The World-class university as a research company

I have lived and worked in industry and know that special relationship between clients and suppliers: in order to maintain one’s clients, one must identify the product-market couples within which, assuming a well-controlled level of investment, one might become number one. That is, if one isn’t already. One must educate one’s suppliers so that they are not compromised in the drive for the desired level of performance at an acceptable cost. Finally, the business must be organized fractally, in teams on a human scale, each one dedicated to a project, whether this project be technological or systemic, no matter what the level of the project in the final system produced by the business, and without considering the internal or external nature of the suppliers and the clients of the partial project. Under these conditions, management (which is only one, particular view of the business as a whole) can, with respect to external circumstances, easily adapt the business’s form, products, markets, and careers—assuming that it has maintained an accurate understanding of the careers and talents of its personnel. For, such knowledge is essential in avoiding illusions and dead ends.

A world-class university would seem to me to be a business which participates in the advancement of knowledge. It does so on the two-fold register of the production of knowledge itself and of individuals capable of cultivating, adapting or transferring knowledge. The lab, in the Anglo-Saxon sense of the term, is the basic project of this business, welded for a limited time to a manager. The constant renewal of the team, and not only in the form of doctoral and post-doctoral students, is necessary for maintaining creativity. Drawing the metaphor out a little further, the markets are the established or emerging disciplines and the products are the concepts created for a particular market but which spawn new fields in other markets. Take for example Hilbert spaces or the Riemannian geometries of mathematicians, omnipresent in the most universally applied models of calculus, or the particle networks of statistical physicists which have found their place in statistics or in many theories of learning, or the concept of evolutionary genes or of viruses which have cut across the profound
separation between Biology and Computer Science. A world-class university must then, in its social body, use a kind of chemiotaxy to perceive the general thematic movement which is accessible while preserving its international status. It must also regulate the thematic mobility of the teams which produce the movement of the whole. That is to say, the indicators which must be followed are the size of the niches of excellence (which depend on the maturity of the areas of specialty), an equilibrium between the autonomy of the teams and a pressure for renewal and growth. A natural alternation is often desirable in which one goes back and forth between concentration on a given narrow objective and explorative adventure. It is perhaps a special bias of the most advance research in France to insist too much on the process of modeling in order to lay out the terrain to be explored before throwing oneself into the phase of experimentation. With such a tendency we risk the possibility of missing an opportunity in an emerging field which is still too fresh to allow for solid concepts. However, the question is: is this the sign of a research style (and of its researchers) who are too mathematical or rather, as law is determined by necessity, is it the mark of a research which is too poorly equipped.

A special model of undergraduate studies: the French touch and biodiversity

The university system tends to be divided into smaller units like undergraduate colleges, specialized professional universities, and research institutions which provide a graduate and doctoral education, and recruit their students—like their researchers—through a national or global competition. In France a branch of undergraduate studies is handled not by the universities but rather by the preparatory classes of the Grandes Écoles located in the high schools. The latter are the path of choice for “well-informed” families—one enters by submitting a school record while preparing the baccalaureate during the last year of high school (entry is conditional upon passing the baccalaureate with distinctions). Exceptions to local recruitment, which is otherwise the general rule for the university system, are more common for the preparatory schools because the hierarchy among these preparatory institutions is more clearly established and accepted (the national press regularly publishes the results of the national competitive exams). In particular there are migrations throughout the first three years of university towards more prestigious institutions in large cities and vice-versa.
As for entry into graduate studies, the current creation of a masters, according to the so-called “Bologna” system, is accompanied by a more coherent set of academic cursus than was previously in place. This process is further emphasized by the creation of large “Doctoral Colleges” consisting of doctoral institutions which gather students from scattered DEA-programs. In turn, it will certainly highlight the specificity of large universities of national importance (that is to say regional when speaking on the scale of Europe or China!). One can thus envisage an increased intermixing throughout France – a phenomenon which is relatively rare even if it is licit – and an extension of the intermixing on the scale of Europe, at least in the form of binational trajectories enhanced by regular international jamborees. The French university system would thus resemble the scientific Grandes Ecoles where passing from the first half to the second half of university through a national examination is not, in general, a selective process. Moreover the transition in university is determined according to thematic interests, rather than being a result of the tyranny of short-sighted rankings. It is thus an opportunity for a national intermixing tempered by groupings according to contents of the education (more or less emphasis on classical mathematics during the preparatory classes, mastery of languages, chemistry, or biology…).

At the École normale supérieure more so than in the other Grandes Écoles, the students who enter through the examination process which dates back 200 years, have a vast multidisciplinary education. However, each discipline is relatively traditional and includes a methodology which is very solid but which, at the same time, has not always integrated the most recent bibliographical tools. We dedicate the first year within the walls of our university, which is a final year of undergraduate studies, to the flourishing and discovery of a group of modern disciplines and of multidisciplinary questions. It is important to avoid a pre-fabricated path of graduate studies, regulated solely by an ignorance of the breakthroughs in current scientific fields and the choice of thesis subjects in areas which are perhaps useful but already saturated, which would mean that only true genius rather than simple excellence would suffice for securing a dominant role in the given domain. At the École normale supérieure, like in Centrale or Sciences Po for example, the students are given large opportunities of exposure to an appropriate (systemic) level of the study of natural systems and their interactions with human systems—this is outside of the philosophical systems to which they have had a relatively early exposure. These
remarks do not call into question the existence for some of the students of a quasi-monastic path for access into graduate studies. This results from an evolitional process and has thus important virtues which are laudable in these times when students are abandoning the fields of fundamental research and thus contributing to the weakening of the professoriate in the high schools. The introduction of biodiversity in recruitment, not only participates in the enlargement of the path for those who have followed the rules, but also the discovery of the method for those who have transgressed them.

However desirable, it would be unreasonable to assume that all students will realize the full diversity and expanse of the scientific or technological field at the same age, independently of social and local contexts. And yet this diversity is the necessary condition for a well-informed educational choice, as much for the benefit of the individual as for the collectivity. A first condition is that the student must overcome the false dichotomies which might deter him or her from a number of dynamic areas which are vital to the development of society: a taste for “soft” sciences and humanities as opposed to “hard” sciences, mathematical versus experimental talents, predisposition for fundamentals rather than for applied sciences…. In this vein, we have for instance a project between the École normale supérieure and the École centrale, to promote co-directed theses bringing together basic researchers and engineers. On the other hand, late bloomers create a different sort of intermixing, a more subtle mix of different maturities (and behind them of different social contexts) leading to a confrontation of different rewarding or foreboding experiences. Even more than regional intermixing, this mix is likely to produce cognitive sparks among students—or, the ‘exotic associations’ of which we will speak in a few moments.

On the scale of China or a Europe of 25 nations, regional intermixing is surely a form of cultural intermixing. Nonetheless, it is not certain that it will lead to cognitive short-circuits as powerful as those which take place in a transcontinental context. This is the policy we pursue at the Ecole normale supérieure, where in the place of a masters degree with a European-wide examination, we have introduced an “international selection.” We have an expressed ambition to put into place jointly directed theses and joint master’s cursus with a number of chosen countries (with China this is already in progress). An extensive process of exchange of senior researchers and post-docs is maintained through these theses. Universities, who have
a certain mastery over housing students and visitors, have more autonomy in this area, and thus a greater responsiveness to such a policy. While this is not generally the case in France, we at the ENS have the facilities to provide such services. We must thus continue to work to increase our hosting capacities.

**Education as Individuation: from encyclopedism to aesthetics**

*(or from recipes to assimilate to a garden to cultivate)*

Let us now turn towards some cognitive considerations related to the area of creativity—obviously a concern for world-class universities!—by quoting Gilbert Simondon, a French philosopher whose doctoral thesis was published in 196? under the title “On the Proper Use of Technical Objects”:

“An encyclopedic technical education aims at giving an adult the feeling that he is a complete being…the image of an individual man in his state of real maturity…And yet there remains something abstract in an encyclopedic education, an uncontrollable lack of universality…It leaves behind the temporal, successive, quantum character of the discoveries which brought us to the current state…Encyclopedism, exclusive of historicity, provides man with the possession of a false entelechy, because this step is still rich with virtual elements. There is no determinism which guides the invention…What the autodidact is missing is the process of having been brought up, that is, having become an adult progressively through a series of temporal developments structured by crises” Following the ideas of Simondon, I propose to use the passage from the encyclopedic compiling of knowledge to the aesthetic adventure not from the perspective of the production of an object (from the abstract to the concrete), but rather from the point of view of the production of the subject (individuation).

The ingredient which is essential to individuation, comparable in principle and in its aim to the random recomposition of genetic inheritance in the process of sexual reproduction, would be the total autonomy of the individual as it is ensured by the randomness which guides mental processes and “exotic” decisions and the evolution of a “mental garden” - that garden which draws its topology from a mysterious proximity between types which are totally foreign to one another. What I call exotic decisions are the free decisions according to Bergson in his *Time and Free Will*, where he opposes free acts to associative determinism : “a free decision emanates from the entire soul…strictly speaking then, free acts are rare”. He also describes a process of exploration and decision-making which is at the heart of Darwinian theory:
“a self which lives and evolves as a result of its own hesitations, until a free action comes forth just as a ripe fruit falls to the ground.” It is the degree of independence which exists between one’s own genes and those of one’s parents which gives hope to the individual that he will be able to escape his parents’ woes. Just as the perfectly random response, within progressively established personal limits, to questions posed to the individual which authorize a response time of days, weeks, or more, is the guarantee that the individual will escape a social determinism in the eyes and expectations of the surrounding society. I do not have the competence to judge if rolling dice on decisions which could be decisive in the long-term is compatible with human dignity, but I believe that I can state that this notion of free will would be, seen from the exterior of the individual, conceptually impossible to distinguish from a free will guaranteed by a homunculus located next to the heart or the brain. One might easily convince oneself that, functionally speaking, this would not disturb any of the protocols upon which our society is constructed—no more the notion of civic responsibility than the educational process. Alain Supiot [Man, Of What Are We Speaking] opposes the man “of senses,” the subject and object of the natural sciences, to the man who “makes sense” or “is made sense of,” the subject and object of the human and social sciences. Such a duality is none other than that of encyclopedism versus aesthetics. One can imagine that a middleware somewhere in the cerebral architecture separates senses from sense, a sort of gate between perception and cognition. I would prefer the image of an architecture made of multiple layers, like the architecture of telecommunications, in which, the more we distance ourselves from the material world, the less there is for the senses and the more there is to make sense of. Randomness is indeed present in these architectural structures, thanks to, in particular, an unavoidable asynchrony at the largest level. I recently heard a Web anthropologist explain that the loop between a technique and its uses is non-deterministic. It is no more than an example of the loop which ties together society and the individual. The instrumentalization of such a loop by technology (in the Human Computer Interaction, or the Computer Supported Cooperative Work) thus offers new opportunities for experimentation on the moments of “free will.”

The full-scale integration which allows for access to Very Large Systems gives one the opportunity to deploy strategies of random evolution. This integration was done by “nature”; more recently microelectronics and nanotechnologies are beginning to work towards this at a low cost. We have witnessed in the past twenty years in
industry the rapidity of evolution this implies for tools of conception, production, and for objects themselves: this impetus opens the floodgates to the aesthetic. Today, a well-balanced education, more than ever before, must not be satisfied to expose the student to encyclopedic erudition; it must teach the student the elements of an aesthetic development, demonstrate that it is the most daring aesthetic initiatives which are the most reasonable in the long-term, and that, in the best of cases, instruction teaches not only rules but also virtuosity.

**Conclusion: The incubatory function of an elite university**

*Is the similarity between the development of the brain, of professional groups and of society at the root of the influence of the university on society?*

Could one not imagine that the communication between human brains has secreted an external architecture extrapolated from their internal architecture, where one would find the same contiguous connections, exotic associations, resonances, so that the individual interior gardens would emerge as clump banks in a collective garden of variable topology: a clump bank of languages and idioms always in the making, new proximities created by new uses, fashions which attract one to such and such a buzzword. This collective garden would evolve on multiple scales and multiple dimensions simultaneously: expert groups, professional groups, consumer groups, ideological currents, groups of enthusiasts of all kinds. Today it is easier than ever to experiment on such a garden, thanks to the version which has been created on the Web.

If one believes that the similarity between the levels of informational organization which stretch from the brain to society is not a given, but rather a construction, then any intervention in the architecture of mental gardens can have an impact on the levels above it. There are moments of tremendous evolution in the paradigms of universities: for example, in France, the creation of the New Sorbonne in 1885-1900, which was the response of French positivism to the dominance of Prussian science; at a more global level, the anti-elitist movements of 1968 and the beginning of an intense democratization of access to university. I would not be surprised if one could find among the works of historians of social groups enough material to speculate on the waves of propagation of paradigmatic organizational evolutions which have their foci within the universities.
A specific concern for such a study could be that contributing to the development of a stronger nation implies, on the one hand, a daring push forward and, on the other, a strong mastery of potential risks. A university at the heart of the great undertaking of democratizing access to knowledge and developing modern methods must innovate without obliging others to take risks—neither the students, who are preparing long careers, nor, the organizations, which it sends down new paths through its research policy. A university situated on the most advanced frontlines of research must depend on young researchers capable of overcoming potential dead ends. Reciprocally, a highly-selective elite university with a prestigious faculty owes to itself and to the region in which it recruits significant challenges. At the *Ecole normale supérieure* we consider that we must push our young graduates to constitute, within their own generation, new research teams dedicated to what they do consider to be the upcoming fields. We believe that this policy of early responsibility (“give the students the car-keys at an early age”) is paramount in defining our role as a world-class French university.