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ORIGINAL ARTICLE

Second-Order Innovation: modelling the context of invention: lights on Italy in the 1960s

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The aim of this contribution is to consider Italy during the 1960s in order to model contemporary innovation dynamics. The purpose is not only for collective memory retrieval but primarily for de-constructing the innovation circuit and re-constructing it by means of a more sophisticated and detailed frame. A glossary of eigenvalues will be suggested through the concepts of garbo, cenacolo and pollinator; moreover, this glossary will be tested in two case studies: those of Olivetti and Bialetti. Starting from a simpler and circumscribed innovation regime, the final objective is to supply theoretical tools and support policy design in the actual "dark age", in which the message is drowned in a sea of noise and where people begin to confuse hoaxes with signals, thus polluting communication and forcing a causal interpretation of casual relationships.

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1. THE GOLDEN AGE: A LOOK TOWARDS THE NEW ITALIAN LANDSCAPE

Italy after the Second World War experienced an "unexpected belle époque" (Calvino, 1961) with GDP growing at an average rate of 6% and a national income per capita doubling in the decade 1954-1964 (Toniolo, 2013). Although at the beginning of the 1950s, only one third of Italian families bought meat more than once a week (Bocca, 2018), the beef consumption per capita would double in less than ten years, reaching 27 kg in 1961 (www.fao.org), representing astonishing growth, both in terms of quantity and of quality. After almost two decades of fascism, a new entrepreneurial vision was free to extend across a larger time scale and new products, conceived to satisfy latent needs, appeared on the market. A change in the structure of social life was fostered by a widespread diffusion of radio and television as a "powerful means of linguistic unification" (Migliorini cit. in De Mauro, 1973, p. 107), contributing to the (re-)construction of an Italian identity.

Before thematizing some distinct features of the qualitative side of this belle époque, well interpreted by artistic avant gardes, it is worth mentioning two macroeconomic determinants, as a result of which scholars have termed this period a "miracle". Firstly, Italy belonged to the group of countries that had access to industrialization in its third phase: Italy was "the last among rich

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countries and the first among poor countries" (Amatori, 2016) and it has been capable of exploiting the Gerschenkronian "advantage of backwardness" most effectively. Secondly, it is not a "miracle" based on the increase in consumption, but on the increase in investments. As a non-intentional outcome of the failure of agrarian reform, there was pressure for an internal migration, from the poor regions of the South to the industrial cities and districts in the North, especially Milan and Turin. In addition, a self-financing process of huge investments for big companies was possible due to the low cost of labour. The early success of motor factories is not accidental:

> *"the great desire of the Italian people [was] to recover and return to normal life, primarily by satisfying two pressing demands – for housing and for increased mobility – which would be made possible by stepping up manufacture of motorcycles, and – especially – of automobiles at reasonable prices" (Amatori, 2011, p. 164).*

Italy became a country capable of running at "100 km/h" along four development axes: steel industries, telecommunications, infrastructures and oil industries, mainly located in the North Central region of Italy. However, the pressing demand for increased mobility ran along the Autostrada del Sole, the motorway connecting Milan and Naples inaugurated in 1964 and punctuated by service stations. With construction starting in 1953 and renowned architects (Bacciocchi, Bianchetti, Bega, Nervi, Ratti, Bacigalupo) taking responsibility for the design, these beautiful buildings were one of the weapons used to start a "beneficial arms race", a symmetrical schismogenesis (Bateson, 2000) between public and private companies in providing assistance to an ever increasing number of motorists, further contributing to the "booming" growth of this industry.

Besides all these elements, we need to consider the aforementioned history from a second-order perspective, in order to emphasize the systemic conditions which fed the invention and allowed it to circulate during the Italian "golden age".

2. Second-order innovation

Italy became a country capable of running at "100 km/h" along four development axes: steel industries, telecommunications, infrastructures and oil industries, mainly located in the North Central region of Italy. However, the pressing demand for increased mobility ran along the Autostrada del Sole, the motorway connecting Milan and Naples inaugurated in 1964 and punctuated by service stations. With construction starting in 1953 and renowned architects (Bacciocchi, Bianchetti, Bega, Nervi, Ratti, Bacigalupo) taking responsibility for the design, these beautiful buildings were one of the weapons used to start a "beneficial arms race", a symmetrical schismogenesis (Bateson, 2000) between public and private companies in providing assistance to an ever increasing number of motorists, further contributing to the "booming" growth of this industry.

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> *"may come as a shock only to those who let their thinking be governed by the principle that demands that only the rules observed in the past shall apply to the future. For those the concept of 'change' is inconceivable, for change is the process that obliterates the rules of the past" (von Foerster, 1972, p. 38).*

In our attempt to model the production of innovation during the Italian "golden age", we started with the material relating to the studies and based it on an incremental innovation process

(first-order innovation), in order to consider a second-order innovation where the component of non-incremental invention plays a dominant role in a specific sense. Episodes of second-order innovation have a peaking nature (taking place on a tight timescale) and, à la Kuhn, they represent a crisis of the current scientific paradigm and a shift to a new one already available (Cerroni & Simonella, 2014, p. 51). We could also see them as examples of innovation à la Prigogine, where, despite the (illusion of) irreversibility of the Second Principle of Thermodynamics, an "unexpected (…) order through fluctuations" (Prigogine, 1977) may appear. This is the von Foerster's principle of "order from noise".

Italian economic growth (the "Italian-style" economic growth) during the "miracle" is the consequence of a peculiar ability to find solutions to constrained optimization problems where one of the constraints is the low level of investment in research and development. The Italian case, then, is not so much that of an economic growth without a "technical change" (or technological shift); it rather shows the importance, within the innovation, of the variation element of the invention and, therefore, of the abductive capabilities of certain entrepreneurs, artists, intellectuals and scientists. Italy during the 1950s was characterized by the Schumpeterian entrepreneur, a category that does not feel restricted by national geographical horizons and the main feature of which is the capability of adapting imported technologies in order to produce (and export) a mainly incremental innovation (Amatori, 2011). However, the Schumpeterian typology is probably not the most fitting with which to analyse the second-order innovation. For Cerroni and Simonella, the innovation is more likely to be realized by a person with low status (they do not have prestige to lose) or by newcomers (who carry with them the privilege acquired in other disciplines, attracted by scientists with a higher status). A lower status also implies a low individual inertia, as confirmed by the two authors:

> *"the individual has no explicit awareness of the style of thinking, that exerts a natural condition that is impossible to contradict (…). This style leads him to see, interpret and solve problems in one and only one way. It is as if a constraint existed that dictates the rules for the formation of concepts and gives shape to the culture of that epoch" (Cerroni & Simonella, 2014, p. 34).*

A low individual inertia, combined with a redundancy of available solutions, is the status that characterizes improvisation, and it is necessary to switch to a new frame of reference in the shortest possible time. In other words, a perceived uncertainty in some aspect of life, combined with an amount of unused resources available in the context, may act as an accelerator for imagination, a sort of compressed spring that snaps in one direction. "The overall idea came from happenstance (…). Art comes forth when someone doesn't know what he is doing" (Munari cit. in Bellasi, 2004, p. 39). These actions are based on non-standard logics (Micheli, 2018), peculiar of a highly non-linear and chaotic environment where, thanks to a very low inertia (intrinsic instability and redundancy) and to the presence of an inner gyroscope (see the notion of garbo in the next paragraph), the second-order innovator can re-adapt him(her)self in times and ways beyond anyone's reach.

To conclude these preliminary notes, if the incremental innovation of the Italian "golden age" can be seen primarily as the industrial work of the Schumpeterian typology of entrepreneurs, taking a second-order innovation perspective (centred on the role of invention) permits us to enrich the model of explanation with qualitative factors, such as characteristic figures of the artistic and cultural-industrial panorama of that age. We call them pollinators and they act on different scenarios as nodes of typical social networks that we will call cenacoli. It is, therefore, necessary to introduce a glossary of the second-order innovation.

3. MODELLING THE INNOVATION: A GLOSSARY

3.1. The concept of *Garbo*

In the "noisy" Italian macroeconomic scenario after the Second World War, in which a second-order innovation can be generated, some concepts emerged as keywords to explain the process and the outcomes. The first term is related to what we can now suggest as being the "Italian way" of doing things, the Italienischer Gusto, well known for centuries and only able to be translated into a musical language through the genius of J. S. Bach and his perfect mastery of polyphony. In respect of gusto, we have preferred to use the term garbo, which identifies a "balanced quantity" of gusto, more than an arbitrary definition of it. In this sense, garbo implies an objective quality in thinking and making things, shared by a group across class differentiation. In English, garbo could be positioned in the middle ground and rendered as courtesy, politeness, mild manners, kindness, gentleness, grace, lightness, suavity; it is mainly associated with the shape of objects (with the optimum shape of objects). The optimum shape is the (unique) solution to a constrained optimization problem (where constraints are numerous and various in nature), the formal qualities of which "are not only the external features but are principally those structural and functional relationships which convert a system to a coherent unity both from the point of view of the producer and the user" (Maldonado cit. in WDO).

In association with this definition of design (dated 1969), the constraints of industrial reproducibility of the object (and, mainly, of its shape) and its economy, the garbo is meant to be the additional constraint to which the object of Italian design must comply, and which distinguishes it from all the other objects designed as a solution to the same problem. The object of design, endowed with garbo is the optimum maximum (Ottimo Massimo was the dog in Italo Calvino's Baron in the Trees) solution. It is the one enveloping the function of the industrial object with a surface of minimum extension; it represents the minimum surface for a given function, managing at the same time to hold the maximum density of significance. Indeed, design represents the best ratio between constraint (a given set of constraints) and possibility. The variety and numerousness of constraints to which the design problem is subjected, is what distinguishes and enhances the capacities of Italian designers. "The greatest freedom arises from the greatest rigor", claimed Victor Vasarely: creativity is expressed at the highest level when the number of constraints to be satisfied is the greatest. The optimum shape, the "skin" of the minimal surface that separates the system-object from the external world, represents the equilibrium, the structural order between the catabolic phase, the anabolic phase and the tension reduction, in accordance with Kohler's law of Dynamic Direction "which reduces tension not by dissipating or degrading energy but by organizing it according to the simplest, most balanced structure available to a system" (Arnheim, 1971, p. 31). This surface tension reduction is plastically represented by a fold that "unfolds" (Deleuze, 2004), stretches and simplifies and, by simplifying, progresses. As Bruno Munari stated "to simplify is to progress".

The object featuring a design with garbo possesses to the greatest degree the characteristics of "necessity or inevitability (it could not be different from what it is) and simplicity (it describes with the fewest number of concepts a wide variety of phenomena)" (Dirac & Barone, 2019, p. 24). In the pursuit of a "necessary" or "inevitable" shape, the designer is guided and comforted by Theorem no.3 of Gordon Spencer-Brown's "Laws of Form": "The simplification of an expression is unique. That is to say, if an expression e simplifies to an expression es, then e cannot simplify to a simple expression other than es" (Spencer-Brown, 1972, p. 14).

The optimum maximum design, as a converging feedback process, made possible thanks to the ability of the designer to get in and out of the point of view using a "conversational" approach à la Glanville, is therefore, the result of a mutual influence between base and superstructure, a ballet

between two points of view. The order from noise, represented by the optimum design object, can be seen as a form of structural self-organization that can be autopoietically perceived by an external observer only: in order to obtain it, the designer must have the lowest individual inertia, combined with the highest redundancy, that is the ability to create a universe of possible worlds and then converge (swerving constantly between "in" and "out") to the "plastic precipitate" representing the unique optimum solution to the constrained problem.

Does the design of the "boom years" represent a maximum point of an ideal representation of garbo as a function of time? Certainly at the end of the "golden age", we witness the rupture of the triadic balance between forces indicated by Arnheim: the form that, by losing its ornaments, could shrink to the function and wrap it, thus minimizing the surface and satisfying in a unique way (the optimum one) all the conditions that the design problem poses; the same form has, for a certain reason, to simplify the model representing the problem, by relaxing some constraints. The distinction between the design object and the environment is no longer made by the mark of Spencer-Brown (the ultimate possible simplification): a gap is created between the form and what it wraps and conveys, between the system and its boundaries, between the membrane and the external space, between in and out. This crawl space is the effect of an approximate solution to the constrained optimization problem: it represents the sgarbo, the plastic measure of a false appearance.

3.2. A Landscape of *Cenacoli*

> *"If chance favours prepared minds, it particularly favours those at work in microenvironments that make for unanticipated socio-cognitive interactions between those prepared minds. These may be described as serendipitous socio-cognitive microenvironments" (Merton & Barber, 2002, pp. 259–260).*

We have termed those transdisciplinary teams, highlighted by Merton, that make interactions possible between "prepared minds" (open, redundant, with low individual inertia) cenacoli ("cenacles"). Their role is, among others, to make real the admonishment of Heinz von Foerster: "I shall act always so to increase the total number of choices". That is to say, cenacoli enable individuals with extremely low inertia and redundancy, to increase the number of choices (the number of possible worlds between which to move) passing from one cenacolo to another by using a serendipitous (abductive) approach, thus producing innovation in respect of the constraints.

> *"In particular, the larger the distance in the semantic content between the two statements of the major premise, the greater will be the discovery power of the abductive syllogism". And the greatest discovery power will be obtained "when the logical antecedent [in the major premise of abductive syllogism] is contrary-to-facts, i.e., counterfactual" (Manfredi & Micheli, 2015, p. 12).*

Etymologically, cenacolo is the act of having lunch together with guests but it is also the dining room, as a place to stay and to invite guests. Moreover, cenacolo can be a meeting place for artists and men of letters, a place where supper is consumed, where bread of angels (Dante) is consumed and shared. Since Silvestro Severgnini, director of Rivista Pirelli (houseorgan of Pirelli Company), in a programmatic article written in 1951 employs the similarity of "culture as bread", a cenacolo, therefore, may also be defined as a "place" (not necessarily a physical place), dense in relationships, where a multidisciplinary culture is shared and eaten: cenacolo is a Dantesque "banquet of wisdom".

Milan, between the 1950s and the 1970s, was "punctuated" by cenacoli acting as evolutionary accelerators in a cultural sphere, encouraging an "interdisciplinary critical mass" essential for the

boost in incremental innovation. Remarkable examples of cenacoli were represented by art gallery groups (cultural movements linked to the territory but capable of maintaining a dialogue with other movements on an international level), private houses and informal places (Sottsass-Pivano Milanese home, the Jamaica bar), intellectuals and influential entrepreneurs, institutions (Brera Art Gallery, La Scala Theatre, La Triennale), the editorial staff of magazines and periodicals, public and private companies.

Some of the places with the greatest variety of disciplines were the houseorgans. Conceived as magazines to promote the company among employees in the 1930s, although already active at the end of the 19th century, the houseorgans crossed the boundaries of the company-publisher to appeal to a wider and heterogeneous audience, by means of broadening the variety of contents. There were more than 80 houseorgans in Italy during the "miracle years": "institutional" magazines (such as Civiltà delle Macchine within Finmeccanica, Rivista Pirelli within Pirelli, Comunità within Olivetti, Gatto selvatico within Eni, Stile Industria within Triennale, Esso Rivista within Exxon Mobil Corporation and many others) however, there were also "niche" or "underground" magazines (Azimuth, Room East 128, Pianeta Fresco, Methodos, Cenobio, Il Verri, Il Mulino, Officina, Il Caffè, etc.).

The birth of these cenacoli succeeded one other at a very high frequency: they formed a "pulse train", a thick succession of peaks at a short temporal distance from one another that could be regarded as a continuous signal, as a "broadband network" (Bologna, 2016) that raised the social "noise" level, especially in Milan. The transmission of culture through a broadband network composed of an extraordinary succession of cenacoli was also the mechanism by which trade union conflict in Milan during the end of 1960s was made possible. Broadband networking also allowed a

> *"huge transmission of expertise and knowledge from one factory to another, from one city to another, during a period with an extremely high turnover in the factories. There are factories that replace 10-15% of the workforce, there are people leaving then returning, transmitting their knowledge, coming back from emigration with great industrial experience" (Bologna, 2016).*

The knowledge workers were perhaps the most aware of the potential represented by the city in terms of the efficiency and efficacy of the circulation of information: "in the metropolitan melting pot the job opportunities are generalized and spread with unparalleled efficiency by all business organizations" (Berta, 2008, p. 135). Milan was, therefore, a landscape extraordinarily full of cenacoli; these constituted a dense network of contacts, similar to the forest that enabled Cosimo Piovasco di Rondò, the Baron in the Trees of Italo Calvino, to continuously "travel around the world, thus trumping the monkey that in ancient times was said to travel from Rome to Spain without ever touching the ground" (Barenghi, 2019, p. 243). On the high and thick branches of the lush forest formed by the cenacoli during the years of the "miracle", many artists and intellectuals, new versions of Cosimo Piovasco di Rondò, moved nimbly. Each time they moved, they carried with them the network of relationships they created and the cultural stimuli that could spread along those arcs: they acted as cultural pollinators. Leonardo Sinisgalli was one of them: as an engineer and poet, he was an "abductive intellectual" himself, finding ways to connect disciplines as far apart as possible, thus enhancing a cross-breeding effect between them. On the website of the foundation dedicated to him, all the disciplines in which he engaged and played the role of pollinator, are listed: poet, narrator, essayist, publicist, art critic, translator, art director, director, documentary maker, radio author, draftsman (www.fondazionesinisgalli.eu), thereby implying the numerousness and the variety of his cenacoli. In particular, he was able to identify and exploit better than others, the

importance of the houseorgans, and was capable of accurately interpreting the cultural situation of these years:

> *"There is a great flowering of houseorgans; it is easy to predict that their number will increase year on year and that every branch of industrial, financial or simply commercial activity will have an information bulletin of some kind, either large or a small" (Sinisgalli, 1952).*

Giuseppe Lupo painted a detailed picture of the links and the collaborations that Sinisgalli was able to cultivate and take with him to new magazines, like Pirelli and Civiltà delle Macchine, which he was requested to take over (Lupo, 2001). During his stay in Milan as an advertising consultant at the beginning of the 1930s, Sinisgalli managed the technical office for advertising at Olivetti, "a new Bauhaus" (Lupo, 2016, p. 14): here he came into contact, among others, with Edoardo Persico (founder of Il Milione art gallery, director of Casabella magazine and teacher at ISIA art school), Giò Ponti (architect and designer, director of Domus), Guido Modiano (typographer and graphic designer who invited him to join Edilizia Moderna). In the Pirelli magazine, scientists and engineers could access details on the Nobel Prize for Literature, awarded to Montale and Quasimodo; in the magazine Civiltà delle Macchine, Quasimodo, Cantatore, Caproni, Gentilini and Mafai travelled throughout Italy, disseminating information on the reality of the big factories: "By favouring the dialogue between science and humanism, art and literature, advertising and design, Civiltà delle Macchine represents the Sinisgallian process that best sums up and interprets the multidisciplinarity and interdisciplinarity of poet-engineers' thoughts and work" (Campus, 2013, p. 34).

The garbo represents the moral characteristic of a cenacolo, the place where a more efficient crossbreeding between disciplines becomes possible. The cenacolo acts as a "high-pass filter" by selecting solutions with garbo to constrained optimization problems: its thickness allows the abductive approach necessary to solve the problems of constrained optimization when garbo is one of the constraints, thus contributing to the generation of second-order innovation. At the end of the "golden age" the thickness of the cenacoli decreased, the garbo weakened and the mutual interactions acting in the broadband networking mechanisms were no longer as efficient. When the perspective vision is lacking and the space of possibilities is shrunk, a weakening is generated in the systemic thought process that renders possible the plastic precipitate represented by the object with garbo. The object generated by a less dense, less efficient network of cenacoli will be able to convey a lower density of meaning, thus influencing to a lesser extent the environment into which it has been inserted and the people who use it, thereby starting a malicious schismogenetic process.

4. THE FAILED DOCKING

It is again Italo Calvino who reminds us that "every belle époque ends with the gunshots of Sarajevo". The dense forest that allowed Cosimo to move easily without touching the ground, suddenly changed its configuration:

> *"Trees seem almost to have no right here since my brother left them or since men have been swept by this frenzy for the ax. And the species have changed too; no longer are there ilexes, elms, oaks; nowadays Africa, Australia, the Americas the Indies reach out roots and branches as far as here" (Calvino & Colquhoun, 1977, p. 217).*

"The failed docking", "the miracle bag snatched", "we had the moon", "the touched miracle", "the missed country", "the Italian style miracle": these are just some of the expressions used by historians, politicians, economists and sociologists to baptize the end of the 1960s, when the first signals of globalization appeared and the chain of impulses created by the cenacoli began to lose their density.

Franco Amatori pointed out five main reasons for the "vegetation change" in the Italian industrial landscape: 1) the failure of frontier technology projects (electronics, chemical and nuclear, personified by second-order innovators, such as Enrico Mattei, Felice Ippolito and Adriano Olivetti); 2) the degeneration of the state-entrepreneur after the successes of the 1950s and 1960s; 3) the nationalization of electric energy, carried out in the worst possible way; 4) the crisis of large entrepreneurial families, not only on account of the statistical destiny of grandfather, son and nephew, highlighted by David Landes, but also due to an absence of protection for stock market investors (Consob was born in 1974); 5) the long autumn of trade union conflicts and the inability to manage the changes of such an important period, when 17 million Italians relocated from their place of residence (Amatori, 2017).

The upper range of the temporal interval defining the "economic miracle" is quite nuanced: it can be identified in the "warm autumn" of the workers' struggle in 1969 or, better, in its prodromes, namely the strikes within industrial Italy in 1967 (Bologna, 2016). However, Giuseppe Berta identifies precisely in the nationalization of electric energy, the watershed that marks the "beginning of the end", thus backdating this defining moment to 1962:

> *"the end of Mattei can be recognized as the date from which the Italian big boom came to an end, surrendering to the opaque years (...) But if you prefer a less dramatic date than 27th October, 1962 you could choose that of 16th June, when during the night the ministers gathered at Villa Madama and reached an agreement on the nationalization of electric energy, thus reshaping Italian capitalism" (Berta, 2008, p. 45).*

Some figures highlighted in a testimony of Guido Carli are useful in understanding clearly why 1962 can be identified as the peak of the "miracle" (at least from a numerical perspective):

> *"In 1962 wholesale prices went up by 30%. Labour incomes increased by 18% in 1962 and by 23% in 1963. In that year, unemployment reached its lowest historical level ever: 2.5%. In 1963 the account balance shifted to a liability of 400 billion [in Italian Lire]: the quantity of imports grew by 22%, exports slowed down. The overall balance was in deficit of over 1800 billion" (Carli cit. in Berta, 2008, p. 51).*

Italy is a country where "in the main, the entrepreneurial world had shown itself to be reluctant, even at the end of the war, to outline a course of growth that diverged from the path along which it had been moving until then" (Berta, 2008, p. 63). This attitude demonstrates a refractoriness in relation to the second-order innovation, to Richard Feynman's "perfectly reasonable deviations to the beaten track". Less than 20 years after the end of Second World War, as the president of Comit, Luigi Mattioli stated, quoting Shakespeare's Henry V, "Miracles are ceas'd" (Berta, 2008, p. 48).

5. OLIVETTI AND BIALETTI AS CENACOLI OF INNOVATION

We aim now to compare Olivetti and Bialetti, two renowned examples of Italian industrial design, with a peculiar attitude for second-order innovation, despite their different networking capabilities, business dimensions and cultural backgrounds.

The picture painted by Giuseppe Berta of the "axis of modernity" between Turin and Ivrea allows us to highlight some of the ways through which Olivetti's strategy was deployed, starting in the 1950s, under the guidance of Adriano Olivetti, son of the founder Camillo. A courageous and clear capability of adopting countercyclical corporate strategies can be perceived:

> *"Around 1950 the company went through a growth and organizational crisis (…) At that point, there were just two solutions: become smaller, reduce working hours, restrict recruitment; there were 500 excess workers. (…) The other solution was difficult and dangerous: to establish a more dynamic and audacious policy of expansion immediately. Without hesitation, the second approach was chosen" (Adriano Olivetti cit. in Berta, 2008, p. 27).*

If dynamism and audacity are the characteristics of those who act, by exploiting low inertia and redundancy to increase the space of possibilities, acting "without hesitation" cannot fail to make reference to the precept contained in Matthew's Gospel which gives encouragement to "enter through the narrow gate" (Matthew 7:13), in accordance with the positive correlation between the aforementioned constraints and second-order innovation, and with the "socialistic and evangelical" technology of Adriano Olivetti (Piovene, 2017, p. 202). This was the same vision that drove industrial restructuring, such as the quick transformation of a cotton mill on a new production site with 600 employees, dedicated to the brand-new typewriter model "Lettera 22" (Berta, 2008, p. 29). Furthermore, Olivetti applied the triadic principle of static equilibrium to the corporate structure: this self-regulatory principle, already discussed by Arnheim when he analysed the creative process, was translated into an organization where the technological push of an engineer had to be balanced by the counter-pushing forces exerted by an economist and a humanist. Another component of the strategy of Adriano Olivetti was represented by a huge investment in internal and external communication activities: advertising (and the related cenacoli), travelling exhibitions (e.g., Olivetti formes et recherche, organized in Paris in 1969 by Gae Aulenti and then continued for two years with viewings in Barcelona, Madrid, Edinburgh, London and Tokyo), magazines and houseorgans (e.g., Comunità, Rivista di filosofia, Tecnica e organizzazione, Metron architettura, Rivista Olivetti, Notizie Olivetti, etc.) published by a dedicated company. This made it possible for Olivetti (and, even to a lesser extent, for Pirelli, Eni, Triennale and others) to build up a meta-cenacolo, a thick network of cenacoli composed of other cenacoli, where denser knots could transfer energy in a cascade form to smaller cenacoli, in an analogy to Richardson's writing about the auto similarity properties of turbulent structures:

> *"Big whirls have little whirls that feed on their velocity, and little whirls have lesser whirls and so on to viscosity" (Vulpiani, 2014, p. 183).*

This situation results in an almost-fractal structure, in which every node, if enlarged, shows itself as a new cenacolo on a small scale that connects other knots, cenacoli themselves, thus enabling the creation of extremely efficient connections to transfer the information. Cenacoli, therefore, represent the "place" where the invention or component of innovation, can be produced, where it is possible to "establish a bridge between the artisan and the philosopher" (Wiener, 1994, p. 80). Cenacoli are the places where the conditions are created not only to produce optimum maximum design objects, but also to take those "perfectly reasonable deviations from the beaten track", which in the case of Olivetti was the creation of a pioneering "electronic division" and the production of the world's first personal computer in 1965. The electronic division for Olivetti was not merely a "technology" but, was much more the opportunity to own that "wide-ranging ability of a horizontal discipline, capable of performing a regulatory function in relation to all other sectors" (Perotto, 2015, p. 85). The structure, based on a meta-cenacolo, enables a relativistic approach to time and space: the distance separating Ivrea, headquarters of Olivetti, from the main international cities where Adriano Olivetti sends his best managers, is much shorter than the few meters of water between the port quay in Portofino and the yacht on which the industrial tycoon Rinaldo Piaggio used to eat his dinner alone,

to emphasize the difference between him and entrepreneurs like Olivetti, engaged in a "contest of demagogy" (Berta, 2008, p. 11).

From the rich meta-cenacolo of Olivetti, we now move to the peripheral and less dense landscape where Bialetti lived and grew up, and where he had the exceptional insight to foresee the huge potential of the new-born television advertising.

At the beginning of the 20th century, in Crusinallo, a small village close to the Swiss border and too far from the Milanese relational dynamics associated with "broadband social networking", was the firm Bialetti, specializing in aluminium processing. In 1933, Alfonso Bialetti invented a new domestic appliance that would revolutionize the way that coffee was brewed at home: the Moka Express, an example of a non-incremental innovation that, at least at the start, could be developed even without the cenacoli and their "dense landscape". The invention of the coffee maker by Bialetti is another example of a solution to a constrained optimization problem: the use of aluminium to manufacture the Moka became necessary due to a shortage of steel (mainly destined for the war industry) and indulged the fascist autarchic policy that saw aluminium as the material symbol of the 20th century. Moreover, the physical principle on which the operation of the Moka was based, was similar to that of the manual washing machine (so called lisciveuse) used by housewives in Crusinallo and abductively applied by Bialetti to his new espresso coffee maker. The coherently art déco shapes of the Moka followed the dictates of the garbo and got closer to an ideal of aesthetic perfection, as Alessandro Mendini admitted, when he defined it as a "limit, absolute perfect tool" and a "machine or instrument ever more sophisticated and perfect that (...) looks like a satellite (...) intended to land on the moon" (Mendini, 2014).

However, for a quantitative boost to production, at the beginning of the 1950s, to progress from 1,000 to almost 20,000 units per year, two more steps were required: the use of "non-standard" relational skills, based on the ability to make the most of unexpected occasions (improvisation); the use of one of the most dense and contaminated cenacoli: Carosello. The undeniable proof of improvisational capabilities was provided by Renato Bialetti, son of the founder Alfonso: acting as a "situated agent", he "absorbs information from his surrounding environment, modifies himself according to it and, in turn, modifies the environment itself. A similar process also occurs in jazz improvisation" (Chella & Manzotti, 2011, p. 65). Bialetti, therefore, played like a skilful jazz musician being able to turn the casual and unrepeatable nature of an exceptional encounter to his favour:

> *"I was in the lobby of an hotel with French customers and, at that time, the coffee maker was a novelty to them. They were perplexed and doubtful, and I was afraid of being unable to close the sale. Just then Aristotle Onassis came by, he was going to the bathroom; I plucked up courage and followed him, and I said: "I am a young Italian entrepreneur, please help me, since you started from nothing as I have. When you come back to the lobby please say that you are using one of my products, that would be very helpful to impress those tough customers". I went back, convinced and resigned to the fact that Onassis would walk past. Instead the miracle happened. Onassis, pretending to see me at the last moment, turned around, he gave me a pat on the back saying, "Renato, how are you? You know, I have never tasted a coffee as good as the one brewed by your coffee maker!" (Renato Bialetti cit. in Amato, 2013)*

Renato Bialetti was able to understand the communicative potential of Carosello, one of the most powerful and meaningful tools which analysed the Italy of the "boom years". It was a television programme broadcast every evening continuously from 1955 to 1977 (with rare exceptions: the religious celebrations of Good Friday and All Souls' Day, the deaths of Pope Pius XII and Pope John

XXIII, the Piazza Fontana terrorist massacre, the assassinations of John and Robert Kennedy, etc.), described as follows by one of its founding fathers, the cinematographic director Luciano Emmer:

> *"What is a carosello?*
>
> *Very short movies aimed at creating humour at peak viewing times, with the task of inserting the advertising message at the end, after having grasped the viewers' attention. This message was strictly forbidden from eclipsing the story being told" (Croce, 2008, p. 5).*

Carosello, like the garbo, is a structured and structuring structure:

> *"For 10 minutes during the evening and over the first twenty years of this celebration of consumerism, we pass from the warmth of the community (the Gemeineschaft of Tönnies, to be pretentious) to the secularized, disenchanted and abstract society, the Weberian Gesellschaft (...). It does not take much to transmit the relentless effect of reflections, or even a series of concentric circles from the screen, through which Carosello establishes the rules of conduct to which society adapts; the advertising will then strengthen present and future behaviours and attitudes of the middle class, and will programme codes and patterns of even more «advanced behaviour»" (Berselli, pp. v–vi).*

Carosello was undoubtedly a cenacolo, a node of a multidisciplinary and interdisciplinary network that facilitated cross breeding and produced non-incremental innovation. Its sketches (in which very famous artists were often played, such as Totò, Eduardo De Filippo, Dario Fo, Joséphine Baker, Brigitte Bardot, Louis Armstrong) were written and directed by distinguished representatives of Italian culture of that era: in addition to the aforementioned Luciano Emmer, we remember Sergio Leone, Valerio Zurlini, Pier Paolo Pasolini and Federico Fellini. The images which appeared in the opening sequence, created and directed by Emmer, were painted by Netta Vespignani, wife of the painter and scenographer Renzo Vespignani, founder of the urban culture magazine Città aperta, together with Ugo Attardi, Elio Petri, Italo Calvino and Elio Vittorini. It was not so obvious to recognize the potential of Carosello in the 1950s, if we consider that during the same period, convinced of the belief "No réclame, I dislike réclame", one of the biggest textile industrialists, leading a group of almost 5,000 employees, would lay the foundation for the dissolution of the whole industrial sector in little more than a decade (Berta, 2008). On the contrary, Renato Bialetti invested to a great extent in communication through Carosello, also inspiring his friend and graphic designer Paul Campani to create the cartoon, "Little man with the moustache", the character which from then on, became a hugely popular ambassador of the company. The six million viewers who watched Carosello every day, at suppertime, would boost the sales of the Moka Bialetti from 1,000 pcs/year during the pre-war period to 18,000 pcs/year during the period of the "boom".

6. CONCLUSIONS AND PERSPECTIVES

The 1960s (lato sensu) could be viewed as a peculiar period for the development of a non-incremental innovation, intended as a product of an abductive approach, made possible by two characteristics of the "boom" era: the cenacoli and the garbo. This form of innovation had a cybernetic nature, strongly dependent on the intensity and density of the relationships inside the cenacoli, acting as a sort of "condensation point", capable of producing more intense relationships. The ease with which information travels in a cenacolo is in direct proportion to the density of the cenacolo itself and to the frequency of its birth: this enables a "broadband structure" to be formed that enables the pollinators (figures that can be identified both in cultural and industrial contexts: Leonardo Sinisgalli, Luciano Berio, Ettore Sottsass, Giulio Natta, Enrico Mattei, Bruno Munari, etc.)

to move from one cenacolo to another (or to create a brand new one) with minimal energy expenditure, and bringing accumulated stimuli as a dowry. What remains of a garbo-based innovation process is a twofold outcome. Firstly, it is a "plastic precipitate", stable over time and space, represented by optimum design objects featuring unique characteristics. Secondly, as briefly explored in our case studies, it is associated with a specific relational ethos which combines the value of "desirable duty" as an advantageous target for the whole of society (Cerroni & Simonella, 2014, p. 40), with financial success and prestige.

Our pilot study in second-order innovation is intended to direct further research towards the exploration of the possibilities of our time, turning on appropriate "lights" to enlighten our contemporary darkness. Taking seriously the purpose expressed by Margaret Mead in one of her consistent contributions to cultural change, we can analyse the specific conditions on which the emergence of the cenacoli is based, namely design action and policy for renewal. "These clusters we can construct, if we will" (Mead, 1964, p. xxii). That, in turn, implies a "second-order decision": we must "decide to decide" (see Micheli, 2018 and Luhmann, 1993). Our goal is to understand the innovation contexts and, if possible, replicate them. Indeed, the model elaborated so far is constructed by a set of terms for innovation and by a mechanism for its diffusion; in order to replicate the innovation contexts, the variables in the model must be well defined: "Even in a quantum world, by using the right variables (still unknown) you should be able to recover the determinism of nature" (Vulpiani, 2014, p. 105).

Transforming the qualitative considerations into quantitative would be recommended. This can be done by analysing the characteristics of the social networks along which the innovation associated with garbo travelled during the years of the "economic miracle", by means of the tools of mathematical sociology. Moreover, apart from pollinators, it could be interesting to investigate the role played by other categories of actors in the networks in which the second-order innovation is expressed, for instance the gate-keepers (Lewin). With the term gate-keeper we are referring to people located in the tight spots of the "stream" (of information) and capable, by means of small actions at that point, to generate a considerable modification of the stream itself, or even to influence the course of events so much as to provoke "catastrophic" discontinuities (Thom, Giorello & Morini, 1980, p. 81). For instance it would be interesting to further analyse the role played by Vittorio Valletta, who considered the Olivetti Electronic Division as "a threat, a mole that must be cut away" (Gallino, 2011, p. 11) thus yielding it to General Electric; or the action of Eugenio Cefis who dismantled the dreams and the network of international alliances amassed by Enrico Mattei.

In conclusion, we have made a modelling effort to enlighten the actual "dark age", where the message is drawned into a sea of noise, and people start to confuse hoaxes with signals (Silver, 2013), thus polluting communication and forcing a causal interpretation of casual relationships. The horizon for such a research requires to explore the remains of a thick miraculous Italian forest and to expand the set of identified eigenvalues in the corresponding model. The outcome will be an even more precise and useable map of the trees on which, as Cosimo Piovasco di Rondò, we could climb again, this time never having to descend.

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