



The legacy of Luigi Orsenigo as a scholar and as a friend. Remarks at the Conference in honour of Luigi Orsenigo at Bocconi University on December 2018

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The legacy that I would like to talk about is that of Gigi as a scholar and as a friend, which in my case are closely intertwined and overlap.

Gigi has been a major actor in two major developments that shaped the way we look at the economy today. One was the emergence of *innovation studies* as a field: here Gigi was in the first group of researchers that entered this new field after it was founded. He contributed with so many relevant and original contributions which strengthened the field in its original areas and also widened it in new directions, such as innovation and industrial transformation, role of institutions and science. The second development was *the rise and establishment of evolutionary theory* to which since the 1980s Gigi enthusiastically gave his contributions with many papers and books on various aspects: the empirical analysis of innovation, the evolution of industries and the modelling of industrial dynamics.

Intellectually, Gigi grew up in those vibrant and exciting times of the SPRU of the 1980s. These were times of ferment because, at SPRU, a group of scholars and researchers greatly contributed to the way we think about innovation, economic change, industrial transformation and industrial dynamics. Gigi arrived as a fresh Ph.D. student coming from Bocconi University and was soon immersed in that unique atmosphere.

In the years at SPRU, while deciding, writing and completing his Ph.D. Gigi received strong stimulus, inspiration and ideas from three people that represented a core aspect of SPRU in the 1980s. One is *Chris Freeman*, the founder and the leading figure of SPRU with his path-breaking work on technology and the economy, on the relevance and complexity of industrial transformation, and on the role of institutions and history. From Chris, Gigi took a broad view of innovation and learned the importance for a scholar to ask big questions that challenge the conventional wisdom. The second is *Keith Pavitt* with his keen interest on innovation in industries, his search for sectoral patterns of innovation and his unique, deep and unconventional

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view of technologies and industries. A lot of Gigi's interest in industries and firms, in the details and in the contexts in which innovation takes place, comes from the deep and broad view of Keith on technologies and sectors. The third is *Giovanni Dosi*, at that time a SPRU Ph.D. student a few years ahead of Gigi, who became one of his long-time friends. Giovanni has exerted a pervasive and profound influence on Gigi, with his passion for radically changing the way economists think and with his forceful embrace of evolutionary theory.

From those exciting years at SPRU, Gigi emerged with a research program that aimed to tackle the major challenges related to a broader understanding of economic change and industrial transformation. This theoretical and empirical design had solid foundations in evolutionary theory, the key role of innovation, the central place of economic dynamics and the pervasive effect of institutions in economic change. This design accompanied Gigi throughout his life.

Looking at his work over his life span, Gigi's contributions cover a large number of areas and topics. It is not the place here in my remarks to review Gigi's scientific contributions in a detailed and deep way. Suffice it to say that Gigi examined the role of science in innovation; the pervasive presence of networks among scientists, universities and firms in biotechnology and pharmaceuticals; and the articulated and often complex relationship between university and industry. He also contributed to a better understanding of innovation diffusion and its modelling and of the then relevant view of linearity in the innovation process. Gigi also discussed extensively the role of IPR in innovation and the need to develop consistent public policies –in terms of industrial policy, antitrust, regional policy and even vaccine policies - able to trigger, affect and stir the innovation process.

All of these topics were tackled by Gigi in his typical way: original, sharp and rigorous, but also challenging. His writings usually included broad discussions that would connect various aspects and theories in a consistent and thought-provoking way. And even when he was theorizing, Gigi always started from an examination of the empirical dimension, careful to pay attention to the stylized facts related to the topic he was examining. Based on this empirical analysis and on realistic behavioural and organizational assumptions, Gigi then proposed an appreciative theory. And when he laid down formal models, he was always guided by the consistency of formal theory with empirical phenomena: in other words, his modelling was always empirically grounded. This is a typical evolutionary methodology.

In Gigi's work throughout his lifetime, it is possible to identify four key areas of research that actually establish his legacy:

1. One area is his work on *industrial transformation*, the emergence of novel technologies and new industries, and the institutions that foster and then accompany this change, with the *pharmaceutical industry and biotechnology* as key reference points. This part of Gigi's work is in the spirit of Chris Freeman and Alfred Chandler, who were concerned with a broad analysis of industrial transformation, the role of large firms and the key role of institutions. Starting from his Ph.D. dissertation, his examination of the pharmaceutical and biotechnology industries illustrated the effects of an emergent techno-economic paradigm, the key influ-

- ence of science, the complex role of institutions such as IPR, the dynamics of networks of actors and knowledge and the changing role of large pharmaceutical companies and new biotech firms.
2. The second major area is Gigi's work *on sectoral patterns of innovative activities and the learning environment* that affects them, in the spirit of Josef Schumpeter and Keith Pavitt. Gigi moved beyond the identification of sectoral patterns of innovation as discussed by Pavitt, by linking the two basic Schumpeterian patterns of innovation to the learning environment that characterizes different sectors - the technological regime, defined in terms of opportunity, appropriability and cumulativeness conditions, and the knowledge base.
 3. The third area refers to *industrial dynamics*, with a specific focus on firms' patterns of growth and the persistence of innovative activities, in the spirit of Simon and Bonini in their discussion of Gibrat's law, and of Paul Geroski. Here Gigi linked the dynamics of firms and their persistence in innovation to the heterogeneity of firm learning and capabilities and to the characteristics of and change in technologies.
 4. Finally, Gigi contributed to the development of *evolutionary models of industrial change*, in the spirit of Richard Nelson and Sidney Winter. With history-friendly models, a new way of modelling the evolution of industries, starting from an understanding of the specificity of the industry and its evolution, was proposed. Then, on that basis, one could develop dynamic models of innovation, firms, competition and changes in market structure. History-friendly models have been considered a second generation of evolutionary models because they pay attention to the heterogeneity of the context- in this case the industry- in which firms act, and to the specific evolutionary path of an industry. But these types of models can also move from the specific to the general, thus allowing a better understanding of some specific properties of industrial dynamics. When developed for a set of industries, generalization on some aspects of industry evolution can be proposed in an evidence-based way.

Gigi's scientific and intellectual legacies go hand in hand *with his personality*. He was intellectually curious and read broadly and extensively. He had a unique style, an extraordinary sense of humour and a strong sense of friendship. Gigi was passionate about the things he believed in. He was collegial and interactive, a key member of the invisible college and of the international community of innovation scholars and evolutionary economists, in which he continued to participate and contribute until his departure. The International Schumpeter Society always had Gigi among its participants and most active members. In these conferences as well as in other gatherings related to workshops and seminars, Gigi loved to discuss for hours (and after hours), often in front of a beer in a pub, on a wide variety of topics, sharing his ideas and his points of view with intensity and sharpness that, true to his spirit, always provoked interesting debate.

As a *friend and co-author*, Gigi was a great person to interact with and to work with. He was a highly creative and curious non-conventional thinker, and constantly enthusiastic about our common research.

Our work relationship dates back to the early 1980s. We were both from Bocconi, but we did not meet for the first time in Bocconi. We met during a coffee break at a workshop at IRS (Istituto per la Ricerca Sociale), a research center in Milan focused on economic policy that used to gather many un-orthodox economists from the various universities of Milan. I still remember our first meeting, because over small plastic cups full of mediocre coffee, we soon started talking about a variety of things, from his on-going experience at SPRU and mine at Yale, to our research interests that magically overlapped. Very interesting, nice and funny guy, I thought. Over the next months we met a few times at some scientific events. But the key moment in our collaboration was during his final year of the Ph.D. at SPRU. He came to Milano from Brighton for a few days. It was the second half of the 1980s and I was then a young teaching fellow at Bocconi. We met in Bocconi and, while walking towards the Bocconi bar for a coffee (with Gigi coffee breaks and any other type of break were always welcomed!), we started talking about the great differences in the patterns of the organization of innovative activities across sectors and of the need to do something together on this topic. Our discussion started of course from Schumpeter, Pavitt and Nelson and Winter, and then moved on. We decided to illustrate, assess and explain the major differences in the patterns across technologies and industries by using patent data and conducting the analysis at the firm level for both incumbents and new innovators. I remember we continued to talk intensively after that coffee and for a long time. We were very excited about the idea of not only pinning down the patterns of innovative activities at the firm level, but also exploring the key evolutionary mechanisms at the base of these differences.

So, we decided to move on forcefully in this direction. I started to work on the general framework while Gigi went back to SPRU with the mission to get the printouts (yes printouts!) of the rough and not cleaned patent data at the firm level for a lot of countries and technologies. And when he came back to Milan with this rough and uncleaned patent data, we started to work intensively on our first paper on Schumpeterian patterns of innovation, which was published in 1988. This was more than 30 years ago. By the way, Gigi and I were supposed to celebrate this anniversary in 2018, but obviously we were not able to do it.

A lot of work by Gigi and me on Schumpeterian patterns of innovation and technological regimes took place at the mythical *CESPRI* during the 1990s and the early 2000s. *CESPRI* was a research center at Bocconi, specialized in internationalization, innovation, and related policies. *CESPRI* was a very informal and open place, full of dynamism, enthusiasm and intellectual energy, that one could see flaring up continuously in seminars, meeting rooms and even in the long narrow corridors of the Center. *CESPRI* represented a unique place for the intellectual ferment and for the generation of our ideas, but also for the great warmth and unique friendliness (and also unique fun) that one could experience every day. Plus the composition of the center was in constant flux because, in addition to the senior and the younger researchers, visiting fellows would frequently come by in a very informal but stimulating way and students doing their thesis for the Italian “laurea quinquennale” would work side by side with the older researchers. At *CESPRI*, Gigi and I shared our new ideas and views with many of the people that

have now become integral parts of the international scientific community interested in innovation and industrial change.

Later on, Gigi and I became involved with the *Gang of Four* (as Tim Bresnahan would call us): Richard Nelson, Sidney Winter, Gigi and I. The Gang of Four is responsible for the development of *history-friendly models*. It all started in the late 1990s in a hotel room, one late afternoon after a conference, when the four of us met. In that hotel room and in a meeting that followed soon after, the Gang of Four started talking how the current evolutionary models could not model the evolution of industries that were so different, as it had emerged from so many empirical studies. I was bringing the examples of the evolution of the semiconductor and the computer industries and Gigi the ones of the pharmaceutical industry and biotechnology. The four of us converged to the view that formal models could complement the appreciative theory and the histories of the evolution of industries. So, we decided to launch a research project that would try to capture and represent in a formal way the richness of the different patterns of industrial evolution by developing models that would highlight the specificity of those sectors. The four of us became soon convinced that this research would represent a second generation of evolutionary models, following the seminal contributions originated by the 1982 book by Nelson and Winter and by the efforts of other evolutionary scholars such as Stan Metcalfe and Giovanni Dosi. In this way, history-friendly models were born. That research program kept Gigi and me quite busy for two decades.

I do not want now to start bringing in other personal memories of specific episodes of my work life with Gigi. There are so many episodes with him that it would take hours to remember all of them. I only would like to remember our routine of working together. Actually, it was not a routine at all. We enjoyed working together because it was a cocktail of hard work, intense discussion, fun and plenty of jokes. In the breaks of our working days, Gigi would show his unique and sharp sense of humor, his incredible memory for old funny episodes and his great ability of recounting in full detail paradoxical situations, which he or the two of us experienced, with masterful descriptions of people and events. And of course, we shared our common passion for Milan, our soccer team. Sid Winter and Dick Nelson can witness the excuses that Gigi and I found in order to break up our work during the weekends in New York working on our history-friendly book, in order to catch the Milan games that were played back in Italy. All of these are great unforgettable moments.

In conclusion, the legacy of Gigi is centered on his many contributions on evolutionary theory, economic dynamics, innovation and institutions, all related and connected in the grand research design that I mentioned earlier and that Gigi embraced many years ago.

Destiny came too early to take Gigi away. He was still in his full creativity and had so much productive and intellectual energy. Even few days before his final departure, Gigi was discussing with me about new projects that we were supposed to do together. Gigi's human, intellectual and scholarly legacies will always be with us. We all miss him deeply, but especially I miss him.

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