Science, technology, and solidarity: the emergence of a free culture for the future¹

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*Received: August 18, 2020. Revised: September 5, 2020.
Accepted: December 14, 2020. Published: March 5, 2021*

How to cite this article: Reina-Rozo, J. D., Medina-Cardona, L. F. (2021). Science, technology, and solidarity: the emergence of a free culture for the future. International Journal of Engineering, Social Justice and Peace, v. 8, n. 1, p. 86-104. 10.24908/ijesjp.v8i1.14279.

Science and technology are changing. We have seen the emergence of open and citizen-based science practices in the context of facing pandemics, such as COVID-19, xenophobia, or inequality, among others. Open science is a movement that advocates the collective construction of knowledge. This perspective has shown its importance with the emergence of rapid response initiatives to the current situation at national and international levels. This article discusses the relevance of knowledge commons and transparent objects in the era of intellectual property. Solidarity technoscientific initiatives become a vehicle to pose free culture as a pillar of a human future based on mutual support. In that sense, universities, publishers, students, the scientific and engineering community, and even citizens are creating efforts around open science intending to share results, data, designs, specifications, and even resources despite new socio-political limits and precautions. We argue that a technoscientific movement based on solidarity, free and open culture, is key to permeate and transform the various layers of governments, research institutions, and citizens-led initiatives. To address this, several examples are exposed offering a brief critical appraisal in the context of open science, a concept still in the making.

Key Words: Solidarity technoscience; Free Culture; Open Science; OpenGLAM; Futures.

INTRODUCTION

Science and technology are not the same today when compared with a past in which knowledge was distilled in a top-down fashion. The relation between the so-called scientists, media, and civil society has changed dramatically. New questions, processes, and actors are emerging in the technoscience scene, where collaboration and transparentness have been situated at the center of public demand for scientific work. We have seen the emergence of an open and citizen-based science in the context of facing pandemics, such as COVID-19; xenophobia, or inequality, among others. Open science (OS) is a movement that advocates the collective construction of knowledge and the promotion of diverse actions such as open access to academic publications as well as open scientific data and the development of more participatory scientific and technological activities (Lafuente, 2020).

This open perspective is showing its importance with the emergence of rapid response initiatives to the current situation at national and international levels (Hensher et al., 2020), despite its limits and precautions (Koerber, 2021). The latter becomes more evident in the case of OS adoption by institutions amidst socio-political tensions and disruptions (Smart et al., 2019). This illustrates a gap between institutional understandings of OS, the growing interest around it and the solidarity practices led by scientists, engineers, and free culture enthusiasts across the globe.

The number of solidarity initiatives based on mutual aid is rising globally, particularly through supportive activities towards other people without expecting a reward, but rather from instinctive feelings of solidarity aimed to strengthen the social fabric. Universities, publishers, students, the scientific and engineering community, and even citizens are creating efforts around open science to share results, data, designs, specifications, and even resources (Chan et al, 2019). We see a solidarity science movement based on a free and open culture permeating various layers of governments, research institutions, and citizens-led initiatives. Recently, a conceptual framework for solidarity technoscience was presented by Dagnino (2019a).

In particular, Colombia has also shown signs of engagement in this global trend, with different stakeholders encouraging data sharing, more open research about public health and Covid-19, and fostering new spaces for active participation of civil society in technoscience. For example, in the first semester of 2020 the Colombian Science and Technology Ministry (MinCiencias) led the “Mincienciatón” initiative, a hackathon-like effort promoting collaboration among researchers. As a result, public universities, such as Universidad de Antioquia, have generated open prototypes of low-cost mechanical ventilators.

Similarly, citizens who are enthusiastic about science and distributed manufacturing (maker movement) have organized themselves into collective processes to create quick solutions that are easy to implement and, above all, open for anyone to replicate (Kera, 2017). This is what OS is like: it promotes historical and ethical principles of science such as communication, replicability, and solidarity among people. It also responds to new interconnected dynamics, creating a

collective space for discussion where the exercise of knowledge becomes more horizontal and concerns us all.

The Universidad Nacional de Colombia (National University of Colombia) has also explored open science, although in a fragmented way. One of the recent efforts in this direction was the Latin American Conference on Open Access, Open Data and Open Education –OpenCon Latam 2019– which brought together academics, activists, librarians, students, and civil society from several countries in the region to discuss open science under the precepts of the "Panama Declaration". As a result of this event, a representative of the University's teaching community was invited to participate in the open science panel at the World Science Day for Peace and Development, held at the UNESCO headquarters in Paris in November 2019, which paved the way for the UNESCO Draft Recommendation on Open Science (2020).

The same year saw a different initiative emerged at National University towards the same direction: the International Conference on Engineering, Social Justice and Peace, which was proposed as a scenario for dialogue about the relationship between technology and collective welfare, just at a time when a global reflection on copyright, patents, dissemination of knowledge and their sociopolitical implications was taking place. Finally, the National University's past efforts and experiences in the area of open access have also laid fundamental blocks for this type of work. . Some of these include the Editorial Center of the School of Human Sciences and its experience with the publication of open access books and, more generally, the National Library System and its support for the institutional repository and open access digital academic journals.

Open science is also a manifestation of a broader movement that combines techno-political, philosophical, and creative positions brought about by new technologies, especially the Internet (Bartling & Friesike, 2014). Open science seeks, albeit in a heterogeneous manner, to use them for more participatory access to culture in general. In this sense, open science is part of free culture, which not only raises these questions from the scientific exercise but also artistic creations and citizen expressions. An example of this is the OpenGLAM movement, which is concerned with issues similar to open science from the point of view of galleries, libraries, archives, and museums (summarized in the acronym GLAM), that is, for a more equitable enjoyment of cultural artifacts.

The current status of COVID-19 shows that this free culture goes far beyond open access to scientific publications and data, and highlights artistic creation related to science and technology as critical to social well-being. Think of the vast amount of audiovisual resources (music and films), books, collections, and others that are being released to provide alternatives during the quarantine. With this in mind, this article has the objective of discussing open science and broader free culture tenets under the light of the COVID-19 emergency, global south perspectives, and the lens of solidarity. Despite the advantages of these concepts, some intellectual property excesses are named as an obstacle for broader adoption of deeper OS practices. The structure of the text is fragmentary, reflecting that open science is still in

construction without a globally accepted definition and highlighting the richness of the examples and outcomes.

KNOWLEDGE COMMONS IN AN ERA OF EPISTEMIC INTELLECTUAL PROPERTY

The current situation of epistemic inequality has pointed out some structural problems in scientific and technological practice. These are part of the critics addressed by open science. Specifically, the COVID-19 pandemic has generated several initiatives around the world from which a series of tensions arise related to copyright and the patenting of certain key elements for the treatment of this disease and immunization against it. Knowledge commons is a complex epistemic ecosystem simplified in resources shared by a group of people that is subject to social dilemmas (Hess, 2012), based on a socio-technical ecosystem (Escaño, 2017).

The literature has shown that the understanding of knowledge commons in the Global South is limited, in particular those related to local and indigenous knowledge (Hess, 2012). Despite the observation of Hess, there are emerging discussions about knowledge commons, citizen-scientific practices, and public policy design in Latin America, particularly in Brazil (Albagli, Clinio, Parra and Fonseca, 2018) and Ecuador (Vila-Viñas & Barandiaran, 2015).

To illustrate, consider one of the known cases of tension over intellectual property in the pandemic context: the Venturi's valve, created by an Italian biomedical company (Tino et al, 2020). Since this company did not agree to collaborate with the design and manufacture of valves for mechanical ventilators that are essential in this medical emergency, its design was used by groups of makers to manufacture different biomedical equipment in a distributed way, thus placing themselves at risk of future lawsuits.

This example is key in the scenario of establishing amendments to copyright laws for periods of emergency, which is a starting point for a necessary and deep discussion of copyright policy worldwide. Especially in a crisis scenario, liberating scientific and technological discoveries is not only needed but also an imperative for academics and practitioners around the world working towards a global social justice agenda. In this context, some governments have proposed a COVID-19 technologies access pool, especially around sharing knowledge, intellectual property, and data. The international solidarity calls for action intend to make the response to COVID-19 a public common good, but there are resistances from countries from the Global North to allow for this knowledge pool.

The public domain must be the goal for an open science movement in the perspective of Hess's and Ostrom's knowledge commons practice (Hess & Ostrom, 2007). In this way, the Open and Collaborative Science for Development Network (OCSDNet) has published the manifesto for open and collaborative science (2015), which reflects that there is no one right way to do open

science. It requires constant negotiation and attention to context. OCSDnet has identified seven values and principles at the core of the practice for a more inclusive open science:

- a) it enables a knowledge commons where every individual has the means to decide how their knowledge is governed and managed to address their needs,
- b) it recognizes cognitive justice, the need for diverse understandings of knowledge making to co-exist in scientific production,
- c) it practices situated openness by addressing the ways in which context, power, and inequality condition scientific research,
- d) it advocates for every individual's right to research and enables different forms of participation at all stages of the research process,
- e) it fosters equitable collaboration between scientists and social actors and cultivates co-creation and social innovation in society,
- f) it incentivizes inclusive infrastructures that empower people of all abilities to make, and use accessible open-source technologies, and finally,
- g) it strives to use knowledge as a pathway to sustainable development, equipping every individual to improve the well-being of our society and planet (OCSDNet, 2015).

Meanwhile, in Panama City, alongside the CILAC Forum (Latinamerican and Caribbean Open Forum for Science) carried out in 2018, the Open Science Panama Declaration was proposed (Karisma, 2018). This declaration promotes science as the core of democracy, freedom, and social justice at the present historical moment. It has two main components, as follows: first, essential elements for open scientific practice—open access, open data, open education, citizen science, open research, reproducible and replicable, open evaluation and open peer review, open tools, and free software, and hardware policies, open infrastructures, open-source innovation, free licensing, equitable access to biological research material. And second, public policy strategies for the implementation of open science.

Arza and Fressolli (2017, p. 465-467) have pointed out the main benefits associated with open science from the knowledge commons perspective. First, it improves scientific efficiency through the broader availability of knowledge resources and more vibrant collaboration among heterogeneous knowledge actors. Second, it improves the democratization of scientific knowledge, by making scientific resources more accessible, enabling the participation of a wider community in the research process, shaping science better understandable for a more extensive population. Finally, it improves research capacity to attend to societal needs, supporting the visibility of local problems, promoting community participation in scientific and research agendas, while the open availability of scientific resources deters private appropriation of such resources.

TRANSPARENT SCIENCE, TECHNOLOGY, AND CULTURE: SOME EXPERIENCES

The hegemonic economic model has mediated science, technology, and culture as social processes in the last century, shaping the relationship between society and knowledge. The idea around closing knowledge through patents, industrial secrets, and copyrights, in general, is problematic to the need of fostering a deep dialogue between diverse forms of knowledge and understandings. From the Nonaka and Konno systems of knowledge creation point of view (1998), there are two ways to construct and experience knowledge. On the one hand, the explicit knowledge of academia and formal research institutions can be expressed in words and numbers and shared as specifications, data, and scientific formulae. On the other hand, tacit knowledge is highly personal and collectively held, mainly as oral traditions and rituals. This kind of knowledge is deeply rooted in individual and collective experiences as well as in the emotions, ideals and values shared.

Both types of knowledge must be understood in their relationships, especially the potentialities of this synergy on the places where they are materialized, from the lens of solidarity technoscience (Dagnino, 2019a, 2019b) and its engineering praxes (Reina-Rozo, 2020). Cultural artifacts that contribute to our knowledge of the A One of the practices towards the pluriverse of tacit knowledges in Amazon indigenous communities in Colombia have been created with special attention to the process of production. The book “He yaia godo ~ bakari” (ACAIPI, 2012) is the result of a ten years process of knowledge systematization with Yurupari river communities (Vaupés Department, Colombia). And in the book “Curación como Tecnología”, Bárbara Santos (2019) explores the deep relationship between technologies and ancestrality through conversations with indigenous leaders. In this case, Santos and some colleagues started a path to make these types of knowledge more accessible and understandable.

Likewise, how can we make the processes of techno-science and culture more accessible to our territories and societies? One response to this question is the idea of *transparent objects*, suggested by Arvatov in 1925. In order to understand this concept we need to recognize technology as one representation of “material culture”. Arvatov (1997) states that “*from the point of view of material culture, any machine represents both a technical, productive way and an everyday, consumer object*” (p. 120). In this sense, Arvatov suggests that “the mechanism of a thing, the connection between the elements of a thing and its purpose, were now transparent, compelling people practically, and thus also psychologically, to reckon with them, and only with them” (p. 126). Also, through her analysis of Arvatov’s work on transparent objects Kiaer (1997) manifests that those objects “*will produce new ... experiences of everyday life*” (p. 105), allowing people to use them “*in everyday life as by making them in the sphere of production*” (Kiaer, 1997, p. 105). For a better understanding, we share an example of making objects (technologies in this case) more transparent in times of crisis.

After the fall of the Soviet Union, while the unjust sanctions imposed on Cuba by the United States were maintained, the island experienced what was called the “Special Period in Times of

Peace", which referenced the economic crisis that arose at that time. During this time, the Cuban State published "*El Libro de la Familia*" (Verde Olivo, 1991) through the island's army publishing house. This was a compendium of explicit knowledge, that is, technical knowledge about engineering, medicine, agriculture, nutrition, and defense, among other areas (Marques & Cobbe, 2020). The book included techniques that could be applied by civil society in their daily lives to provide themselves with food, shelter, and technical services. This effort was led by the Cuban army, and it additionally involved the participation of institutions such as the Education Development Research Centre, the Ministry of Education, the University of Havana, the "El Piñón" Bicycle Repair Workshop, the Scientific-Technical Information Centre of the Ministry of Light Industry, and the Defense Information Centre of the Revolutionary Armed Forces. The resulting 430-page volume was essentially oriented towards knowledge focused on the family garden and its animals, human nutrition, first aid and acupressure, phytotherapy, do-it-yourself approaches, and population protection and survival. Image 1 shows the cover of the book and one from about 300 transparent science and technology practices, which is oriented to beekeeping as a food alternative.

Image 1. Front page of *El libro de la Familia* and some images. Source: Verde Olivo (1991).

The book "*Con Nuestros Propios Esfuerzos*" (Verde Olivo, 1992) was published the following year with the support of the provincial and municipal party committees. It included contributions from hundreds of people throughout the island. According to the presentation, the book "gathers in its pages some of the experiences developed in the country to face the special period in time of peace" (p. 11). Thus, it is composed of 300 pages where more than 900 experiences represent the empirical knowledge of men and women in transparent techno-science. This publication is divided into fourteen sections dealing with topics such as agricultural cultivation, animal husbandry, food, public health, transport, household items, services to the population, housing

and building materials, energy, culture and sport, teaching aids, toys and crafts, defense and, finally, other experiences. In particular, the last section features an experience called "development of the science and the technique in Las Tunas" (p. 264) describing actions such as the creation of the Municipal Scientific Popular Council, which included 30 multidisciplinary groups and 12 research areas.

Image 2. Front page of “Con Nuestros Propios Esfuerzos”. Source: Verde Olivo (1992)

Based on the practices of transparent knowledge in Arvatov's sense, Ernesto Oroza—a Cuban designer—formulated the concept of "technological disobedience" to describe and analyze techno-political practices in two ways: first, to alter the dynamics of production and consumption driven by neoliberalism; second, to motivate the elaboration and re-appropriation of artifacts that are already considered obsolete (Oroza, 2012). Nevertheless, Sklodowska in her text “Invent, then Resist” (2016), analyzes from a linguistic perspective the books of Verde Oliva, especially the chapters focused on food and gastronomy, and she ends up offering a critical perspective about the technological disobedience concept.

OPEN EFFORTS TOWARDS SOLIDARITY TECHNO-SCIENTIFIC PRACTICES IN THE CONTEXT OF HUMAN HEALTH

The role of transparent science and technology has been discussed strongly in the COVID-19 pandemic and the discussion has focused on two main elements: vaccine(s) and treatment(s). On the one hand, the vaccine is becoming one of the most desired developments of scientific inquiry in contemporary history. On the other hand, the World Health Organization has launched the international clinical trial “Solidarity” to help find an effective treatment for COVID-19. Now,

we see pharmaceutical corporations, research universities and states negotiating the future of people. Each day, the media is a platform for geopolitical competition and its implications on international stock exchanges. Nevertheless, it is not common to be able to find transparent and collaboratively vaccine projects against the control of the knowledge and tools.

Regarding this issue, we must remember two initiatives of open and transparent vaccines in the last century. The first one is the Polio vaccine, discovered by Dr. Jonas Salk, then tested in 1952 and finally released on April 12, 1955. As Smith (1990) describes, it was possible to successfully develop, test and deploy a polio vaccine, going from a small laboratory experiment to the first and largest national vaccination campaign in the US. The process to open and disseminate the vaccine was a breakout point in public health and pharmaceutical research, due to the opposition to patenting and profiting off the discovery. In a tape from 1955, a statement from Dr. Salk made clear the desired future of science and technology, when he was asked about the ownership of the patent, he answered: “Well, the people, I would say. There is no patent”, and then asked, “Could you patent the sun?” (The New York Times, 2016, 1:58).

Image 3. Dr Jonas Salk and his Polio vaccine. Source: Smithsonian (Karsh, 1956).

The second initiative of open processes of vaccine discovery and dissemination is the experience of the Influenza vaccine. Kapczynski (2017) analyzed the knowledge production process of the global influenza virus-sharing network that for decades has produced critically important improvements in the search for a vaccine. The author studied the network as an emerging case of “IP without IP” based on the open science movement. However, this is not a recent effort to rethink medical discoveries and their relationship with society through public policy. Stiglitz & Jayadev (2010) look at four different sorts of policies that may be used to address some of the inadequacies of intellectual property regimes related to pharmaceutical drug discoveries. Adding to the latter, Baker, Jayadev, & Stiglitz (2017) suggested to revisit the relationship between development, intellectual property and innovation and the pathologies of the current IP system, especially in pandemic times (Stiglitz, Jayadev, & Prabhala, 2020). Finally, the project Free the

Vaccine (<https://freethelvaccine.org/>) has gained momentum in this time of privatization of every dimension of our lives, when it becomes more evident that science must serve people's needs.

Image 4. A makerspace printing PPE in Colombia. Source: Escuela de Robótica del Chocó.

As tensions rise, opportunities emerge more strongly at the global level with the aim of generating alternatives to counteract the effects of this situation. Every day there is evidence of the development of free or open source technologies, such as mechanical ventilators, tests to detect COVID-19, masks made by 3D printers and protective visors (See image 4). As a local example of this trend, we look at “Escuela de Robótica del Chocó”. Located in one of the poorest regions of Colombia, its purpose is to bring together children and technology with a social innovation rationale. Using a donated 3D printer, the maker space of the “escuela” was able to print PPE (personal protective equipment) face masks—an important achievement considering the scarcity of medical supplies in the region.

This shows how affinity groups can be created based on the need for open source medical supplies against COVID-19. Additionally, civil society has also been present in the generation of citizen initiatives, such as "hackathons", distributed citizen laboratories, distributed fabrication of PPE, citizen diagnostics, networks of mutual aid and neighborhood solidarity. One of those collective action initiatives was the Frena La Curva platform (<https://frenalacurva.net/>), which impacted the Iberoamerican region with more than 140 projects in 22 countries and 800 citizens collaborating in the online community.

Similarly, some emerging initiatives are related to the creation and use of online video games to find treatments to diseases, including Eterna (<https://eternagame.org/>) and Foldit (<https://fold.it>). Foldit is a citizen science tool that challenges participants to edit proteins to make them more stable and thus find a treatment for COVID-19. Hence, the relationship between creation and open science shows us the integral and participative vision that this free culture seeks.

These and other experiences create a hopeful space from the contributions that scientists, technology enthusiasts and citizens are making in a collaborative and open way. However, many of them are emerging in the global north. From this point of view, the question arises: Are we, in the global south, prepared to take advantage of this opportunity for open, citizen-based science to address not only this pandemic, but also the most pressing problems of our societies? This question is relevant in light of the inequality that prevails in many of our countries, particularly in terms of access to the Internet, as one of the tools for accessing knowledge, science and technology. Here, the role of education institutions as universities is key.

Universities must be leaders in the creation of institutional policies for open science and free culture in order to fulfill its mission of being the scientific, cultural and collective project of the society. It would be fundamental for the university to consolidate open science as a tool for making knowledge and research fundamental human rights (Appadurai, 2006), which must be defended beyond the current pandemic and economic model with a view to seek collective well-being. One of the leading practices in academia is scientific communication, particularly journals. Some of them are starting to use Creative Commons Licences, others are centering their focus on open processes such as the Journal of Open Engineering (<https://www.tjoe.org/>), the Journal of Open Source Software (<https://joss.theoj.org/>), and the Journal of Open Hardware (<https://openhware.metajnl.com/>). There are even efforts to share pre-prints in the engineering world as the Engineering Arxiv (<https://engrxiv.org>), and more structurally, in terms of open publish process, the Pubpub Community (<https://www.pubpub.org>).

FOR A FREE TECHNE: RECOVERING HOLISM THROUGH ART, SCIENCE AND TECHNOLOGY

Until this moment we have advocated for open science in particular and free culture in general to underscore the importance of collaboration and solidarity in facing future challenges. And although the terms "open" and "free" appear to be directly shaped by some premises of the free and open source software movement, in fact, they offer a reinvigoration of an alleged original spirit of science endeavors back in the XVI centuries, when western modern science was born. Principles as reproducibility, fallibility and communication demand an active community of peers eager to share their findings. Having that in mind, the current state of affairs in which science practices are embedded within a neoliberal economic pursuit mindset can be traced back to the XIX century when rationalism was triumphant.

Shortly, two outcomes can be attributed to such turn: the insistence on the rationalism fallacy of binding knowledge exclusively for the exercise of rational thought (Fores, 1979) and a subordination of technology to science, in the form of applied science. It should be noted that such an approach not only ignores the practical knowledge present in craft and engineering traditions, but it also establishes a rationalist hegemony in which other forms of knowledge are

discarded. From these general observations stems a clear dictum: the articulation of open practices in science and culture must be extrapolated to embrace open dialog among disciplines, different forms of knowledge (scientific, sensorial, affective epistemologies), and different ways of conceiving the world—different ontologies.

The current trend of interactions between art, science and technology can be named as an example of the latter statement. Briefly, it points out to the current interest and funding of projects where the three disciplines intersect. Clearly, this tendency can be read as a manifestation of a post-modern shift from disciplinarity to multi or transdisciplinarity, recalling a famous similar suggestion made in "The two cultures" by C.P. Snow (Snow & Collini, 2014). In that text, the breakdown between science and humanities was deemed as an obstacle for solving the world's problems (Grover et. al 2011, p. 8).

Historically speaking, the industrial revolution and its division of labor is connected to this gap, which nonetheless finds prominent counterexamples in popular figures such as Leonardo Davinci or Alexander Von Humboldt, whose experiments and explorations combined art, science and technology. From an epistemological perspective art has acquired a sort of inferior position compared to science from the rationalist perspective. This understates art as a valid form of knowledge and in fact disesteems the value of sensible and practical methods, which indeed, have influenced science with methodological plurality whenever science has been in crisis (Weibel, 2007, p. 20). For this reason, the collaboration between these disciplines encourages the re-assessment of the term *techne* from its original meaning. Opposed to Aristotle's *episteme*, *techne* signified "Art" for the ancient Greeks, but etymologically, it is bound to the origin of technology, exhibiting an old and often forgotten intertwining between disciplines.

The previous paragraphs offer a plausible conclusion: that open science and free culture, open arts—so to speak—must be included in a new form of thought for the future. From that, it should be no surprise that several practitioners, movements, collectives and schools from the arts' realm, have noted such relationships, covering several aspects such as intellectual property, methodological freedom and use of open technologies. To name a few cases, the celebrated International Situationism magazine published in the 1950s, already included a note allowing further use, copy and adaptation in a gesture that predates the present open licensing schemes (Cramer 2013, p. 25). Similarly, focusing on an analog network quality, in 1967 the Underground Press Syndicate was founded, which gathered alternative press initiatives and designed a common repository of printed media which every member could use freely, as long as they accepted this free flow of information (Ludovico 2013, p. 42).

More recently, and displaying a strong latinamerican rationale, projects such as LabSurLab, emerged as summits in Medellín (2011) and Quito (2012) (See Image 4), as well as in the form of publications about the interaction between art, science and technology with an strong global South open ethos. LabSurlab is a good example of the potential of free collaboration between peers and disciplines, featuring DIY technologies workshops, technology sovereignty

discussions, and even ancestral knowledge contributions, all grouped under the concept of citizen laboratories, connecting directly to the citizen science layer of the open science movement (Jaramillo & Duque, 2012).

Image 5: Labsurlab Medellín 2011. Source: Jaramillo & Duque (2012)

FINAL REMARKS

Technology will not save us, but it is clearly a part of us. This complex statement implies that a critical assessment of techno-science is urgently needed regarding the emergence of a so-called "free culture". On the one hand, the dangers of the hegemonic rhetoric on technology, referring to the turbo-capitalist Californian ideology type, are already acknowledged; that is, techno-solutionism is widely applied in an asymmetric fashion. On the other hand, possible Neo-luddism must be ruled out, considering not only the potential of technology but also its significance to the human species.

To illustrate the first branch of the statement, STS tradition applied to a global south vision, has denounced the evident inequality in the form of imported solutions. As Chan put it, population and elites in the Global South perceive technology (particularly information technologies) as a solution transferred from the west "from a globally networked to a remotely disconnected" (2014, p. 184). Emerging experiences need more understanding and even "prototyping" as the Buen Conocer (well-knowing) project, carried out in Ecuador during the second decade of the XXI century. This process allowed ecuatorians to imagine other forms of techno-scientific practice and reflection, through an open, collaborative and participatory research lens rooted in the ontological adventure of Buen Vivir as a collective well-being pursuit (Barandiaran, X. E., Araya, D., & Vila-Viñas, D, 2015).

Similarly, in this text we have referred to some examples related to the maker culture. It is very common that the maker narrative is perceived through an optimism prism, a logical development of information technologies whose historical linearity obfuscates some comparable practices located outside the west that even predate the maker hype. In this sense, if not approached carefully, the maker culture appears as one of several techno-myths that do not embrace solidarity as a praxis. As a consequence, it can be said about these technologies that "their technological determinism, their assumption of the values of neoliberal capitalism and the various ways they may render Global South and non-Western perspectives invisible" (Baybrooke 2017, p. 26).

It can be added that in order to assess technology properly, we have to escape its instrumental vision in which it is deemed as a byproduct of science that works as means to an end. Precisely here it is convenient to recall the reading of technology made by the late Bernard Stiegler, who used the concept of originary technicity to understand technology as an exteriorization of our bodies in tools, artifacts, languages and memory devices. In that way, a strong bond between human and technology is stated as a defining force in our evolution (Stiegler 2008, p. 7). Recognizing these kinds of philosophical antecedents, a more fluent and diverse relationship with technology can be built, in which humanity and other beings are the priority, not instrumentality and techno-determinism. Another perspective worth mentioning is the work of Blindert & Garcia, (2020), that invites us to politicize technology—again—particularly through the social appropriation of radio and the fostering of this movement.

As an example of the complexity of the science, technology and society triad and its tensions, it can be said that new Big Data technologies reflect some of the problematic outcomes of techno-determinism. In its pursuit for obtaining valuable information by applying algorithms on large data sets, the big data approach can be interpreted as an accelerated development of rationalism. More precisely, and referring to Heidegger, as an instance of the idea that nature reveals itself through calculation and ordering (1977). As a consequence, this prevalence of number operations as indexes of phenomena excludes other forms of understanding and in fact, they are connected with economic power and the trend of calculability and indicators imposed by neoliberalism politics since the 1980s (Cardon 2018, p. 15).

Moreover, besides the problems of rationalism represented by calculation reductionism, other problematic premises lie behind Big Data. First of all, large data sets tend to privilege the quantity dimension, reducing the relevance of, for example, small data sets with good quality and fewer errors (Borgman 2015, 4). Second, the algorithmic operations, which often complement Big Data methodologies, are composed of obscure implementations that are covered by corporate secrecy defying transparency. In this form, the scientific and society agency at large is undermined considering that, as the current crisis shows us, data is paramount in informing public policy decisions. Finally, it has to be clarified that a critical appraisal of Big Data does not entail a rejection of the usefulness of computer driven calculation or a defense of an old and inconvenient quantitative-qualitative dualism. On the contrary, Big Data could be a valuable

knowledge instrument if it allows openness, transparency and accountability and if it is considered not as a panacea but as another instance of a diverse pool of technical and cultural resources to aid society.

The final call is to encourage openness of the free metaphors applied to several disciplines. Despite the fragmentary nature of this text, several examples of what we could name as a free and open imperative have been provided. Furthermore, it should be stressed that the quest for a better future entails a post-disciplinary dialog in which other valid forms of knowledge (arts, crafts, ancestral, among others) can also interact. In doing so, the observation of Layton (1974), who saw the scientist as a combination of abstract thinker and artisan, can be expanded to include other ways of knowing the world.

Here, diversity doesn't only apply to compartments of knowledge, but to different stakeholders (not only in academia), practices and methodologies. Additionally, the construct of the commons—which surpass the public/private oversimplification—provides a meeting place in which hybridization is the proper answer to many questions. Citizen initiatives such as the right to repair, to research and to produce, offer a balance against predominant corporate appraisals of science and technology, which have already shown signals of ideological exhaustion. As a consequence, a new social landscape requires the blossoming of new metaphors and strategies, which can turn the ivory towers of knowledge into open squares and *barrios* where equal citizens meet to create and discover together.

Despite the enormous potential of open science, we need to consider its limits and precautions: why does it not apply everywhere? The COVID-19 pandemic has made it possible to understand that scientific collaboration, openness in techno-scientific practices and the questioning of intellectual property for a free culture must be elements for continuing research in this area and applications at the institutional and governmental levels, which, until now, have been tangential.

NOTES

1. This is the third iteration of this text, based on a short note published by the School of Arts at Universidad Nacional de Colombia, and its corresponding public lecture. This manuscript contributes additional and more in depth content around context, cases and reflections.

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