I-1.31: Innovation and Regulation serving the digital Revolution

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Electronic communication and digital revolution

In the most developed nations, as in emerging countries, the economy and society are currently being entirely transformed by an industrial revolution originating in information and communication technologies. This phenomenon is commonly called the "digital revolution." Manufacturers, network operators, service providers, content editors, and consumers, which are the driving force of the electronic communications industry, form the beating heart of this revolution: they are the source of permanent innovations in technologies and applications and the generators of a new form of growth and a knowledge-based society.

In order to fully appreciate the contribution of electronic communication networks and services to the dynamic of the digital revolution, one must explore further than the obvious fact that these networks and services make up a system for the distribution of information and communication signals, just as the railway allows for the transportation of persons and commodities, or energy networks allow for long-distance transmission of electricity, petroleum, or gas. Under the surface of this façade, electronic communications are a boiling forge, the caldron where the processes of innovation that are generating and shaping our knowledge-based society gestate.

"*Caution! One train can hide another!*" warned those old signs that used to be found in train stations and before railway crossings. This is a wise recommendation that we could usefully reprint here by saying "*Caution! One obvious fact can hide another!*" or, by quoting Jean Paulhan[1]: "*The nature of the obvious is that it goes unnoticed.*" [2]Of course, electronic communications are an infrastructure, or better, an "infostructure," which create synergies between networks, services, applications, and content. But, at the same time, they are much more than equipment for the transmission of signals: they are truly a melting pot for innovation, a platform of creativity whose shifting borders are framed by the innovation process itself. Their close relationship to innovation—and therefore, with its inherent unpredictability—characterizes electronic communications and fundamentally distinguishes them from other network infrastructures.

Innovation and unpredictability

During the inception of the railway, two centuries ago, engineers did not have much doubt concerning the future utility of the infrastructure they were designing: it would always be used by trains that would transport people and freight. One hundred years later, some imagined, in the early days of the telephone, the advent of the "*théâtrophone*" by which concerts could be broadcast in opulent Parisian flats, just as some anticipated that the Minitel would quickly and completely replace the postal service. None of these people could have forecast the future dominant use of these then-nascent technologies: interpersonal communication for the former, and dating chatlines for the latter.

Similarly, those who are currently building fiber optic networks or fourth-generation mobile networks are at least partially incapable of predicting the potential usage of these

[1] Jean Paulhan, French writer, publisher, and literary critic, 1884-1968.
[2] *De la paille et du grain*, Gallimard, 1948

infrastructures, which are the fruit of an unpredictable process of collective invention and production, consubstantially implicating network operators, content producers, and consumers in a tangle of supply and demand.

In other words, the "fluid" carried by electronic communication networks is not so much information as innovation! Therein resides one of the most notable differences between the digital revolution and the two industrial revolutions that historically preceded it: this time, unlike the previous ones, networks are not simply enabling economic and social transformations whose impetus is external to them, but they are the very place where these transformations are emerging and being implemented.

Whereas railway and electricity networks stimulated and decupled the effects of the revolutions that gave birth to them, electronic networks – especially the Internet – also do this, but much more, by constituting themselves the place where the digital revolution is taking place and the ecosystem where it is flourishing. These networks and their halo of content and services cannot be reduced to the simple instrumental dimension of a tool at the service of mankind, for they are a "total" object in the philosophical sense of the term: they are an all-encompassing universe and an environment where new business models and new social practices are being invented. This economic and social invention is highly unpredictable, for it follows a random and unplanned path, just like surfing on the Internet, which – according to the model of "serendipity" – more certainly leads one where he does not yet know he wants to go, rather than where he thinks that he wants!

Innovation and regulation

Therefore, regulating the electronic communications industry does not simply involve regulating network infrastructures, which is the traditional goal of sector-specific regulation; it also means regulating the third industrial revolution's engine of innovation, which is a much less classic and much more ambitious target! The regulator must adopt a duality of behavior in order to achieve this duality of goals: he must be both a problem solver and an uncertainty reducer in fulfilling the first goal; and a midwife for creativity and a catalyzer of initiative, in fulfilling the second.

But is it possible and sensible to "regulate innovation," or is this simply a provocative oxymoron, *i.e.* a stylistic device based on a lexical contradiction? As though he meant to illuminate a painting of our question using *chiaroscuro*, Napoleon Bonaparte is reported to have said these incisive words during his Italian campaign:

"Rules are for soldiers and not for warriors. The battle mocks codes, it demands new rules, invented for it and by it, and which disappear once it has finished."

This is quite a pertinent analysis, as long as we agree that innovation is the "battlefield" of electronic communications, the innovators are the "warriors" of technological progress, and the regulators are the rule makers. First of all, just like the battlefield and the military code, innovation and regulation seem to be semantic antonyms. Whilst regulation, like military rules, are in principle stable, certain, and prescriptive, innovation is like the theater of operations in that it is essentially effervescent, unpredictable, and unable to be planned in advance. Just as an inappropriate rule must not hinder the efficiency of the battle, overly restrictive regulation must not inhibit innovation.

The "Napoleonic" vision of antagonism between regulation and innovation is especially put forth by those fiercely opposed to any form of regulation for the Internet. These players, including major network operators such as AT&T, fear that regulators

want to treat the Internet like a historical monument that must be preserved intact by coercively enforcing the principle of neutrality, which would dangerously threaten the exceptional dynamic of innovation of which this network is the stronghold, so pertinently described in this witticism ascribed to Vinton Cerf[3]:

"Take a plate of spaghetti inside a spinning washing machine trapped inside a rotating cement mixer attached to a rubber band and dropped off of a rope bridge during an earthquake. Please describe the ketchup's movement."

The argument against regulation naturally flows from this striking image. It is thanks to the traditional absence of regulation that the Internet is a constantly changing thread, which creates new connections and deletes others every day for the benefit of innovators and users. The few documented cases of discrimination and anti-competitive behavior have been minor and rapidly cleared up, so why should we change direction today, why should we create laws and a body of *ad hoc* rules?

Regulation as a maieutic practice

However, using innovation's unforeseeable and self-organized character to argue that regulation is completely unfounded seems excessive. Indeed, unforeseeable does not mean that regulation cannot succeed, as long as it is designed differently. The regulator cannot decide on what technologies to adopt or what applications to invent; but he can serve as a catalyzer, a stimulator, an inciter, a trustworthy third party, in order to create the most favorable conditions for innovation to take place. This change of perspective opens the way to regulation as "maieutics", in which the regulator encourages collective invention without trying to take the innovators' place.

The maieutic regulator must agree to supplement his familiar problem-solving behavior with an approach designed to give birth to cooperative solutions, such as hearing market players, organizing forums and working groups, publishing good practices, etc. Then, like the host of a party, the regulator must not organize and feed the conversation himself, but rather must make sure that his guests feel at ease and are able to fruitfully exchange. This approach is not radically new and it was for instance already practiced in France by the *Commissariat Général du Plan* at the end of the last century; what is more original here is promoting it as a methodology of its own for regulating an industry.

This promising path has recently been followed by the ARCEP[4] in order to promote – but not impose – the respect of the principle of network neutrality, which is the necessary foundation for the full and free expression of digital innovation[5]. In this case, we observe the double distance the regulator has taken from the regulatee: on one hand, innovation is not being directly regulated, but its upstream condition, neutrality, is; on the other hand, the method of regulation is not prescriptive, but incentive-based.

The princess and the frog, Darwin and Lamarck

The innovators who invented *Google* or *Facebook* in their garage or dormitory room are like fairytale princesses who kiss frogs that transform into princes. The princess does not know beforehand whether the frog she chose will turn out to be a prince, but she

[3] American engineer and researcher born in 1943, co-inventor of the TCP/IP protocol.
[4] Autorité de régulation des communications électroniques et des postes (French telecommunications and postal regulatory authority)
[5] Cf. Nicolas Curien et Winston Maxwell, *La neutralité d'Internet*, La Découverte, 2011.

puts so much faith into her kiss that she cannot fathom any other outcome. No regulator, no planner, no monarch, however powerful he might be, could choose the right frog in her stead, nor could tell her how to kiss it, and especially could not kiss it instead of her!

Like the princess' kiss, the act of innovation is more like Kant's categorical imperative than his hypothetical imperative: instead of deciding whether or not to take initiative based on a minute examination of his chances for success or failure, the innovator creates movement by believing in it. Even though this proactive attitude promotes success, it obviously does not eliminate the probability of failure – this is the difference between reality and fairytale – so the process of innovation, like biological evolution, works based on natural selection: many projects must be aborted so that a few can prosper.

Therefore, innovation is a Darwinian[6] biological process that combines chance and necessity, alternates between trial, error, and success, and is sequential and path dependent. It is not a Lamarckian[7] process in which the innovator's hand is guided by an end goal, or is held by a regulator, like the giraffe's neck would grow longer by constantly having to stretch it to reach the highest leaves of the trees.

For a number of paleoanthropologists, the Darwinian nature of innovation is far from being a fortuitous analogy and is part of a global process of biological and cognitive co-evolution: since prehistory, a parallel can be drawn between "progress" on one hand, meaning the growing diversity of technological and cultural production, and on the other hand, the biological evolution of the human species. If Darwin, rather than Lamarck, is right about the correct interpretation of the principle of transformation that they both promoted, then the trajectory of progress should more closely resemble an unpredictable sequence of randomly selected innovations, rather than a deterministic progression of answers to problems that man successively encountered.

Faced with Darwinian innovation, the wise regulator must avoid any tendency towards abusive planning, because he knows he will never be able to replace the market's random dynamic. Because the "infostructure" of electronic communications' very value is the unpredictability of the innovations it will produce at any given time, trying to reduce this unpredictability would mean suffocating the birthplace of the digital revolution. If he were overly-inspired by Lamarck, the regulator would be tempted by economic "eugenics" and would risk creating a "*Jurassic Park*" effect by preconceiving unnatural scenarios, meaning that he might orient the supply towards services that would be rejected by the demand, or by smothering applications that are the most promising.

Therefore, the aroma of planning that emanates from the *Digital Agenda* recently adopted by the European Commission should not fool national regulators. They must remain fully conscious that their sole desire to see this calendar carried out will not affect its course, but rather, that change will depend on the market players themselves. Therefore, a wise regulator will take the regulated system's unpredictability into account,

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[6] From the name of Charles Darwin (1809-1882), an English naturalist, father of the model of natural selection according to which the evolution of species takes place over generations through the natural selection of individuals best adapted to their environment.

[7] From the name of Jean-Baptiste de Lamarck (1744-1829), a French naturalist, the first before Darwin to have proposed a transformative vision of biological evolution, thereby eradicating the theory of creationism. Lamarck's model differs, however, from that of natural selection: it supposes that creatures change in reaction to their environment, and the mutation of species takes place via intergenerational transmission of acquired characteristics, rather than by natural selection.

and, since this unpredictability feeds innovation, will ensure that it is maintained at a sufficient level, rather than suppressed. He will respect the market's spontaneity, and will abstain from inhibiting its creativity by meditating upon the message that is sent to him by George Eliot's[8] poetic expression:

"The stars are the golden fruit upon a tree out of reach."

Here, the stars are none other than the fruits of innovation, and the tree is the system of collective invention that causes them to ripen; the tree is out of reach because it grows free from any sort of planning. The regulator is the hidden character of this metaphor, and yet he is well present: he is the nurseryman, the gardener that prepares and waters the loam of innovation; a Darwinian gardener that does not try to take nature's place, but creates the right conditions for it to work; a gardener that prevents the emergence of an uncontrolled jungle without trying to design a French garden.

Although the regulator's natural tendency is to follow Lamarck by attempting to define goals and try to attain them by shaping the market's mutations, he must also be able to be Darwinian by allowing the regulated industry itself propose solutions to the problems its changes have caused, in accordance with the model of participative regulation initiated by the ARCEP concerning net neutrality. Going from Lamarck to Darwin means practicing regulation as maieutics, on the basis of round-table discussion, co-regulation, and even self-regulation by the industry. The regulator must not completely disappear, but rather becomes a facilitator for relationships between the various players in the industry.

Between under-regulation and over-regulation

Nonetheless, Darwin did not kill Lamarck, and their two points of view are more complementary than contradictory, in biology as in regulation. Thereby, the regulator that fosters unpredictability must at the same time reduce uncertainty. This is a paradox, but not an antinomy, because in order to better tap the creative sap of unpredictability, market actors need a certain amount of security: maintaining the degree of uncertainty inherent to the process of innovation would not be possible without reducing the degree of uncertainty to which innovators are subject. Therefore, the regulator will act to preserve the randomness inherent to the genesis of innovation, and at the same time will make innovators' environment less uncertain. His definitive goal is to provide market players with the confidence they need to innovate, and to temper "exogenous" uncertainty in order to keep up "endogenous" uncertainty.

Somehow, the regulator is like a bus driver in foggy weather: confronted with uncertainty concerning technologies and applications, he ensures the safety of his passengers – the market players – and must therefore adapt his speed in function of his visibility and the power of his headlights. If he drives too slowly, too prudently, going so far as to stop his car on the side of the road, he "over-regulates": then, the driver-regulator certainly prevents dangers caused by the fog but, so doing, he reduces the market's dynamics to immobility. By attempting to eliminate all exogenous uncertainty, he also dries up all endogenous uncertainty. On the other hand, if he drives too quickly, accelerating through turns until the market-bus drives off the road, he "under-regulates" by allowing the fog to blindly take full control of the trajectory: by attempting to give free rein to endogenous uncertainty, he allows exogenous uncertainty to destroy the system.

[8] British novelist of the Victorian era, 1819-1880.

In function of his visibility, the regulator must set his cursor at an intermediate position between the double excess of under-regulation and over-regulation: the thicker the fog, the more intense the regulation must become, because the need to ensure players' safety by reducing exogenous uncertainty is more important than promoting innovation by fostering endogenous uncertainty, and *vice versa*. The alchemy of regulation means neither over-regulating, nor under-regulating, but striking a balanced compromise between stability-inducing market oversight and freedom provided to innovators. Another illustration: if the market for electronic communications were a gas, the regulator would be in charge of maintaining it at the correct temperature. When the system is thermodynamically overheated, regulation must cool it by slowing the molecular movement in order to avoid chaos due to destructive entropy. On the opposite, when the gas is too cold, regulation must heat it up by accelerating its molecules in order to avoid the glaciation of absolute zero, caused by a lack of creative entropy.

The "physics" of regulation

Looking at regulation through the prism of physics is not simple rhetorical artifice, for the very conceptualization of the notion of regulation is precisely due to scientists, especially Ampère[9], who studied the conditions for stability of systems. Thinking about regulation's scientific foundations leads us to examine the mechanism that links regulatory devices to regulated systems. Indeed, regulation is not "absolute," but rather "relative" to the system it regulates. This is a property of interdependency that evokes the modern concept of gravitation, as defined in relativistic mechanics, which contrasts with that issued from classical mechanics' older theory.

Going along with the metaphor, the regulation of electronic communications does not follow - or no longer follows - a heliocentric model, where operator-planets orbit around a sun-regulator. Regulation more closely resembles gravitation of general relativity than that of classical mechanics: it is due to a geometric deformation of the electronic communications' space created by the market's stars, which themselves are moved by the force field they helped to generate. Thereby, we have gone from Newtonian regulation to Einsteinian regulation, which is transformed as much by market actors as it impacts them, in a loop of dynamic duality.

Notably, in order to create the best possible conditions for innovation, regulation must accept that it can be changed by the very market forces it is trying to influence. The simultaneity that characterizes this reciprocal relationship provides an original vision of regulation. We should revisit the sequential scheme according to which a phase of essentially symmetrical, reactive and adaptive regulation comes after a phase of mostly asymmetrical, proactive and prescriptive regulation, designed to limit the incumbent's power. In the relativist view of regulation, the reactive phase does not replace the proactive phase, but the two indeed coexist in osmosis, for flexible incentives and directive supervision are not mutually exclusive.

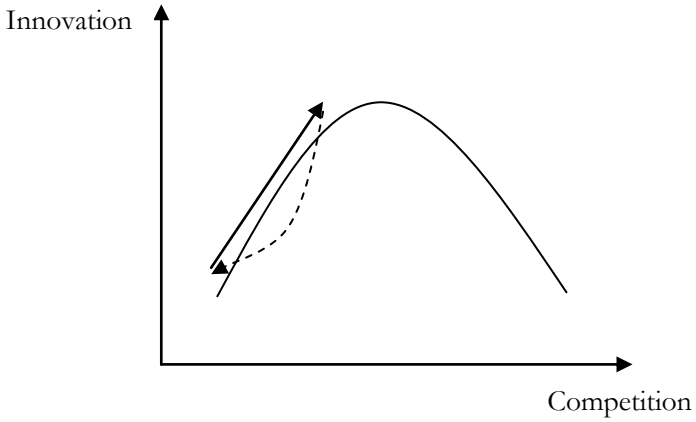
Competition and innovation

European sector-specific regulation, especially that of the electronic communications industry, is by essence pro-competitive. But does competition foster innovation? According to Frédéric Bastiat[10], "*Destroying competition means killing intelligence!*" But what

[9] André-Marie Ampère, French physicist and mathematician, 1775-1836.
[10] French politician and liberal economist, 1801-1850.

about the other way around? In other words, does promoting competition necessarily mean developing intelligence? Does it mean encouraging innovation?

To answer this question, economic theory has established the existence of an inverted U-curve[11]. When competition is weak and then increases, innovation increases as innovative companies thereby acquire a competitive advantage: this is the so-called effect of "escaping competition" On the other hand, when competition is intense and then gets even more intense, innovation is inhibited because the expected profit decreases as competition destroys any hope of earning money on innovation. In reality, the two opposite effects of escaping competition and rent confiscation are always simultaneously present, but the first effect dominates the latter on the rising side of the U, and the latter is stronger than the former on its descending side.



Whence the idea that regulation favorable to innovation should encourage "optimal" competition, rather than "maximal" competition. In the case of electronic communications, it is reasonable to think that the oligopolistic market structure, which prevails in Europe today fifteen years after the industry was opened up to competition, is located on the rising side of the inverted U-curve; so stimulating competition will not harm innovation. Furthermore, in relation to other industries, the considerable potential of technological advance and changes in applications for telecommunications feeds the engine of entrepreneurial innovation with a particularly powerful fuel, which stretches the inverted U-curve's domain of growth towards the right.

Lastly, in this industry, the development of competition is not so much due to a progressive increase in the number of competing firms using a stable technology as to a permanent race towards technological renewal, in which a limited number of same players compete. In other words, the innovation-competition dynamic cannot be represented by a linear left-to-right shift along the inverted U-curve, but rather describes cycles back and forth the rising branch (see figure). The game of competition is made up of consecutive matches with each new technology: today, the match is being played on the court of fiber optics, as it was yesterday on the one of copper wire; and on the court of fourth generation mobile phones as opposed to previous generations. Thereby, a virtuous cycle is born, wherein competition fosters innovation, which likewise reignites competition.

[11] Cf. Philippe Aghion *et alii*, « Competition and Innovation : an Inverted U Relationship », *Quaterly Journal of Economics*, 120(2), pp. 721-28, May 2005.

Precaution and innovation

In his dictionary of received ideas, Gustave Flaubert concisely defines innovation with an alarming exclamation:

"*Innovation: always dangerous!*"[12]

It is indeed possible to try to regulate innovation, not to encourage it *ex ante*, but to prevent, reduce, or correct its possible negative externalities on the environment or on society *ex post*. This is where the very (overly?) well known principle of precaution comes from: even though the causes cannot always be foreseen, we can nonetheless prepare ourselves for the consequences.

We must, however, make sure that excessive precaution does not nip innovation in the bud. This means that we should adopt a "principle of audacity" rather than a principle of precaution, but that we should still be cautious: innovators' main goal is "to dare," but in order to be able to dare in the long term, it is not prohibited, and is even advisable, to take a few precautions!

In other terms, we must not confuse the "risk", which is inherent in all forms of innovation and human initiative, with the "danger", which is caused by uncontrolled or poorly controlled risk. This is why we "avoid" a danger, which is precaution, but we "take" a risk, which is audacity! Regulating innovation according to the principle of audacity means allowing unforeseeable benefits *ex ante*, while remaining capable of anticipating and preventing potential collateral damages *ex post*; the undesirable opposite would mean suffocating any new ideas beforehand because of an unreasonable fear as to what they might engender.

The principle of audacity is a warning against the dictatorship of fear, and can be applied to technological innovations as well as to the invention of new services. To take an example from each register, we could say that the realization of electromagnetic waves' potentially negative effect on human health must not stop the roll-out of mobile networks, but must lead us to impose safety standards. Similarly, the advent of internet-ready television sets must not cause the audiovisual industry to stop taking initiatives, but rather must lead them to form win-win partnerships with online content producers in order to develop innovative applications that combine interactivity and access to content. In both cases, regulation is necessary, in order to ensure public health in the former case, and cultural diversity in the second. However, regulation must be designed in such a way as to allow innovation to flourish, rather than simply seeking to avoid the worst.

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Having reached the end of this brief essay on regulation's function in a digital world, the reader will have understood that the author wishes for a regulator that gives confidence rather than lessons, that controls uncertainty rather than creates certitude, that helps market actors find appropriate solutions rather than solving problems for them. Beyond a wish, this is a necessity, for history is an evolutionary process that will soon eliminate any form of regulation unsuited to the new environment that the digital revolution has created.

[12] Gustave Flaubert (1821-1880), *Dictionnaire des idées reçues*, 1913.