CHAPTER 19

From MOOCs to MOORs: a Movement towards Humboldt 2.0

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INTRODUCTION

Massive Open Online Courses (MOOCs) have attracted a lot of attention in the academic world in general and presidents' offices more particularly. But some worry that this model of teaching is a step back to a vertical and unidirectional model of knowledge transmission and that it breaks down the Humboldtian contract of mutual enrichment between teaching and research.

In this article, we argue that, on the contrary, MOOCs offer an interesting opportunity to reconcile teaching and research.

THE RAPIDLY CHANGING ACADEMIC LANDSCAPE

2012 was famously baptized "Year of the MOOCs" by the *New York Times* (Pappano, 2012). Nevertheless, and despite some storytelling, MOOCs were not born out of nothing. Actually, they are just the tip of an iceberg of transformations that universities have been experiencing in recent decades.

We distinguish four external drivers to these transformations:

- **Demography**: Worldwide, the number of young people is larger than it has ever been in history, mathematically increasing the need for education and more specifically for higher education. At the same time, people live longer in good health and, at least in economically wealthy societies, old people are socially active and still seeking personal development, such as life-long learning.

- **Politics**: New Public Management policies have developed in many countries. In this context, universities are regaining a degree of autonomy that some had lost to governments and public authorities in the previous centuries. This new autonomy generally goes hand-in-hand with an increased demand for impact, performance measurement and accountability (Tolofari, 2005).
- **Economy**: First, the globalization of the economy has had impact on universities with an increase of mobility, of international collaborations, of competition. The academic playground has grown considerably. Second, many countries have seen an increase in their wealth and the development of a new middle class, eager to get more education. Particularly revealing is the case of China. Third, and maybe more importantly, the economy is more and more dependent on knowledge: "Knowledge is fast becoming the most important form of global capital" (Burton-Jones, 2001). Universities are impacted through their two core missions: teaching, as the economy needs more and more educated people; and research, as innovation is a key driver of growth.
- **Technology**: Computers have changed our ways of working, communicating, or doing research, to name but a few. More importantly, the advent of the Internet and tools like Wikipedia make entire libraries available at a mouse click and, more profoundly, modifies the role of the "experts". Professors are no longer the only source of information and today's "sage on the stage" needs to be more of a curator. Lastly, humanity produces more data in two days than it did from the birth of *homo sapiens* to the year 2003 (Lane, 2014).

This context has had a huge impact on the academic world. To highlight some of the most significant ones:

- **Massification**: The World number of students went from 0.5 to 100 million between 1900 and 2000 (Schofer & Meyer, 2005). It is expected to exceed 500 million by 2035 (Calderon, 2012). This means that a 30,000-student university has to be built every single day for 35 years to respond to this new demand. It also means that the geography and sociology of higher education are rapidly changing, moving from North-West to East and South, and from elite to mass to universal education (Trow, 2010). Of course, the expectations of this new student body are quite different from the ones of the few elite students of a century ago.

- **Online learning**: The increase of online learning happened before the birth of the MOOCs. Between 2000 and 2010, the percentage of U.S. students who took at least one online class jumped from 10% to 31% (Allen & Seaman, 2011). In this area, private for-profit universities have been particularly present. Hybrid- or blended-learning is more and more mainstream.
- **Continuing education**: In parallel with online learning, life-long learning has massively increased in the last 20 years. To take the example of the University of Geneva, the number of students enrolled in life-long learning programs or courses witnessed a 50-fold increase in two decades, before stabilizing.
- **Internationalization and competition for talent**: The advent of global university rankings in early 2000s shed light on competition among universities that is no longer national but of an international nature. Attracting the best students, researchers and professors is a key strategic issue (Wildavsky, 2012). International collaborations have continuously expanded and universities are looking beyond borders including, for example, through off-shore campuses.
- **Massification of research**: The number of scientists worldwide follows a continuous increase. Because science grows through debates among peers, this massification has, *de facto*, increased the specialization of scientists.
- **Economization of science**: Research funding has also evolved, implying more stakeholders, demanding greater accountability and, sometimes, greater and faster impact on society (Swiss Science and Technology Council, 2013; Stephan, 2012).

MOOCs are born from this context. They are not a tsunami or an avalanche. They are not a disruptive innovation brought by young challengers to oust fossilized old-timers. They are one among the many innovations that universities have adopted to face the multiplicity of challenges we just described.

Having said that, MOOCs contribute to changing the academic landscape.

WHAT MOOCS ARE ACCELERATING

The University of Geneva was among the first European universities to enter into partnership with Coursera. As such, we have witnessed a number of evolutions that MOOCs are accelerating:

- **Knowledge dissemination**: Knowledge dissemination is one of the core missions of universities. MOOCs allow reaching a very wide audience, geographically, culturally and socially diverse. Nowadays, most of the MOOC participants are not actual students but life-long learners. As such, it is a mistake to think of MOOCs as a replacement of traditional on-campus education.

- **Diversity**: Reaching large audiences, MOOCs allow the creation of two-way mentoring between people of different backgrounds who are following given courses. Hence, they can be an incubator and an accelerator for economic and social innovation. Well used, they can become an agent of empowerment and equity (Goldin & Katz, 2010).
- **Visibility**: MOOCs are a new tool in university branding. They are an open door in the classroom that permits the demonstration of competencies, excellence, high-profile topics to many stakeholders: prospective students, collaborating researchers, donors, public funders, alumni, collaborating industries, etc. They participate in the global competition we described.
- **Student selection**: If successful, a MOOC can be used not only to attract students but also the select the best ones.
- **Rebalancing teaching and research**: Research has long been the main, if not only, criteria for recruiting and promoting faculties. Providing a large visibility for teaching, MOOCs are rebalancing this status. Campuses are talking about teaching and learning as they had not for decades. This new focus on teaching is welcomed at a moment where public debate has accused universities of fooling their "customers", making them pay for star-scientists while being taught by adjunct faculty. Of course, MOOCs will create a new type of stars: teaching-stars, but universities are used to handling research-stars and should cope easily with this new challenge.
- **Teaching innovations**: MOOCs are also catalysing new ways to teach, and particularly collaborations between instructors. Just as research is nowadays a team adventure, teaching in a MOOC involves many people with different competencies. And, just like research, teaching in a MOOC can involve multiple institutions: universities, museums, media companies, experts… Following a mastery-learning philosophy, MOOCs bring also some new tools such as in-video quizzes or multiple peer-assessments. We expect to see a blossoming of interactive tools in the coming years.
- **Big data**: One domain where MOOCs can bring an important element to teaching innovations is pedagogical research. By collecting vast amounts of data on how student interact with pedagogical material, MOOCs allow improvements in efficiency. Currently, hundreds of A/B testing are being performed on the various platforms. By analysing conjunctly multiple variables, this efficiency increase will go hand-in-hand with a personalization of learning environments and learning material.

- **International collaborations**: The multiplicity of partners can extend beyond the creation of a single MOOC and partner universities can create common programs. These can be fully online or blended. For reasons of economic efficiency, the MOOCs constitute a tremendous incentive for institutional collaborations, in particular at the international level, mainly between the best universities in the world which will offer joint degrees.
- **Interdisciplinarity**: MOOCs are an efficient tool for interdisciplinary programs where students from diverse backgrounds need to get a mutual understanding of each other's domain.
- **Unbundling**: The ultimate personalization experience is a complete unbundling of higher education. Currently, campuses offer a package of services: teaching, mentoring, lab work, field work, remediation, access to libraries, sports, counseling, placement, internships, recreational and cultural activities, etc. All these activities can be offered by different institutions in different places, transforming each and every individual experience into a unique pathway. MOOCs participate in this trend by allowing classes to be taken remotely and by dividing knowledge into short learning modules. That said, a complete unbundling will be a nightmare for most students, lost in in too many offerings. Therefore universities will have to re-bundle parts of the student experience.

MOOCS AND RESEARCH

Beyond data on student behaviour collected for pedagogical research, some MOOCs have been used to collect research data in other domains. As an example, one of the instructors of Geneva's MOOC on International Organization Management asked volunteer students to send her short descriptions of Public Private partnerships, the central topic of her research. A hundred students sent her interesting case studies that she could use.

MOOC participants are also feeding research by providing feedback on new concepts, enriched by a broad cultural diversity and, very often, a good knowledge of practical situations where these concepts applies. This is epitomized by Duneier's testimonial on his sociology MOOC: "Within three weeks, I had more feedback on my sociological ideas than I'd had in my whole teaching career," he said. "I found that there's no topic so sensitive that it can't be discussed, civilly, in an international community." The online discussion forum spawned many global exchanges. Soon after Professor Duneier talked about social norms, using as his example the lack of public restrooms for street vendors — including an embedded video of New York vendors — students in

Hong Kong, India, Russia and elsewhere commented on the situation in their own cities. (Levin, 2012)

All these examples demonstrate that the arrival of MOOCs allowed the emergence of a new shape of research which would simply not be possible without this evolution creating what we may call Massive Open Online Research (MOOR).

But is there a way to better intertwine research and teaching in MOOCs? Answering this question requires first describing another movement, parallel to MOOCs, called Science 2.0.

SCIENCE 2.0

We have already evoked some of the transformations faced by science in the last decade. "Science 2.0" is one of them. According to the European Commission (European Commission, 2014), "'Science 2.0' describes the on-going evolution in the modus operandi of doing research and organizing science. These changes in the dynamics of science and research are enabled by digital technologies and driven by the globalization of the scientific community, as well as the increasing societal demand to address the Grand Challenges of our times. They have an impact on the entire research cycle, from the inception of research to its publication, as well as on the way in which this cycle is organized." Let us highlight some key domains impacted by this evolution.

First, new modes of knowledge communication arise. Preprints have long been the privilege of physicists, but are expanding to other disciplines. Scientific blogs emerged in the 2000s and continue to fuel the scientific debate. Social networks, either dedicated to scientists (ResearchGate, Mendeley…) or not (Facebook, Twitter, LinkedIn…) are being used by a vast majority of researchers (Van Noorden, 2014). So, if still dominant, the paper article in a scientific journal or conference proceeding is no longer the only way to communicate to peers or to a broader audience.

Second, a movement towards openness touches many aspects of science projects: open data, open notebooks, open codes, open access to publications… The aim of their promoters is to suppress the pay walls that prevent professionals, public bodies or laypersons from having access to the results of scientific research, vastly publicly-funded; as well as facilitating research in other laboratories or verification of published results. Although well in phase with the scientific ethos, this movement is slowed down by several issues, such as promotion practices, lack of incentives, privacy protection, and burden of data management.

Citizen science is a third expanding area. Popularizing science has always been an interesting but difficult issue. Making a non-professional audience fully engaged in the science process is even harder. Some domains like astronomy, botany or entomology, have a long tradition of amateurs collecting new data or species, but they remained an exception in the scientific field, largely restricted to professional researchers. Two projects have demonstrated that digital technologies can help close the gap between the 'main street' and the lab.

The first one is FoldIt. Researchers were facing the difficult task of folding proteins, i.e. finding their 3D structure based on their chemical composition and physical laws. The problem is too heavy to be solved by brute-force computers and too complex to rely on traditional optimization algorithms. With the assumption that human spatial reasoning was key to solve this type of problems, they invented a game called FoldIt where gamers competed to get the best possible 3D-shape for their molecules. The game was a big success and "players working collaboratively develop[ed] a rich assortment of new strategies and algorithms" (Cooper *et al.*, 2010).

Another example of citizen science is the Galaxy Zoo project that latter evolved into the Zooniverse platform (https://www.zooniverse.org). In Galaxy Zoo, volunteer participants where asked to classify different galaxies depending on their morphology. Today, more than a million people are active in dozens of crowdsourced scientific projects, ranging from astronomy to humanities. This activity demonstrates the willingness of many citizens to be part of research projects that they find useful or intellectually interesting. By intertwining learning and research, citizen science links MOOCs with MOORs, both of them improving each other's impact on society.

COMBINING MOOCS AND CITIZEN SCIENCE

Together with a local start-up (MMOS), the University of Geneva is currently starting a project that will integrate a citizen science platform and MOOCs. The expected outcome is to improve both research and teaching.

On the research side, while tasks have successfully been completed by citizen scientists in a variety of disciplines, the commonly used platforms suffer from one major drawback: they tend to be limited to simple curation and annotation tasks that can be performed without having to teach or learn specific skills. But MOOCs provide a teaching and learning environment where the specific skills needed to gather data, to address complex data curation and annotation tasks, or to optimize model parameters, can be learned. As a result, the scope of tasks that can be crowd-sourced into MOOCs will be significantly larger than the one addressed in the commonly used citizen science platforms. As an example, one can imagine that participants in the Geneva's MOOC "Adaptation to climate change" could select beaches that seem to present risk of erosion (step 1), then enter the characteristics of the selected beach in a computational platform that quantifies these risks (step 2), analyse if the computed output corresponds to an identify level of risk (step 3) and, lastly, propose an action plan to reduce risk (step 4). A later stage will team up participants to address even more complex problems.

On the teaching side, the project developed by the University of Geneva considers MOOC participants as research and innovation partners focusing on a shared given research challenge. This stands in stark contrast to most common MOOCs that only provide students with coursework assignments whose solutions do not contribute to scientific research or innovation and whose role is limited to assessing knowledge or skills. By engaging MOOC students with data processing tasks directly relevant to novel research projects or to global grand issues, this project will not only contribute to strengthen their data-driven skills, but also reinforce their intrinsic motivations to learn and discover. By strengthening these motivations, we hope to attract additional students as well as increase the number of active ones.

TOWARDS 'HUMBODLT 2.0'

Emerging from a post-war *tabula rasa*, the Humboldt's model of university was conceptualized in the early 19th century in Germany. It is articulated around three major principles (Renaut, 2006). First, the university is autonomous and free from external pressures, namely, the Church, the State and society. Second, it intertwines two domains that were previously separated: teaching and research. Third, it encompasses all knowledge but without the dominance of one discipline over another nor the dominance of teaching over research or vice-versa.

This model was particularly successful: Germany was a scientific powerhouse by the end of the century. It was a major inspiration of the new American universities and it remained an ideal throughout the 20th century. We could argue that the model was never fully implemented. In the same manner, the research norms, formalized by Robert K. Merton, are contradicted by the history of science (Anderson, 2010). Nevertheless, it is an ideal-type that greatly influenced the "idea of the university".

This model has been challenged many times in the recent decades. But we follow Robert Anderson in that "it is better to see the 'idea of the university' not as a fixed set of characteristics, but as a set of tensions, permanently present, but resolved differently according to time and place. Tensions between teaching and research, and between autonomy and accountability, most obviously. But also between universities' membership of an international scholarly community, and their role in shaping national cultures and forming national identity; between the transmission of established knowledge, and the search for original truth; between the inevitable connection of universities with the state and the centres of economic and social power, and the need to maintain critical distance; between reproducing the existing occupational structure, and renewing it from below by promoting social mobility; between serving the economy, and providing a space free from immediate utilitarian pressures; between teaching as the encouragement of open and critical attitudes, and society's expectation that universities will impart qualifications and skills. To come down too heavily on one side of these balances will usually mean that the aims of the university are being simplified and distorted."

Today, MOOCs and MOORs, through the mediation of Science 2.0, offer an opportunity to reinvent Humboldt's model once more, to resolve these tensions differently.

In MOOCs, collaborations in teaching as well as horizontal discussions among participants lead to "**teaching feeding teaching"**. In MOOCs, feedbacks from many cultures and practical experiences lead to "**teaching feeding research"**. With the opportunity to combine MOOCs and MOORs and in particular citizen science, we will experience "**hands-on research feeding teaching**" as well as a new degree of research improvement by trained "human computation". These cross-fertilizations, combined with the new equilibrium between teaching and research, make us believe that the Humboldtian university will embrace the digital revolution with success. Humboldt 2.0 is just around the corner.

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