Between Excellence and Quality: The European Research Area in Search of Itself

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Abstract

The Bologna process aims at fostering a European Higher Education Area. In this presentation, we shall focus on the research side of this project and examine how a European Research Area can be designed and implemented.

We begin by criticizing the use of neutral and largely undefined words such as "area" and submit that the European Union should design a research topography positioned between two worlds, a smaller one comprised of the member states on the one hand, and a bigger one corresponding to the rest of the world. Distinctions between science and society, and applied versus pure or theoretical science should also be revisited along the lines suggested by the concept of "mode 2" production of knowledge introduced by Michael Gibbons and his colleagues in 1994. Finally, the concepts of quality and excellence should be carefully distinguished. The former deals with minimum standard assurance while the latter identifies the very best. This distinction will require universities carefully to delineate their own internal behavioural boundary between quality assurance and the quest for excellence. We believe the European project should clearly focus on quality thresholds and leave the issue of competitive excellence to member states.

With these tools in place, this paper identifies how a networked, distributed approach to research (largely inspired by the free software movement) is the best solution for European universities to address the concern for quality without inhibiting the quest for excellence. Finally, an implementation strategy is sketched: it targets mainly (but not exclusively) younger researchers while underscoring the importance of fully supporting Open Access to both the literature and the data.

I. Between Space and Territory

In developing programmes and in defining a number of economic, cultural and political objectives, European authorities have used the word "area". For example, the Bologna process addresses issues related to the creation of a “higher education area”. The *raison d'être* is to act “...as a key way to promote citizens' mobility and employability and the Continent's overall development”[1].

Why was the word “area” chosen ? Its main quality is its neutral tone that avoids most difficult, or even unacceptable, political connotations. Quite likely, the intent was to find a vocabulary adapted to a socio-political entity that is both complex and ambiguous – namely, “Europe”. Using the word “area” finesses a fundamental question for the future of the continent: What is the adequate topology of the European Union ? The word “area” fills the void, so to speak. It does so without attracting too much attention to itself, but it does so at a cost: good concepts do not try to “finesse” issues; on the contrary, they try to analyze them.

Building an entity like “Europe” or, more precisely, the “European Union” brings into play nation-states with their attributes of sovereignty, integrity, inviolability, etc. The Peace Treaty of Westphalia casts a long shadow over these principles. Quite obviously the member states, as building blocks of Europe, already have a strong sense of their own topology and the word territory captures it well. If the creation of a political Europe has met with ambivalence and even resistance, it is because it threatens to impinge upon national territories. The fear of national dilution, as well as issues of collective identity, haunt the consciousness of millions of individuals in each partner country.

Terms such as “space” and “territory” carry their own baggage, and the use of these words has not always been coherent, or even consistent. Witness the ways in which geographers approach such terms. For this particular academic tribe, space acts as the empty and unstructured condition of possibility for human activities. In a very real sense, space precedes geography. It is the empty slate on which human history is inscribed. That story unfolds in the ways various groups settle, occupy and wear the soil. In particular, when humans begin to build roads, chart navigation routes or exchange information, they structure space and thereby transform it into a territory.

But geographers are not the only ones interested in space. Observers of culture, such as Michel de Certeau, for example, look at space very differently. For de Certeau, space lies in contradistinction to place, a locus, a *lieu* in French[2]. There is rootedness, order and stability in de Certeau's *lieu*, and a good deal of affinity with Aristotle's notion of place. Space, by contrast, is where movement takes place.

1 See http://en.wikisource.org/wiki/Bologna_Declaration_of_19_June_1999.

2 Michel de Certeau, *L'invention du quotidien. I. Arts de faire* (Paris, Gallimard-Folios/Essais, 1990 [1980]), pp. 172-3.

Manuel Castells, yet another important observer of contemporary culture, would probably agree that his “spaces of flows” correspond to a large extent to de Certeau's space[3]. De Certeau's perspective is internal to the envisioned space. His is the dynamic vision of the walker who creates his landscape as he perambulates. Castells, by contrast, registers the motion, and retains its stable, but static, trace.

The point of this paper is not to develop a philosophy of space or provide an answer to the question of “what is Europe ?”. I understand that a number of philosophers have been and are already hard at work on both issues... Neither does it aim at fixing the adequate topographic vocabulary for such a complex political entity. The previous remarks about space and territory were meant only to underscore the relative poverty of vocabulary choices. Rather, the point of this paper is to examine how scientific research, scientific communication and “Europe” might intersect, how that intersection could be characterized, and what would be the best means to make this intersection as rich as possible. All these questions will constantly accompany the expression “European Research Area (ERA)” whenever the phrase occurs. As we shall see, ERA will eventually mutate into ERN or “European Research Network”.

A first cut at an answer might take the following form: while science projects itself as a universalistic (i.e. equally valid everywhere) set of theories, observations and experimentations, research on a day-to-day basis is strongly grounded in two ways: researchers belong to specific institutions that harbour them and actually pay theirs salaries, and they rely on research funding bodies. Both of these pillars of research exist within some political context, most often tied to a nation state or a region, province, etc. The European Union is now involved in supporting research, but its role is recent, compared to the centuries of state involvement in the support of science, and, at least in the case of the more powerful member states, it still acts as a minor partner. On the other hand, scientific communication, understood as the means to disseminate validated research results, seeks an international reach that goes well beyond individual countries and even a large group of countries like the European Union. One way to express this situation is to say that while the results of scientific research claim universal validity, the actual means through which these results are disseminated tend to be globalized. The two processes are quite different. The universality of science is acquired instantaneously and without any movement, as

3 Castells, Manuel. *The Rise of the Network Society (The Information Age: Economy, Society and Culture Volume 1)*. Blackwell, 1996, pp. 410-9.

an automatic consequence of adhering to the scientific method. The globalization of scientific research results is tied to means of communication, trade patterns and levels of education. Universality is tied to ideas, theories and concepts and could be described as Platonic in essence. Globalization, on the other hand, is materialistic, in the philosophical sense of the term. It relies on communication channels and trade routes. Scientific journals, like scientific authors, want to be disseminated all over the world and seek to benefit from some degree of recognition or prestige. In short, scientific and scholarly communication aims at blanketing the whole planet with universalistic ideas. As any post-colonial thinker would probably argue, this is modernity pushed to its ultimate end.

Europe faces a different challenge. If it tries to design itself as some kind of connected or even unified research area, it must design modes of communication adapted to that specific project, and do so without coming into conflict with the pace at which science grows. And it must do this while taking into consideration that it does not start with a blank slate. There already exists a strong, nation-based, tradition of scientific research with its own means of communication.

The challenge, for Europe is to build a system of scientific communication between European researchers that, both in terms of channels and sites, exhibits specific characteristics that sit somewhere between the communication system already at work within each member state, and the globalized world system of communication.

II. Production of Knowledge: mode 1 and mode 2

Before trying to characterize a European Research Area, let us review a little more how knowledge is created. Quite obviously, creating knowledge requires the presence of some kind of human collective distributed through time and space. In other words, through memorizing, imitating, writing, or formal education, elements of knowledge are recovered from the past, elaborated in some fashion, and carried forward to be bestowed to the future. The same elements of knowledge, within a certain time period, also tend to spread from city to city and institution to institution. Identifying the nature and structure of this "collective" is, therefore, important for the task at hand. Seminars, laboratories, journals, conferences, libraries, universities, research centres, are but some of the ways in which the collective nature of knowledge creation exhibits itself nowadays.

During the second World War and in the years following, science came to be described in ways so familiar to most of us as to appear quite "traditional". Its terms of reference are well known: a "scientific community" is made up of scientists who, as individuals, hold an *ethos* built around four basic values: communalism, universalism, disinterestedness and organized skepticism. Robert K. Merton is the major figure behind this view of science which, let us recall, was designed when sociologists, historians and philosophers obeyed a division of labour that made for a neat set of meta-scientific studies. Historians documented the intellectual meanderings of all too human scientists with their foibles and weaknesses while philosophers, picking up on the former, showed how scientists should have proceeded, had they worked in faithful obedience to scientific method. Meanwhile, sociologists were busy bringing to light the rules embodied in their behaviour patterns. History, philosophy and sociology of science thus contributed to creating a vision of science that was largely independent from society (even for the sociologists who had managed to treat scientists as a kind of autonomous tribe with its own values), and that neatly demarcated scientific knowledge from all other forms of knowledge. As a result, science could claim to have privileged, even unique, access to reality and truth. As a result, it could lecture society in an authoritative manner. The reverse, of course, was not possible.

In recent years, several specialists in science studies have hypothesized that the production of scientific knowledge as described in particular by Merton is not the unique way of doing science. To mark this limit, they have termed it "mode 1of knowledge production"[4]. Essentially rooted in disciplines, "mode 1" scientific research is described in essentially Mertonian terms: it follows theoretical lines of investigations; the results may then be "applied" to concrete problems, but only as a later and secondary step; the research activity is carried out in relative autonomy from society, shielded as it is by the very "purity" of science, its theoretical turn, and the lack of interest of scientists for anything but intellectual rewards. It is not hard to see that this vision of science reflects the point of view of academics that indeed enjoy the luxury of some shielding from society's solicitations. To that extent, it does describe a fraction of what scientists do, but only a fraction.

The same science studies specialists posit that a "Mode 2" of knowledge production is growing in importance within scientific and scholarly research. "Mode 2" places many of the Mertonian

4 Michael Gibbons, Camille Limoges, Helga Nowotny, Simon Schwartzman, Peter Scott, Martin Trow, **The New production of Knowledge** (London, Sage, 1974), *passim.*

characterizations on their head: scientific knowledge does not emerge only from theoretical lines of investigation, but also from concrete problems or situations. Scientific research, particularly when it originates in solving concrete problems, is interdisciplinary more often than disciplinary. Environmental science, or should we say the "sciences of the environment" is an outstanding example here. Also, science is not isolated from the rest of society, but "contextualized", to use the vocabulary devised by Michael Gibbons and his colleagues. In "mode 2", society does not limit itself to listening to the authoritative voice of science; rather, it talks back to science. In short, science and society co-evolve even as they penetrate each other ever more deeply.

"Mode 2" does not reject the Mertonian criteria of scientific ethos; it simply relocates them on the periphery of science. Researchers acting along the lines of "mode 2" sport a more pragmatic, practical, agenda. For example, if patenting is needed, communalism and disinterestedness will simply have to stand back until publication becomes possible. Moreover, patenting does not threaten universalism; it simply allows for universalism with profit. Disinterestedness obviously displays gentlemanly traits, and may be valued for that very reason. However, for most scientists, keeping one's job and being promoted are concerns that probably trump the desire of appearing disinterested in material rewards. Even academic scientists fit this picture. As for "Organized skepticism", it may well be little more than the polite facade of polemics.

Of course, "Mode 2" research is research that is easily carried out in the spirit of the Bayh-Dole legislation that was passed in the United States at the end of 1980[5] and which, presumably, is echoed in the word "market" in the title of this conference. "Mode 1" would approximate what is called here "tradition".

Bruno Latour's notion that we have moved from a culture of science to a culture of research offers a complementary perspective on the shift from "mode 1" to "mode 2" research[6]. Research, according to Latour, far from being a behavioural approximation of the Mertonian values, is energized with human passion and haunted by social ideologies. Latour ironically points to the contradiction lying at the heart

5 The "Bayh-Dole" Act or "University and Small Business Patent Procedures Act" is the United States legislation dealing with intellectual property arising from federal government-funded research. Adopted in 1980, it gave US universities, small businesses and non-profits intellectual property control of their inventions and other intellectual property that resulted from such funding. See http://en.wikipedia.org/wiki/Bayh-Dole.

6 Bruno Latour, "From the World of Science to the World of research" *Science* (1998), 280, 208-9.

of “mode 1” science by quipping that the world of research (or “mode 2”) is “a science freed from the politics of doing away with politics.”[7]

Returning to the idea that collectives necessarily stand behind the creation of knowledge, it is easy to see that the addition of a “mode 2” production of knowledge is going to affect the ways in which scientific and scholarly collectives organize and govern themselves. At the national level, it would not be difficult to see that “mode 1” largely reflects the desire for autonomy on the part of researchers having to live within institutions that pay their salary and provide the tools for their work. And “mode 2” would fit well with the visions of university administrators, governmental designers of science policies and industrial users of academic knowledge. In inciting us to look beyond the crossroad between tradition and market, the title of this conference, in good Hegelian style, appears to call for some *Aufhebung* which could move us past the conflict of contradictory theses. This modest paper will not try to reach such a lofty objective; nonetheless, the conference title does point us in the right direction if we are to think about a research space and the role of universities within it.

III. Scientific and scholarly communication

Once knowledge is created, it must circulate. How is scientific and scholarly knowledge communicated to all interested parties? Going back in history explains many of its characteristics.

The nature of scientific communication has been studied in depth by historians of science[8]. Scientific communication, when viewed from on high, amounts to a large-scale conversation that bridges many people across space and time. It found its humble beginnings in late Renaissance Europe in epistolary intercourse that eventually mutated into more efficient (and mechanical) means of exchange: the printing press was unexpectedly adapted to this end when the politically-inspired gazettes were used as

7 Bruno Latour, “Socrates and Callicles' Settlement – or, the Invention of the impossible Body Politic”, *Configurations* (1997), 5, 232. Quoted in H. Nowotny, Peter Scott and Michael Gibbons, **Rethinking Science. Knowledge and the public in an Age of uncertainty** (Cambridge, Polity Press, 2001), p. 2.

8 See for example Frasca-Spada, Marina, et Nick Jardine. *Books and the Sciences in History*. Cambridge University Press, 2000. Galison, Peter. *Scientific Authorship: Credit and Intellectual Property in Science*. Routledge, 2002. Johns, Adrian. *The Nature of the Book: Print and Knowledge in the Making*. University Of Chicago Press, 1998. Rhodes, Neil. *The Renaissance Computer: Knowledge Technology in the First Age of Print*. Routledge, 2000.

models for scientific journals, even as “pure” science was (and still is) claiming its neutrality and even its indifference to political matters. Depending on the technology used (mail, printed journals or, nowadays, electronic publishing) and on social and institutional factors, delays of variable duration intervene in the publication speed, in the pace of the scientific conversation. As a result, the scientific conversation can appear syncopated on time scales that vary from an instant to several years. However, even long delays do not affect the fundamentally conversational nature of scientific inquiry.

This exchange process started in what has often been referred to as the Republic of Letters or its scientific subset. However, the word “Republic” must be approached carefully. In particular, it does not ensure the presence of egalitarian sentiments. In fact, behind the idea of a “Republic of Science” , there stood coteries of gentlemen who committed to the word “Republic” only to the extent that it referred to a form of peerage with a certain level of civility[9]. Within the confines of scientific debates or collaborations, all actors could treat each other as equals, but, in fact, the “Republic of Science” always incorporated degrees of elitism, and it generally functioned as a competitive arena.

The product of scientific competition is to select the very best, a process generally known as the quest for excellence. Most institutions nowadays claim to be deeply involved in excellence. They seek excellence so much that they end up defining themselves almost exclusively in those very terms[10]. A university, in this perspective, is a place where excellence is sought. And it can be measured, so that universities can be ranked, in Shanghai, in London, and elsewhere[11].

In parallel, the Republic of Science has also left some quiet space for sharing and collaborating, and thus the issue of “quality” has come to accompany that of excellence. Quality, unlike excellence, has little, if anything, to do with competition. It refers instead to thresholds, standards, *minima*, and to results that exceed these criteria. In short, scientific communities have the means to select out and identify their Newtons or Einsteins, but they also need to rely on large numbers of competent, but otherwise largely anonymous, foot soldiers who all agree to work at an agreed-upon level of quality..

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9 See Shapin, Steven. *A Social History of Truth: Civility and Science in Seventeenth-Century England*. University Of Chicago Press, 1995, pp. 134-5.

10 For a critical analysis of the term “excellence” as applied to universities, see Bill Readings, *The University in Ruins.* Harvard University Press, 1996, *passim*.

11 A useful description of various university-ranking schemes can be found at http://en.wikipedia.org/wiki/College_and_university_rankings.

The problem quality faces is that its reliance on a threshold, a "passing grade", is often assimilated to mediocrity. If it is not the very best, how can we be sure of how good it is? Yet, there is no reason why it should be so. Any bar can be raised sufficiently high to dispel such confusions. In fact, if it is raised sufficiently, it yields the same results as any competition. In any case, the Republic of Science needs both quality and excellence. Who should take care of both aspects of the scientific process is an extremely important, but largely neglected, question.

Research centres and universities have been competing with each other for a long while. Even in a country like France, with its official political discourse grounded in equality, an equality guaranteed by a central administration, the notion that each region benefits from the presence of a university as good as any other is largely perceived as a myth, and tacit competition goes on. In most other European countries, competition between universities is more openly admitted. In all of these cases, the term that addresses the issue of competition, covert or overt, is "excellence". Like the word "area" discussed earlier, "excellence" is the diplomatic tool to handle a potentially divisive situation among universities. The "quest for excellence" is but a gentle reference to institutional competition of the most intense nature. Yet, "excellence" often displays its inability to deal with many fundamental questions within the universities. For example, the selection of students may be ostensibly organized around the search for the "best" among them, and it will be publicized in these very terms, but in practice, it really seeks "qualified" students. This is unavoidable, especially when admission levels reach in the thousands and when public financing is tied to the number of admissions. But the vocabulary of "excellence" carries on nonetheless.

The financing of research has also been structured around competition and it too is expressed in terms of excellence. Granting agencies prominently sport this concern on their public facade and universities follow suit, often by by insisting on the amount of money their researchers collect, rather than the number of articles the same researchers publish, and the number of citations they receive. At the same time, it must be realized that much research is routine in nature, and its worth is fundamentally grounded in the basic competence of its practitioners. They are not the best scientists; they are competent scientists. Lest this characterization be seen as demeaning, it should be remembered that much science needs to be carried out at exactly this level. In the end, particularly in the context of what

Thomas Kuhn would have called "normal science"[12], quality control is generally far more important than the quest for excellence. From this perspective, judging the success of a science policy by the number of Nobel Prizes that seem to arise as a consequence of its implementation, or some similar indicator of excellence, appears highly problematic unless some relationship is actually established between the number of Nobel Prize winners and the number of related scientific foot soldiers.

One final remark needs to be made: who appears to stand most enthusiastically behind the idea of "excellence"? National concerns seem to dominate here. Countries compete with each other in countless ways, and countries fuel their claim in favour of high international ranking by organizing national competitions between institutions and individuals. In some ways, the international competition in science resembles that in sports: prestigious international prizes are treated like Olympic gold medals and the scientific representatives of national excellence appear to have been identified in ways not so different from teams of top athletes. We know how much distance separates elite athletic teams from the physical well-being of the general population, and we know how incredibly more important the latter is for the life expectancy of a country's population. Likewise, we can distinguish the training of top scientists from the training of a workforce that commands a reasonable level of scientific and technical competence. Whether the elite model is the right one for scientific and scholarly development is a question that ought to be raised. My own answer would point to the incomplete nature, at best, of such an agenda.

If the competitive/excellence objective is strongly anchored in nation-states, Europe's role in such a context will be quite different. The quick answer is that Europe should opt for quality rather than excellence, and work on mechanisms that will ensure the former (while not discouraging the latter). Actually, European authorities appear to be moving in this direction with the European Quality Assurance Forum which first met in 2006 in Munich and again in 2007 in Rome. However, threats of friction between European and national policies on this issue have also been identified. For example, a 2004 article on the Bologna process concluded that: "We expect more political turmoil when it comes to discussing the adjustments to and implementation of quality assurance mechanisms throughout

12 Kuhn, Thomas S. *The Structure of Scientific Revolutions*. University Of Chicago Press, 1996. 3rd ed. The first edition was published in 1962.

Europe."[13] Actually, this article is addressing accreditation issues, but this is a good example of quality as it distinguishes itself from excellence. The problem is that member states are used to organizing not only various forms of competition corresponding to their quest for excellence, but they also manage selection mechanisms that rely only on quality control: passing grades and grade point averages dominate in these forms of evaluation.

On these issues, national and European agendas do not necessarily converge. However, the tensions emerging between the two levels of government may lead them to redefining their roles in distinct ways. Our thesis is that countries are probably best suited for the pursuit of scientific excellence, while Europe can ensure the creation of a broad-based pyramid of quality. The rest of this paper will attempt to explain how the of quality and the quest for excellence can be set up to work harmoniously together.

IV. The Power and wealth of networks: the free software model

The development of ever larger standing armies and the growth of immense industrial factories have made us familiar with notions such as division of labour, chain of command and centralization. Yet, a number of recent developments have put in doubt some of the conclusions that had been adopted somewhat uncritically in the past. For example, we have seen dozens of programmers worldwide developing software that successfully challenged enormously powerful and centralized companies like Microsoft. And this victory was not even planned. Little did Linus Torvalds, the father of Linux, realize that he was triggering a process ultimately leading to the most credible threat to Microsoft's dominance, when he launched into the Internet the starting code for a minimal Unix-like kernel. The Linux saga started in 1991 and is still growing, and Microsoft finally seems to have realized that it can never be beaten back and uprooted from the computer world. Likewise, the browser Netscape, after it was vanquished by Microsoft's Internet Explorer, reappeared, phoenix-like, in the guise of a free software amusingly called Mozilla, and, yet again, as the hugely successful Firefox browser. At present, Firefox is steadily taking shares of the browser market away from Internet Explorer. The reason is that the programmers standing behind the Firefox browser innovate faster and better than the Microsoft teams.

13 Jeroen Huisman and Marik Van Der Wende, "The EU and Bologna: are Supra- and International Initiatives Threatening Domestic Agendas?", *European Journal of Education*, vol. 39(3), 356.

Other examples, just as spectacular could be quickly mentioned. One that is particularly important is LAMP (Linux, Apache, MySQL and Python). What these mysterious words cover are the building blocks of the software combination found on a majority of servers on the Internet. The Internet itself would not have started and would not have worked, had it not been propelled by free software and its basic philosophy of "rough consensus and working code". Free software development offers important lessons. In essence, it shows that anyone can contribute to a particular project and do so constructively, however small the contribution may be. This requires devising some way of accepting contributions, validating them and integrating them into a larger whole. To achieve such spectacular results, various conditions must be met: tools to keep tracks of versions are essential, as are social rules to filter the contributions. But filtering must not inhibit contributions. It is, therefore, a question of balance between spontaneity and order[14].

At the outset, it was hard to see how such processes could work. As a result, they were often derided, and were deemed unworkable. Yet, enormous projects have emerged that not only work, but do so efficiently enough to compete successfully against rich and well organized corporations. To explain this phenomenon, Yochai Benkler has mobilized Coase's theory of the firm which accounts for the replacement of artisanal workshops by large scale manufacturing structured around a strict division of labour[15]. Under certain circumstances, with certain kinds of activities like coding, Benkler showed, using Coase's theory, that a distributed structure of production can be more productive than the corresponding firm-based industrial model. As this result flies in the face of such apparently obvious principles as "economies of scale", many found it difficult to accept free software at first. However, concrete examples of success could not be ignored forever.

Two important factors have contributed to the rise of free software projects: a layered modular structure and a strict adherence to open standards. The first principle allows transforming a large, perhaps unwieldy, project into the sum of many smaller modules. Moreover, the layered structure of such projects allows working on particular functions without having to worry about disturbing the whole structure. Layers are designed to relate to each other essentially in an input-output mode so that what goes on inside each layer is of secondary importance so long as the input is accepted by a given

14 Glyn Moody, *Rebel Code: Inside Linux and the Open Source Revolution*. Perseus Publishing, 2001, *passim*.
15 Yochai Benkler, "Coase's Penguin, or Linux and the nature of the Firm", available on-line at http://www.benkler.org/CoasesPenguin.html. The original article appeared in the *Yale Law Journal* in 2002.

layer, and the output obeys strict rules making it acceptable to the next layer. Open standards are favoured because they facilitate interoperability within a particular project, as well as between projects.

Free software also relies and depends on a social structure: each project builds its own structure and its own governance and thus invents its own ways and means to move forward. Projects that do not succeed in implementing a good governance model simply fail. But a failed project is never completely wasted because the code remains accessible and can be reused freely by another project. This is no more than a side advantage of this mode of production, but it is significant all the same. As a consequence, the free software model also opens the promise of variety and autonomy while preserving a satisfactory degree of coherence in projects.

Where do individuals find the incentives to contribute to such a system? Again, the rules vary from project to project. However, being associated nominally to an important project can form a powerful incentive for some individuals, especially if they derive some form of attribution from it. Recognition is a powerful motivation for human beings[16]. Free software relies generously upon it. Also, the possibility of testing one's skills on real projects is appealing, and the experience can be put to good use in any curriculum vitæ. The possibility of choosing one's own working problems is also attractive, in particular if they are cutting edge problems. In short, the freedom to create appears to summon a greater productive energy than a rigid and hierarchical discipline.

The free software model brings to mind other, similar, situations. The most obvious among them is that of science itself. In fact, it is not science that resembles the free software mode of production, but rather the reverse. When they imported many of the rules of scientific production into coding, the pioneers of the free software movement essentially rediscovered the whole power of distributed, networked activity that science began to develop in earnest at the time of the so-called “scientific revolution”. It also foregrounds the notion that scientists have conjoined their efforts within a governing structure that corresponds to the Mertonian scientific ethos.

Let us quickly review some elements of the scientific governance system. Articles are submitted to established institutions called journals. There, they undergo a particular type of evaluation called “peer

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16 On this theme, see for example Van Den Brink, Bert, and David Owen. *Recognition and Power: Axel Honneth and the Tradition of Critical Social Theory*. Cambridge University Press, 2007. Much of A. Honneth's studies deal with this fundamental issue.

review" which, in principle, relies on authority, expertise and competence: colleagues, i.e. peers, judge the content and not the author(s) or his (their) institution(s). The practice of "blind peer review", although far from being universal, clearly points in this direction. The outcome of the peer review process determines whether the submitted piece will be integrated into the scientific corpus or not. It also includes editorial corrections, and the final result is a scientific publication. Peer review is often described as a quality control, but it stands closer to a boundary control: either a piece of writing passes into scientific territory, and then it is publisher, or it does not. Publishing, in science, is the process whereby a new article is formally integrated into an archive. In principle, it can be perused by anyone. Advocates of the free software movement often quote the statement that "with enough eyeballs, all bugs are shallow". The same applies to science, with the result that if the number of eyeballs perusing scientific articles is not as wide as possible, the quality of science cannot be optimal.

The journal article plays other important roles in the governance system of science. It provides a precise memory of when the work was done, submitted and accepted, and the names of the creators. Its citations point to prior science needed to support the published results. These are the standard inputs. Later, if the peer-reviewed article is cited, it acts as an output. Finally, if the article should eventually be refuted or corrected, it roughly corresponds to a bug in programming. Because articles rely on each other in a historical sense, they do not quite correspond to the layered modularity of distributed programming. But they come close enough to allow retaining the metaphor.

Whether journals deal with quality or excellence is a difficult question to resolve. In principle, peer review examines the suitability of an article for publication. However, resources and space are always limited, so that forms of competition also play a role in the selection of articles. These forms of competition are themselves framed by the nature of the competition that prevails among journals. Journals compete for the "best brains" because their own prestige ultimately rests on the aggregate prestige of its authors. It must also be noted that, ultimately, almost any article will be published somewhere, and that its ultimate "resting place" may have far more to do with quality than with excellence.

There lies a complex back-and-forth movement between journal prestige, journal quality and author visibility. This complex interaction underpins one of the most important functions of a journal: branding. Scientists compete on the basis of not only what they publish, but also where they publish.

The rules governing the competition between scientists, therefore, depend in part on the rules that govern journal competition. The latter rules, nowadays, are rigidly codified by citation metrics and, in particular the impact factor[17]. This means that the quest for excellence is based on one set of tools, the *Science Citation Index*, that covers only a fraction of all scientific and scholarly journals and that is in the hands of a private company accountable only to its shareholders[18]. This should raise some concerns. It should also help understand why quality as distinguished from excellence is so important. Parts of the criteria guiding the identification of competitive excellence are simply flawed.

The analogies between the distributed production of free software and that of scientific knowledge also bring to minds the characteristics of "mode 2" science. We know that distributed production relies on some form of governance. This means that if science relies on a distributed production, then its governance system is crucial. Another way of stating this simple point is to say that a deeply social issue, that of governance, lies at the heart of any scientific project. The paradox of scientific research is that it needs to act as if its politics had been eliminated to the point of invisibility, which is Bruno Latour's point mentioned earlier[19]. The present confusion between quality and excellence reflects the silent drift in the modes of governance of science. In particular, the enormous importance of the impact factor as an evaluation tool has foregrounded the competitive dimension of science at the expense of quality. Alas, the grave consequences linked with this silent shift have remained essentially unanalyzed.

Symmetrically, the distributed mode of production tends to be concrete and, therefore, tends to seek problems to solve. As a result, it places science at the heart of society. Science and society, as seen from the perspective a distributed production system, do not stand outside each other; rather, they mesh in complex ways. Science, therefore, clearly obeys the tenets of "mode 2" production.

The interdisciplinary nature of research can also be approached from this distributed perspective. Let us remember that the modular structure of codes eases the production of partial results, and that these results can produce a general solution to a larger problem. Such a perspective is highly compatible with

17 See http://en.wikipedia.org/wiki/Impact_factor.

18 The "Science Citation Index " is the original name of Eugene Garfield's invention. It is now known more generally as the "Web of Science". Recently, a competitor, Scopus, has emerged, developed by Reed-Elsevier. In the short term, this competition is to be welcomed. However, if one day Scopus manages to get rid of its rival, Reed-Elsevier will have reached the dream pursued relentlessly (but thankfully unsuccessfully) by Robert Maxwell when he owned Pergamon Science, that of being judge and party in the competitive arena of scientific journals.

19 See note 7 above.

the idea that scientific problems can be solved only with a rich diversity of approaches, technical and theoretical. In other words, interdisciplinary efforts are essential to the progress of science. But this is also what “mode 2” production describes. “Mode 2” conforms well to the general outlines of distributed production of software, and, conversely, distributed production tends to make us look at the whole of science as if it had been in “mode 2” from the very beginning. This is not to say that “mode 2” production of knowledge and “distributed production” are identical, for they are not. However, they overlap enough to demonstrate that the scientific enterprise would not have been possible with only one of these two components.

History vindicates this view. If we look how early natural philosophers worked on scientific problems, it becomes clear that they were competing with each other, and were seeking prestige and glory. But they also collaborated to solve complex problems. It is not enough to rely exclusively on competition to ensure constructive outcomes. For example, measuring longitudes followed many methods that used just about every form of mechanical and astronomical knowledge available to human beings. The result was intensely practical. It was highly political in its implications and consequences for trade routes and colonization. It also stimulated many discoveries, both theoretical and observational, in the areas of classical mechanics and astronomy.

The puzzling point that historians of science should explore more fully is why science has chosen to portray itself under the guise of “mode 1” rather than “mode 2” for such a long time. The answer may have to do with the governance system, once again. Perhaps scientists are no better citizens of the Republic of Science than ordinary human beings are citizens of their democratic state. And perhaps no worse. But the need to foreground an ideal representation of either science or democracy may be crucial for the survival of both kinds of “republics”. Besides, they are not so easily kept separate from each other.

In conclusion, looking at “mode 2” science closely shows how closely it relates to a distributed structure of knowledge production. This provides a way into the design of a proper spatial structure for Europe's research . Let us remember that the possibility of distributed production depends on networked individuals and institutions. This raises the issue of the proper kind of space associated with networks. The central thesis of this paper can now be rephrased as follows: the space of networks, by also fulfilling the needs of mode 2 science, will provide an important key for the designing of a European Research Area.

V. Networks and their Space :

Through the requirements of its research programmes, and for a long time now, the European authorities have tried to move in the direction of networks. Or so it appears to an outside observer. When research must be conducted by at least three institutions from three different member countries, it is difficult to ignore the inherent networking intent in such a condition. We shall leave aside the question of the success of this strategy to continue focusing on the idea itself.

What would a networked and distributed approach to scientific knowledge bring to the project of building a European Research Area, and what would it look like ? To the first question, it is easy to answer that it would create a specific framework that would immediately identify the European project in a unique fashion. It would do so because of its inherently European scale, and because its structure would be without equivalent. We can rest assured that the rest of the world would quickly take notice. Its very existence would raise new questions: how does it relate to national scientific policies, on the one hand, and to the rest of the world on the other. In short, it would set up a strong base on which to develop an authentic European research vision. It would also create innovative perspectives for both the question of European integration and collaboration with the rest of the world.

Moving to the implementation strategy brings us closer to the familiar remark that the devil is in the detail. Broadly speaking, a networked research space would draw much of its inspiration from the free software projects, and would aim at transposing it to particular research contexts. As we have seen, adopting a networked approach also places the objective squarely in the camp of “mode 2” production of knowledge. This means defining objectives that meet some of the pressing needs of our societies. In our time, such issues are not difficult to find. They range from issues related to clean and renewable energy on the science and engineering side to gene-based medicine in the health sectors, and the challenges raised by digitization in the humanities and social sciences. Note that, in good “mode 2” manner, these questions, although concrete and apparently “practical”, will necessarily involve theoretical work. The distinction between "pure" and "applied" is simply reworked into a dialogging continuum of projects ranging from the most concrete to the most abstract.

The next step would be to borrow heavily from the free software model. The big problems should be broken up into modular sub-sets of manageable sizes. Enough of these modules should be sufficiently limited in size and complexity to be within the reach of even modest groups, or institutions. In this fashion, small teams or even individuals working in less than stellar institutions could still claim a seat, or rather the role of a node, inside a variety of cutting edge problems covered by the big problems. Because quality rather than excellence would guide the selection process, such a strategy would ensure that institutions could participate so long as they display a decent level of quality and even though they may not have the financial means to compete with the more prestigious centres. In other words, much talent ignored by policies aiming too exclusively at excellence could be recovered and put to very good use.

The third step in the policy would involve identifying compatible skills, interests, or common difficulties. Because it would seek to break with established habits, a policy aiming at building a scientific research network would be well advised to aim its efforts at young, relatively junior scientists. Strategies to help advanced doctoral candidates, post-doctoral researchers and young faculty to network together should be explored, if only because both kinds of researchers are often caught in strict hierarchical situations and need some breathing space, some autonomy when they still have a fresh and creative view on their subject matters. To this end, European meetings limited to young researchers could be convened, and money provided for travel and lodging to the selected candidates. Again, the selection process could rely on criteria of quality rather than criteria of excellence.

In these meetings, the accent would be placed on opportunities for encounters, discussions and debates. The meetings should be designed to foster a seminar-like atmosphere. To allow for a real mix of participants, the meetings could run for several weeks, on the model of summer institutes. In short, young scientists and scholars should have a chance to do their own networking on a face-to-face basis. With suitable use of tools to encourage contacts, for example forms of social software adapted to research environments, the potential networks emerging as a result of the initial face-to-face meetings would have the opportunity of growing further following the face-to-face meetings. At the same time, this first phase in the constitution of networks would display some of the effects of well-known clustering rules. For example, it has been observed that if A joins with B and B independently connects with C, then A will have a better chance of connecting with C[20]. This simple rule, and other similar to it, can be exploited to further the networking of younger scientists in Europe. It amounts to intensifying network connections in certain areas of research and with certain individuals or groups. Steering this growth process within the geographical limits of Europe would correspond to the deployment of a European research network. It would ultimately translate into a new kind of science policy. As space would grow as networks grow, it would also bring us back to de Certeau's notion of a space that develops even as the individual walks and interprets.

The obvious advantage of this networked, connected, perspective is that it immediately transcends traditional boundaries, be they political, institutional or based on disciplines. The second advantage is that networks are open to both wider and smaller systems. In our case, the European research space designed as a network would not be closed to the rest of the world; neither would it compete against national policies. Instead, it would create a distinctive layer of research that could both lead to the production of original results, but also mesh constructively with other modes of production of knowledge, either at the infra-European level, or with the rest of the world. At the same time, it would create an opportunity for growing ever denser meshes of research all across the continent in a way that would give the European research space a strong, yet distinctive, profile.

Finally, such an approach would obviously favour the diversity of intellectual traditions within Europe, and it would ensure that a rich store of ideas, methods and approaches could be applied to any given problem. Unlike the United States, Europe should not turn into a melting pot, but rather should carefully preserve the full range of its diverse intellectual heritage. From a competitive perspective, this may be one of its more precious resources.

VI. Open Access and Networks: the Missing Piece

If the idea of networking younger European researchers is seriously entertained, building a European Research Area will need another supporting element. We must also remember that researchers will not all come from Oxford, Heidelberg or the École Normale Supérieure. In fact, the quest for quality rather

20 Yochai Benkler, **The Wealth of networks** (New Haven, Conn., Yale University press, 2006), pp. 248-9.

than excellence aims at redress the imbalances inherently linked with the strategy of institutional prestige. However, if more modest, and probably poorer, institutions are to be involved, access to the scientific literature is a crucial issue. In the free software movement, an essential key of its success lies in the open code. It is the free access and re-use of source code that fuels the free software movement and accounts for its unmatched energy and vibrancy. The published literature is the code of science and it too needs to be open. Scientific research is more complex than computer programme codes because it relies on both access to the relevant literature and instruments in the laboratories. However, solving the issue of access to the relevant literature is a big part of the whole picture. Furthermore, research data complements the published literature. For institutions lacking the instruments to produce such data, access to data means the possibility of learning, of checking and verifying, and even of revisiting prior interpretations.

When access to the literature is denied, good scientific work cannot be done. Why is it denied ? Generally, and simply, for economic reasons. Many of the leading journals in science are extremely expensive and most libraries do not enjoy the kinds of budgets that would allow them to follow the steep rise in subscription or licensing costs. This is the reason why Open Access is a crucial piece in the building of a European Research Area.

Open access (OA) to the literature can be achieved in two ways, either through self-archiving of one's own articles, or through the use of Open Access journals. In the jargon of Open Access advocates, these two approaches are generally referred to respectively as the green and the gold roads to OA. In the case of the green road, the difficulty lies with filling the repositories that are waiting for the documents. The response to this difficulty has been a push in favour of mandating the self-archiving of documents. However, obtaining mandates can be difficult because it is inherently political in nature. Nonetheless, the number of mandates is growing most encouragingly[21]. A the time of writing this piece, there were 58 mandates in place in the world. Interestingly, 30 of them, i. e. slightly over half, come from funding institutions. The reason is clear: funders want the result of their funding as visible as possible, if only for political or prestige reasons. Presently, a petition is circulating to ask the European Commission to do the same for its grants[22]. Clearly, if a European Research Area is to be created, and if Open Access to the literature is crucial for its working correctly, a mandate to self-

21 A list with details about each policy can be found at http://www.eprints.org/openaccess/policysignup/.
22 The petition can be found at http://www.ec-petition.eu/.

archive is needed. In fact, all research funded by European institutions should be placed in Open Access and a European mandate to that effect should be enacted.

In parallel, Europe could study examples of scientific communication from countries such as Brazil and its many partner countries, including Spain and Portugal[23]. Consider the following argument: scientific publishing is part and parcel of the scientific enterprise. The cost of scientific publishing, although high, represents only one or two percent of the cost of research. Most of the cost of research is shouldered by public money, so that increasing it by 2% at most does not seem such an outrageous request. This is what Brazil and thirteen other countries are presently doing and, already, they have over 600 titles in Open Access. They are also designing their own metrics to demonstrate the impact of their publications. With such metrics in place, it becomes possible to manage both excellence and quality. In the case of excellence, designing one's own metrics also provides some control over the competition rules that prevail, and overcome artificial exclusion barriers such as the ones that have long been erected by the Science Citation Index and its descendants. Europe could do worse than study such an example, and European institutions should not be mesmerized by the fact that some of the largest publishers of scientific results are European companies. A vibrant research environment is more important to the economy of Europe than maintaining the profitability of publishing conglomerates. This is even more evident if one considers that these very companies, through price barriers, tend to limit the circulation and use of scientific results.

In partial conclusion, a European strategy aiming at developing a distributed production of knowledge based on younger scientists and scholars needs to treat this effort as a quest for quality, and leave excellence as a second order issue, best left in the hands of the nation states. It also needs to create an even playing field for anyone that wants to intervene, and that requires Open Access to the literature and to data. In fact, open access to the data produced in any subsidized laboratory in Europe would usefully complete this strategy. Much work is being done in several countries in order to see how best to implement Open Data without disrupting the work of those who actually produce the data[24]. For the institutions that do not have the means to equip the needed laboratories with the latest and best

23 See the description of the SciELO project at http://www.scielo.org/php/index.php?lang=en.

24 For a general review of the open data programmes, see Paul F. Uhlir and Peter Schröder, "Open Data for Global Science", *Data Science Journal*, vol. 6 (2007), OD36-53. This is part of a special "Open Data" issue published in June 2007.

equipment, there would remain the possibility of working over data produced elsewhere and finding new ways to draw new interesting results from it, or question interpretations. Once again, "with enough eyeballs...", the quality of science can only improve.

VII. Negotiating the excellence/quality divide within and between institutions

The last piece in this puzzle rests with the universities and research centres themselves. It is a piece that must answer a difficult question: how can universities respond to a variety of requests that may pull in divergent directions. For example, how can universities simultaneously respond to the injunction to compete and pursue excellence, and collaborate. For collaboration is important, not only to produce quality (again as it is being distinguished here from excellence), but also to participate meaningfully in a distributed mode of production of knowledge.

The nature of a possible solution will appear clearly with the use of a real example, that of the Media Lab at the Massachusetts Institute of Technology. Media Lab was supposed to do research under contracts with various industries interested in the evolution of the new media. It was founded by Nicholas Negroponte who, a few years later, promoted the project of providing cheap computers for Third World children (OLPC or"One laptop per child"). The interesting detail about the Media Lab is that it offered each company with which it collaborated exclusive results if the company wanted it. However, it also offered another plan to these companies: should they accept to let the results of the work contracted be visible to other companies, then they would have access to the results provided to all the other companies that entered into a similar contractual arrangement. In other words, as Negroponte would argue, foregoing thousand of dollars for one contract could lead to accessing results worth millions of dollars.

Apparently, most companies chose the latter option, and it is not difficult to understand why: the leverage offered was irresistible. At the same time, this led companies to design research topics that, while very useful to themselves, did not hurt their competitive position. It led companies to look for research that dealt with pre-competitive stages of developments that they needed. And as the pre-competitive stage of development tends to be a little more theoretical, this also served Media Lab because, as a university unit, it favoured more fundamental and theoretical work. In short, Negroponte invented a win-win situation for everyone by cleverly locating his institution at the boundary of competitive and pre-competitive work. What is striking in this situation is that most companies found ways to identify this boundary and ways to define contract work that clearly belonged to the pre-competitive stage.

We might observe that while universities do compete with each other, they do not do so as intensely as businesses. If, competing firms are nonetheless capable of doing some sharing, then universities should find it even easier to do the same. To do so, universities have to identify what they need to share. The idea offered here is that universities will quickly find what they can share if they focus on the "quality" side of their work.

The idea of a European research Network presented in this paper ultimately rests on the "quality" side of the universities. It is from that perspective that sharing can be contemplated. It also supports the idea proposed earlier that young faculty may be more open to networking than older colleagues. While many think that no one is as competitive as a young researcher, it is important to remember that much of this competitive spirit is instilled, perhaps even imposed, by an institutional climate which ties promotions and job security to excellence, at least at the level of institutional rhetoric. But the ability to work in teams that is required of many nowadays is a quality that works even better with networks. Young researchers have been junior partners of research teams as doctoral or even post-doctoral students. For this reason, they are well prepared for networked activity if only because they can escape hierarchic structures for at least part of their activities.

In short, research institutions must learn to distinguish the levers of quality from those of excellence. They must also learn how to correlate certain activities to the former and others to the latter. No one is arguing that the edgy climate brought about by competition is not useful in some circumstances. On the other hand, reducing all of research to competition makes little sense and wastes many opportunities that a networked structure could easily help to blossom. The wisdom embedded in the widespread custom of distinguishing passing grades from prizes can easily be extended to the highest levels of research. The European Research Network is presented here as taking advantage of this distinction and strongly working its quality side.

VIII. Conclusion

Working out the specifics of a European Research Area has required a long and somewhat meandering path. We first had to identify an interval placed between nation states and the rest of the world. During this process, we concluded that the ERA ought to focus on quality rather than on excellence, and this meant designing participation tools that were not based on competition, but rather on thresholds. This allowed leaving the competitive spirit behind, in the hands of nation-states, and focusing on raising the general quality of the scientific work done in Europe. Given the uneven development of member states, and the issue of integrating newer members as efficiently and rapidly as possible, such issues appear both important and pressing.

A detour through the analysis of "mode 2" production of knowledge was useful in addressing the issues of academic integrity, research autonomy and professional governance. "Mode 2" science shows that science has always been a hybrid activity, and that distinctions between pure and applied, or between science and society are more rhetorical than real. This suggests that the European Research Area should resolutely be organized in a "mode 2" fashion. The point is all the more obvious when the analogies between "mode 2" science and the distributed nature of scientific work are made visible. Examples drawn from the free software movement became useful at that stage because the free software movement, or "Coase's Penguin" as Yochai Benkler jokingly describes it, is inherently a "mode 2" organizational form and its vibrant energy suggests the transposition of its *modus operandi* to the work of science.

One last step was the need of distributed practitioners to communicate with each other to make the process work. The answer was found in two words: Open Access. Only with Open Access can the scientific literature and data be fully used. Together, they provide the code of science. If lessons from the free software model are to be taken seriously, the code must be freed. It is the only way to liberate the immense energy of distributed production.

With all these tools in hand, there remains the question of the institutions. They were designed within a national context and they have been guided for a long while, perhaps too long, by a rhetoric of excellence that, behind a genteel facade, really refers to a highly competitive context. However, it is false to imagine that all the activities of the universities and all those of the research laboratories are guided only by competition. Teams exist and various forms of cooperation flourish in this allegedly cut-throat environment. Universities should identify the non-competitive fraction of their activities and begin to share with other universities. The example of the Media Lab at the Massachusetts Institute of Technology shows that competing companies found themselves capable of undergoing a similar kind of transformation.

Finally, by pointing out that young researchers should play a major role in building the European Research Area, the policy will help grow a new ethos among scientists and scholars. A new "space of flows", to use Manuel Castells' vocabulary, structured by movable networks will characterize the European Science Area. This will lead in time to extremely interesting transformations in the structure of European science which will positively impact its vitality. Ultimately, it will also redefine the relationship of scientific and scholarly knowledge with the citizen. But this will be the subject of a different conversation.