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From Socrates to the On-Line University

"College is a place where the professor's lecture notes go straight to the students' lecture notes, without passing through the brains of either." – Mark Twain (attrib.)

Socrates did not like books. At least not for teaching ! He preferred a method we now call « the Socratic Method »: Through dialogues and discussions, his students used reasoned arguments on a subject in order to bring out the truth. Plato, his favorite disciple, violated his master's rule, however, by writing down "The Dialogues"; they became the foundation of modern Western thought. In the Middle Ages, the diffusion of knowledge by the means of books was a gradual process. In order to supply the libraries of Europe, manuscripts were copied one by one, notably by scribes in monasteries. After the (re-)invention of printing by Gutenberg, there was a transition in the diffusion of knowledge as hundreds or thousands of copies could be easily made. This wider diffusion facilitated the access to knowledge and led to the education of a larger part of the population. In universities, books became the sources and the documentation for courses, a tradition that continues today.

From the 15th to the 20th century, however, there was no major transformation in the process. For example, in Europe as late as the beginning of the 20th century, town criers still read the newspapers to the population ! The quantum jump in the circulation of information arrived with electronic media in the 20th century. But the effect on the world of education remained surprisingly limited, innovation was considered going from chalk on the black board to a laser pointer and Power Point slides. *Ex-cathedra* courses remain the norm, with the professor reigning as a master, presenting a monologue directed toward a room of hundreds of students. The documentation for courses evolved from individual sheets of paper to reference works, often standardized and, in particular in the Anglo-Saxon world, written by an authority in the field.

The seed of the next revolution was, as for many other domains, the invention of the World Wide Web in 1989. This was the veritable beginning of open access to knowledge: the success of the on-line encyclopedia, Wikipedia, is but one example. The effect on the world of education has taken time, but after 20 years, we finally see the revolution in motion.

This progress can be attributed to a series of technologies, such as on-line video, Skype or social networks. The true innovator of on-line teaching is probably Salman Khan. Beginning in 2006, in his free time, he taught mathematics to his cousins on the Internet by combining a palette of on-line tools currently available. Short videos of explanations written on a "tablet" and an attractive teaching technique are the ingredients of the success of the "Khan Academy". Since then, several thousands of videos, on diverse subjects, have been viewed nearly 200 million times. In 2011, a few American universities, among them Stanford University, started to give free, on-line courses, similar to those given on their respective campuses. The success was immediate, with hundreds of thousands of students signed up from all over the world.

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John Hennessey, the president of Stanford, speaks of a tsunami coming to the world of education, with uncertain consequences in the future.

In a purely Californian style, start-up companies are growing like weeds, offering dozens of courses given by professors from some of the most prestigious academic institutions. The courses are free and thousands of students have signed up. Their business model is not clear, but the numbers do not lie: the potential is there. A parallel initiative called edX, based on the model of non-profit foundations, is being developed by the Massachusetts Institute of Technology, Harvard University and University of California at Berkeley. Welcome to the world of Massive Open On-line Courses (MOOCs), a rather odd acronym for a system with a potential not to be underestimated.

Rather than passively letting the revolution pass by, EPFL has joined the movement. The first on-line course was on the Scala language, given by the computer science professor, Martin Odersky; it led to more than 50,000 registrations and 10'000 students actually completed the seven weeks of lessons and exercises. At EPFL, the initiative to give MOOC classes in French, especially for French-speaking Africa, has received support from the "Swiss agency for cooperation and development" (DDC); this is a challenge that the Californian start-ups will probably not meet.

Is all this really reasonable ? If so, then what happens with the courses on campus at EPFL ? Experience, even if rather recent, has shown that although the preparation for an on-line course is very laborious, it also improves the course given in the classroom. In addition, the professor can then concentrate on the high quality interaction he/she can conduct in person with the students, while putting on-line the background information that forms the basis of the course. According to the students at EPFL, and elsewhere, this is the most effective way to learn the material; and perhaps a more natural method for students who already spend a substantial amount of their time on the Web.

One of the most interesting possibilities is to divide the course into "elementary units", very small in size (typically videos of 10-15 minutes), with a possibility of verifying the student's comprehension via well-targeted questions. Thus, both the student and the professor can ameliorate their command of the material. The students can verify step-by-step their comprehension. Then based on the statistics of thousands of students' responses, the professor can ascertain if his method is well-adapted. Compare this with the *ex-cathedra* courses given to several hundreds of students in a packed auditorium: The professor professes and the student attempts to keep up: there is little exchange between the student and the professor, except, of course, at the end of the semester when the grade is delivered ! And as paradoxical as it might seem, teaching thousands of students on-line is potentially more personalized because the students can give feedback, thus providing better results than the traditional course given in an auditorium. Another possibility consists in using forums that can be organized around courses on line. In view of the large number of students, the discussion platforms are very active. If a student is lost and

asks a question, he/she only need wait a few minutes before someone sends advice, and this goes on 24 hours a day.

The educational results have yet to be analyzed, and understanding them will take time. Nevertheless, it is already clear that for quantitative subjects, it will be possible to closely follow the progress of a student, thus giving him/her access to targeted information and improving his/her comprehension with a level of detail unmatched today.

But we should not be deceived. All this still does not replace small classes, where questions flow freely, and the professor develops his material according to the interaction he experiences with his audience; where, together, the students can discover the subject and the professor can explore it further.

Nor should we underestimate the risks related to the segmentation of the material to be taught. Grand philosophical questions cannot necessarily be separated into elementary parts. The learning process for algebra or computer programming does not necessarily extend to that of all subjects. The tendency towards productivity in all domains, as in the assembly line à la Henry Ford, will probably reach its limits when we decide to educate humans rather than workers. And anyone who has seen the excellent documentary, "Etre ou Avoir", about an elementary school (in Auvergne, France) with only one class of students of mixed ages, will know that we can never replace the teacher by YouTube!

Let's return to the subject of MOOCs, who are making headlines, and look into the crystal ball. The prediction is that the on-line course will replace the textbook, which also means that on a given subject there will only be a few dominant courses. The course in itself will evolve to become a collection of elements of information at the student's disposal, which when combined will provide a new educational experience. This will take place via the electronic tablet, with interactive exercises, on-line experiments, etc. Then the world of education, as with many domains, will be divided into the "for profit" enterprises that seek to develop a market (e.g., as publishing houses did for textbooks) and the "non-profit" institutions that will participate – at least in part – for the well-being of humanity. If we take Wikipedia as an indication, maybe the humanists will win against the merchants !

What would Socrates say about this evolution ? Indeed, the teacher will be able to concentrate on the essential elements of his activity with his students, in other words, hold interactive discussions and debates. A return, in a way, to the Socratic Method !