en/la-universidad/mision-e-historia

perience" comprises an institutional education that provides and fosters inquiries aimed at supporting responsibility, both individual and social.

Moving forward to our specific purpose, we want to briefly outline a direction of reflection, to be further implemented and developed, which can be applied to designing university projects and curricula that may let researchers and students live a new University-experience.

Bio-techno-practice

Given the technological development in the last decades and the growing demand for (health) care assistance, the Bio-Techno-Practice (BTP) framework, explained below, is emerging as undoubtedly the most relevant challenge we have to face. Building human societies, in front of the growing expanding technocracy, is something that requires a deep exercise in looking at the world, at the other and at societies with benevolence. This means leaving aside functional frameworks and expanding the care paradigms. From humans to ecology this has been, in fact, also a growing field of research, market and theoretical activity in the last decade. Our responsibility is that of training scientist to be able not only to deal with such a transdiciplinary panorama but also to develop and pursue ethical objectives through their ordinary activity. Bio-Techno-Practice (BTP) is the name of a university research empowering hub (www.biotechnopractice.org). Aggregating and coordinating the work of top scholars on specific initiatives, BTP relies on a renewed philosophy of science recognizing that many constitutive dimensions of the human understanding are simultaneously involved in scientific practice. And, conversely, that human practice shapes the directions of scientific investigation. Such awareness converges with an urgency of new accounts of scientific practice: new ways of doing science are rapidly emerging, bringing together life sciences and technology, as well as other natural, human and social sciences. Campus Bio-Medico University has two features that make it a particularly suitable platform for BTP: (a) the mission (explicitly stated in the University foundation act) of (re)integrating all different aspects of the person into a unitary frame; and (b) the actively fostered interdisciplinary exchanges between biomedicine, engineering, philosophy and other fields.

Let us spell out what we mean by Bio-Techno-Practice. Bio* – the living – is the locus of complexity, of fine structural and functional multi-layered organization and integration. As a prefix, 'bio' is becoming very common in different fields, like food, architecture, urban planning, clothing, informatics, robotics. This is unlikely to be a mere tribute to a largely media-oriented fashion of identifying biology as the central science of the present. Bio-related ideas play a key role in characterizing contemporary society, informatics and artificial systems, and our daily life, to the point that Bio* can be seen as exceeding the biological world, to reach the physical world, the social world, or, in the most general way, the world of phenomena. In technological domains, reference to biological organization identifies a shared need for a change in the way we look at technology. At the same time, biology makes explicit reference to technological tasks and activities recorded by words like biotechnology, bioinformatics, systems and computational biology, bionics and bio inspired robotics.

If Bio-related concepts are indeed pervasive in our society, their contribution to our understanding is not yet well understood. In a sense, while other fields of investigation (albeit in a still seminal, largely unconscious and somewhat superficial way) leverage the peculiar organization principles at the basis of biological systems, biology seems to be well inside mechanistic paradigms overcome by other sciences many years ago. Although the role and structure of organization have long been central to biological thinking, biology has attempted to adopt reductionist and linear mechanistic models from physics. This strategy brought about great economic investments and communication successes but little knowledge and understanding of complex natural dynamisms. In this sense, the great majority of scientific practice in life-sciences is by far still dominated by an essentialist way of looking at the molecular players of biological systems (genes, proteins) as intelligent agents in charge of 'taking care' of the global organization.

Techno* can be *hardware* like robots or prosthesis, *software* like computer simulation programs and models, or pure theory like scientific paradigms. What is common among all these is the powerful transformation of reality according to some prescriptions and values, and, at the same time, a crucial participation into explanatory endeavors. We increasingly depend on Techno* to better understand the world. At the same time, recent technological advances have produced artifacts whose intrinsic complexity is not totally manageable by the designers, in some cases acquiring a sort of independent existence that asks for an approach similar to the one adopted by biological sciences. It is not without consequences that we add 'scientific paradigms' and 'theory' in the Techno realm. Scientific theories are today increasingly 'freezed' into 'ready-to-use' software made possible by the universal use of automatic computation. On the one hand, the automatization of theories enlarges their domain to very distant fields for which they can provide useful metaphors (think of the huge enlargement of statistical mechanics' application range due to complex network descriptors). On the other hand, it implies a fatal loss of awareness of theory premises and consequences: this can be highly misleading and, still more important, provokes a substantial lack of deep understanding of what is effectively done.

Finally, Practice* is the context where understanding takes place, it is the locus where knowledge is created, conveyed, and used. By emphasizing practice, we vindicate the need to have 'practical consequences' and to be 'committed to the world' of any theory that deserves this name (rather

than being a piece of software, or some beautiful, but unusable, piece of mathematics). A renewed philosophy of science recognizes that many constitutive dimensions of the human understanding are simultaneously involved in scientific practice. And conversely that human practice shapes the directions of scientific investigation. This converges with the urgency of new accounts of scientific practice brought about by the Bio-Techno merging.

In the following section we present the potentiality and fecundity of the educational work developed in universities when its goals are driven by the kind of integration and adherence to reality that we have spelled out in these previous sections. We discuss how scholars and scientists from different disciplines and universities have gathered together in order to realize a project aimed at enhancing research in an interdisciplinary environment as well as at training young researchers in stimulating contexts of work. As we have recently claimed with other colleagues (Bertolaso et al., 2015), in fact, science is "an activity performed by people, with all their skills, attitudes and circumstances. Science is not a modular activity, which can be reduced to the powers of observation and logical inference of a single scientist. It rather is an integral personal activity". Scientific rationality is "a kind of harmony or equilibrium, as the result of the dosage and timing where all contextual circumstances and capabilities are combined". Practice* is also the practical life that is lived by patients and doctors, by students and teachers, by families and citizens, by people in different conditions and situations, including poverty and needs of any kind, by humanity in its environment and with other forms of life. Practice* is the context in which science, Bio and Techno, are called to reach in renewed ways.

A pilot project: "Determinism and indeterminism in the natural world"

Having presented Bio-techno-practice as a general approach and as a concrete initiative based at Campus Bio-Medico University of Rome but expanding internationally, let us now analyze a specific project, the just concluded three-year project "Determinism and Indeterminism: From Science to Philosophy in Spanish-Speaking Academia" (2013-2015), based at Universidad Austral (Argentina) and lead by Claudia Vanney[5]. The case illustrates how students' education and researchers' work could be framed within a perspective open to philosophical issues during the process of knowledge, which is at the base of ethical decisions, and is indeed at the core of the interests of Campus Bio-Medico University of Rome [CBM] and Universidad Austral [UA].

[5] The project was supported by the John Templeton Foundation (https://www.templeton.org/), an organization which serves as a philanthropic catalyst for discoveries relating to the Big Questions of human purpose and ultimate reality.

The project was devised around three big questions of contemporary science. The first question focuses on the notion of determinism in physics, biology and the neurosciences, and also on whether life and consciousness are rightly understood solely in terms of complex material phenomena. It can be expressed in the following way: *How do we understand determinism in physics, biology and the neurosciences?* The second question concerns the ontological constitution of nature and the way nature is addressed by physics, biology and the neurosciences. One can formulate this question as follows: *Does contemporary physics provide a deterministic or an indeterministic picture of nature and in what sense? Which is the impact of this picture on biology and the cognitive sciences? Are matter, life and intellectual consciousness just levels of an increasing complexity or do they respond to ontologically different principles?* The third question evaluates the bearing of indeterminism on the issue of a creator and provident God: *How are we to understand the dependence of the universe upon God? Do physical laws exclude a creator and provident God? Is an indeterministic nature a necessary condition for divine action?*

With respect to these issues, the project aimed at systematically cross the boundaries of what is traditionally considered scientific, philosophical or theological in order to face the specific challenge of attaining an interdisciplinary understanding, and to build a common technical vocabulary that promotes dialogue among Spanish-speaking scholars of different disciplines. The project intended to foster high level interdisciplinary research and to create a regional network of researchers interested in the dialogue between sciences and philosophy. In addition, the project meant to catalyze the generation of other similar interdisciplinary projects in the region in cooperation with institutions of other countries.

Materials and methods

Specific activities were developed within three years, including a monthly seminar named *Determinism and Freedom* and three intensive *Interdisciplinary Research Weeks*.

The seminar *Determinism and Freedom* took place seven times a year and represented the spine of the project, gathering researchers regularly. It consisted of selected presentations, which covered alternatively scientific and philosophical perspectives, with the purpose of reaching cross-disciplinary understanding.

The three *Interdisciplinary Research Weeks* were used as networking occasions. Throughout them, the following activities were organized: 1) two key-note talks open to the general public; 2) a 6-hour course for scholars; 3) a 3-day workshop for researchers working on physics, biology, neuroscience, philosophy or theology.

The 3-days workshops intended to foster high-level interdisciplinary research and consisted of six working sessions,

two every day. Each module stemmed from a specific question, which was based on the present state-of-the-art and on results previously obtained by the researchers involved in the project. Each question engaged a pair of academics of different disciplines. The specific aim of the Workshops was to offer each team of speakers an extended occasion of research: about six months before each Workshop, each pair of academics started to exchange ideas and suggestions in order to prepare their contributions to the common work. During the Workshops, they had the opportunity to engage in advanced criticism and discussion with the rest of the participants. The working sessions stuck to the following methodology. The initial speaker outlined the *status quaestionis*, proposed a promising answer from his/her discipline and cleared the way to a complementary vision, from the viewpoint of the partner. The respondent evaluated the contributions of the first presentation and proposed a possible answer from his/her discipline. The session then remained open to questions and comments from the participants.

The Project included as outputs the publication of three collective academic volumes[6] and three popular science books[7]. With the aim of promoting the dissemination of scientific knowledge in the massive media, the project also organized two competitions for journalistic articles between June 1, 2013 and May 31, 2015. In each competition, two mass-media pieces of work were awarded.

Main results: expertise, network, new academic infrastructure and public engagement

The activities developed in the three years of the project allowed to consolidate the interdisciplinary expertise of the original team of researchers, and to establish the core of a strong network of Spanish-speaking experts, including scientists with a sound disposition to look into the philosophical and theological foundations of their sciences and young philosophers with an increasing interest in science. Concerning the personnel's expertise, the team of academics strengthened their interdisciplinary expertise and network. The researchers of the project are now working in new interdisciplinary projects: 1) "Interdisciplinary Dictionary on Science, Philosophy and Theology", a three-year project that will produce and supply an online interdisciplinary dictionary in Spanish of the highest-academic standards on the main topics pertaining to the relationship between science, philosophy, and theology[8]; 2) "The nature of information for an informational reformulation of the modal-Hamiltonian interpretation of quantum mechanics", a project that seeks to reformulate the Modal Halmitonian Interpretation in informational terms[9], and 3) "The Brain and the Personal Self. Can advances in neuroscience enlighten the notion of person?" The overall goal of this project is to foster positive, constructive, and productive engagement between neuroscientists, philosophers, and theologians in the Argentinian context[10].

One of the most important outputs of the spawned projects was the progressive assembly of a continuously increasing network of scientists, philosophers and theologians. There is now a significant population of scholars with a genuine interest, not only in understanding the apparently opposite fields, but also in the construction of joint enterprises. The three Interdisciplinary Research Weeks and the collective academic volumes constituted a prominent set of events within the project. They enhanced the development of significant interdisciplinary expertise in the region and offered the opportunity to establish new contacts between the members of the network. At the beginning of the project, the team was composed by ten scholars, working in collaboration with five researchers from other four Argentinian universities, and ten researchers from seven Latin American and European universities. The current network of the Philosophy Institute, instead, involves one hundred and fifty five researchers, from forty-five different universities and eleven different countries. Among them, seventy-two are junior scholars, and eighty are senior scholars. Forty-seven percent (47%) of these scholars work in natural sciences (mainly in physics, biology and biomedical science), forty-four percent (44%) in philosophy and theology and nine (9%) in social sciences. Among these scholars, ninety participated directly in the outputs of the project (as invited speakers or authors of a piece of work), and the remaining sixty-two scholars attended different activities.

In terms of new Academic Infrastructure, the Institute of Philosophy started a new collection of books: "De las Ciencias a la Filosofía" ("From Sciences to Philosophy"), on top-

---

[6] The three collective volumes are the following: 1) Vanney C. (Ed.) *El debate sobre el determinismo: nuevas perspectivas desde la ciencia contemporánea*. Anuario Filosófico 2013;46. Navarra: Servicio de Publicaciones de la Universidad de Navarra 2) Vanney, CE, Lombardi O (Eds.). *Fronteras del determinismo científico. Filosofía y ciencias en diálogo*. Madrid: Biblioteca Nueva 2015. 3) Vanney C, Franck JF (Eds.). *¿Determinismo o indeterminismo? Grandes preguntas de la ciencia a la filosofía.* Buenos Aires: Logos – Universidad Austral 2016.

[7] The three high-level dissemination books are the following: 1) de Asúa M. *La evolución de la vida en la Tierra: Ciencia, filosofía y teología.* Buenos Aires: Logos – Universidad Austral 2015. 2) Alfonseca M. *Viajes hacia lo infinitamente pequeño y lo infinitamente grande.* Buenos Aires: Logos - Universidad Austral 2015. 3) Lombardi O. *¿Existe la flecha del tiempo? Ilya Prigogine: entre la ciencia y la filosofía.* Buenos Aires: Logos – Universidad Austral 2015.

[8] The project is based at Universidad Austral and lead by Claudia Vanney. It is founded by the John Templeton Foundation. Cfr. http://dia.austral.edu.ar/

[9] The project is based at Universidad de Buenos Aires and lead by Olimpia Lombardi. It is founded by the Foundational Questions Intitute. Cfr. http://fqxi.org/grants/large/awardees/view/__details/2013/lombardi

[10] The project is based at Universidad Austral and lead by Claudia Vanney. It is founded by The Templeton World Charity Foundation. Cfr. http://www.austral.edu.ar/cerebroypersona/en/

ics relating science, philosophy and theology, to foster a more informed debate in our society. This collection includes the three high-level dissemination books produced during the project, as well as the collective book resulting from the discussions during the three Interdisciplinary Research Weeks. The books are in paper and in a digital format, to make them more easily available in all Latin America.

Concerning public engagement, the project's original goal of involving a non-specialist audience was centered on several outputs. The project website was used as a space for disseminating information and as a means of canalizing the public's interest[11]. To disseminate the results to a wider audience, a series of YouTube videos was also produced. Three popular science books were published and sent to six hundred Argentinian high schools. With the aim of promoting the dissemination of scientific knowledge in the mass media, the Project organized two competitions for journalistic articles addressing the project topics in a public venue. These competitions resulted in the creation of a large database of science journalists and of academics with an interest in writing about interdisciplinary issues in the media. The project-based network of Spanish-speaking journalists and academics who work in the dissemination of science has now more than three hundreds of contacts.

Conclusions: *hidden curricola*

It has become commonplace to argue that science and scientists have responsibilities towards society. However, when we start to investigate what such responsibilities consist of, agreement disappears. Based on a recent discourse analysis of academic meetings and projects, this paper argues that there are currently at least three different aspects to be integrated in order to develop a real social responsibility of scientists: quality, credibility and practical truth. Each of these features of the academic enterprise has a particular definition in the role of science in society and of how to assess and evaluate quality in scientific knowledge production. Each of them might also ground a particular criterion for the governance of the boundary between (or integration of) science and society.

This integration can be considered from different perspectives. According to Michael Polanyi, "the greatness of a scientific discovery is its fecundity" (Polanyi 1961, p. 155). Such fecundity is possible if a scientific discovery and progress is actually based on a wide cultural framework. Therefore, despite being at the forefront of new revolutionary technologies where we witness a point of no return in the specialization of research fields, we maintain the need for the unity of knowledge (Barnett, 2005). The idea of an ethical praxis, which could be grasped at the very core of science and of its methodology, should be used as a unifying basis for insightful educational purposes. This link between knowledge and praxis is possible if we acknowledge the continuous reference to the strength of referring to reality. Polanyi also pointed out that "reality is something that gets our attention via clues that stimulate and attract our minds to go always deeper in it and that, given that its attractive power is due to its independent existence, can always manifest itself in unforeseen ways" (Polanyi 1961, p. 155). On the other hand, Benedict XVI in his speech in London in 2010 expressed the wish for the realism of history as an antidote to the risks coming from narcissism and a kind of auto-referential science. A perspective based on practice and on the strength of reality is an answer to this hope. This perspective implies that research programs must be rooted in the historical and dynamical reality of the Universities and of the personal and collective paths existing within them. This investment will also be an antidote to the contemporary skepticism of a kind of reflection that is not rooted in the study and knowledge of the history and of the historical reasons for the current philosophical trends, etc. Within this framework, faith is at the service of new and old questions about God, signaling the path to a reciprocal autonomy of God truth and practical truth in a way that one does not eliminate the other to assert itself.

These views of the academic activity and environment should also help in developing new foundations for the concept of 'excellence' by bridging the concepts of 'quality' and 'credibility' through the training in practical truth. This dimension characterizes university as a scientific community and a community of knowledge that reveals the orientation potential of this knowledge in individuals' lives and in their communities (technological, social ecc.). This last aspect is somehow embodied in what we call Hc, which is the capability of people of taking care of each other in their physical, social, professional and scientific needs. This means also growing and developing further in an academic environment while creating more sustainable societies. The Hc is a life style. Following what Waddington said to overcome Information Theory's weakness that tried to define living systems specificity in essentially non-active terms: "One gets a better idea of the real nature of the complex systems we actually come across if one thinks of them, not in static terms of the amount of information they contain, but by asking the more dynamic question, how much instruction was necessary to produce them, or what instructions do they tend to impose on their surroundings" (1977, p. 145).

This has special contemporary relevance, for there is now an acknowledged crisis in quality assurance in science, a situation that would have been inconceivable within the traditional paradigm. 'Excellence', by being undemocratically operationalized without scrutiny, could be the enemy of quality in science. 'Excellence', from this perspective, is a negative category, an escape from general responsibilities for the social work of science.

[11] http://www.austral.edu.ar/filosofia-deteind/?lang=en

We believe that this crisis will not be resolved by installing better refereeing techniques, or even by correcting some of the many perverse incentives in current scientific practice. Necessary as they are, they are restricted in their scope to the traditional recognized forms of scientific practice. That is why we have organised these meeting, not merely discussing the problems in more general terms, but also exploring more open-ended and adventurous approaches. We certainly do not expect to find solutions, but we can hope that out of it all we will be able to frame some useful questions.

In order to offer an example of how this might work, we have shown the potentiality and fecundity of the educational work developed in universities whose goals are not driven by the market and economic interests, but by a genuine contact and knowledge of society and its cultural challenges. In particular, we have argued that institutional commitment in university programs should foster all different sciences within a unitary perspective. It's worth recalling that university was born with this very purpose – the unity of all sciences –, which was soon abandoned, thus making universities lose contact with society (Lorenzelli, 2003). We have presented the Bio-Techno-Practice perspective as an updated version of the vocation to combine knowledge, adapted to the current trends in science and society, and now made concrete in an academic initiative – a 'research empowering hub' – based at Campus Bio-Medico University. Then we have discussed a case study, a project, in which scholars and scientists from different disciplines and universities have gathered together to enhance research in an interdisciplinary environment and train young researchers in stimulating contexts of work. Moving from the discussion of the major educational challenges universities have to face in our society, we have presented "Determinism and Indeterminism in the Natural World", the project that we have been developing funded by the John Templeton Foundation. The integration among disciplines and sciences is made fecund through the contribution of people who have been able to put their own knowledge and expertise in service of others and of a common project. The 'excellence' emerging in the results of such a project can be measured in terms of professional success in the academic integration of different research perspectives and expertise.

This case study also shows that coordination and management are essential parts of a project and that they are equally important to progress the research program and empower the human environment. They are key elements of fruitful collaborations. The specific purpose of empowering human environment reveals its fecundity in terms of satisfaction and new possibilities of research programs and interdisciplinary collaborations within the University and among different careers. Moreover, as a long-term outcome, it ensures a fruitful convergence of technological opportunities, social and cultural needs as well as challenges and solutions in favor of each person, cultural environments or societies more in general. We call Hc the capacity to articulate one's own richness, which is underneath anyone's professional and disciplinary specificity and to expand it beyond particular interests contacting others' common interests and topics of research. The core of our proposal is thus based on the integrity of humanist-scientific practice and on the ethics of scientific method, emphasizing both interdisciplinary and international traits. By presenting the major results and outcomes of the project we drew attention to this as an example of good practice in the field of research and academic organization.

In conclusion, let us highlight two main characteristics that reveal the core of the project's meaningfulness also for further initiatives of the kind: (i) researchers working on a common issue from the beginning of the project; (ii) researchers coming from multifarious backgrounds, experiences and different career stages. We recall here again Tanzella-Nitti's reflection that the "Unity" required when targeting the unity of knowledge is not a sum, but a *habitus*. The efficacy of the project chosen as case study, grounded on a 3 year time and long-time perspective, responded exactly to this issue allowing all scholars and scientists coming from different backgrounds to engage in thorough discussions around common stimulating questions, refining their curiosity, interdisciplinary skills and expertise. This clearly promoted an idea of unity of knowledge and capacity to develop one's own Hc, being she a student, a scholar, a teacher, a journalist or a scientist. Moreover, as the results showed, the interdisciplinary and international levels were integrated in synergy, enhancing also cultural, scientific and academic networking. The project's approach suggests therefore a promising strategy for promoting a more participative, global and ethical idea of education in the universities.

Acknowledgements

The authors wish to thank Claudia Vanney (Instituto de Filosofia-Universidad Austral, Buenos Aires) for sharing the results of the project "Determinism and Indeterminism in the Natural World" and for the collaboration in the presentation of the project's results in section 4.

References

Abbs S, Bussoli T, Kavalier F. *Nature encyclopaedia of the human genome*. BJM 2004;328:172.

Barnett R. *Recapturing the universal in the university*. Educational Philos Theor 2005;37:785-97.

Barnett R, Di Napoli R. *Changing identities in higher education: voicing perspectives*. New York: Routledge 2008.

Bertolaso M. *Le human enhancement technologies e l'irriducibilità della complessità biologica.* In: Kampowski SM, Moltisanti D (Eds.). *Migliorare l'uomo? La sfida etica dell'enhancement*. Siena: Cantagalli 2011, pp. 35-58.

Bertolaso M, Di Stefano N, Ghilardi G, et al. *Bio-techno-logos and scientific practice.* In: Bertolaso M (Ed.). *The future of scientific practice: 'bio-techno-logos'.* London: Pickering & Chatto Publishers 2015.

Bertolaso M, MacLeod M (Eds.). *In silico modeling: the human factor. Humana.Mente.* J Philosop Stud 2016;30:III-V.

Brague R, Grimi E. *Contro il Cristianismo e umanismo. Il perdono dell'Occidente*. Siena: Cantagalli 2015.

Brambilla R, Serrelli E. *The goals and conditions of successful interdisciplinarity. Some critical guidelines in planning, managing and evaluating interdisciplinary projects.* Paradigmi 2016, in press.

Cantore E. *Scientific man: the humanistic significance of science.* ISH Publications 1977.

Caporael L, Griesemer J, Wimsatt W. *Developing scaffolding in evolution, cognition, and culture.* Cambridge, MA: MIT Press 2013.

Capra F, Luisi P. *Vita e Natura. Una visione sistemica.* Sansepolcro: Aboca 2014.

Ceccarini I, Palla PG. *Valori universali*. In: Ceccarini I, Palla PG (Eds.). *Perché l'Università. Riflessioni sull'etica del sapere.* Città di Castello: Edimond 2007.

Dupre J. *The disorder of things: metaphysical foundations of the disunity of science.* Cambridge, MA: Harvard University Press 1993.

Gilbert SF, Epel D. *Ecological developmental biology*. Sunderland, MA: Sinauer Associates 2009.

Giuliani A, Bartolini E, Bertolaso M. *L'humus della scienza: per una necessaria riscoperta della meraviglia e della cooperazione nella ricerca scientifica*. Scienze e Ricerche 2016;28:5-8.

Humboldt W. *Università e umanità*. Napoli: Guida Editori 1970.

Jaspers K. *Die Idee der Universität*. Berlin: Springer 1965. Traduzione inglese: Owen P (Ed.). *The idea of the university*.

Johannidis GPA. *Exposure-wide epidemiology: revisiting Bradford Hill-24th.* Bradford Hill Memorial Lecture, School of Hygiene & Tropical Medicine 2015.

Laland KN, Brown GR. *Niche construction, human behaviour and the adaptive lag hypothesis*. Evol Anthropol 2006;15:95-104.

Lionelli S. *Data-intensive research.* In: Dubitzky W, Wolkenhauer O, Cho KH, et al (Eds.). *Encyclopaedia of System Biology*. Berlin: Springer 2013.

Lodovici ES. *Il gusto del sapere*. In: Ceccarini I, Palla PG (Eds.). *Perché l'Università. Riflessioni sull'etica del sapere*. Città di Castello: Edimond 2007.

Lorenzelli V. *L'università per un nuovo umanesimo.* Roma: Univ Edizioni 2003.

Mayor F. *L'università universale*. In: Ceccarini I, Palla PG (Eds.). *Perché l'Università. Riflessioni sull'etica del sapere.* Città di Castello: Edimond 2007.

Meyer G, Sandøe P. *Going public: good scientific conduct*. Science Engineering Ethics 2012;18:173-97.

Newman JH. *Scritti sull'Università*. Milano: Bompiani 2008.

Odling-Smee FJ, Laland KN, Feldman MW. *Niche construction. The neglected process in evolution*. Princeton: Princeton University Press 2003.

Ortega y Gasset J. *La missione dell'università*. Napoli: Guida Editori 1991.

Paoletti L. *Allargare lo sguardo: un obiettivo e un metodo*. Paradoxa 2010;4:8-11.

Polanyi M. *Conoscere ed essere*. Roma: Armando 1961.

Ramellini P. *Ecologia umana.* Studia Bioethica 2015;8:5-15.

Tanzella-Nitti G. *Passione per la verità e responsabilità del sapere. Un'idea di Università nel magistero di Giovanni Paolo II*. Roma: Piemme 1998.

Tosi P. *Università oltre le nazioni*. In: Ceccarini I, Palla PG (Eds.). *Perché l'Università. Riflessioni sull'etica del sapere.* Città di Castello: Edimond 2007.

Waddington C. *Tools for thought*. London: J Cape 1977.