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► **To cite this version:**

Faridah Djellal, Faïz Gallouj. The laws of imitation and invention: Gabriel Tarde and the evolutionary economics of innovation. 2014. halshs-00960607

HAL Id: halshs-00960607

<https://shs.hal.science/halshs-00960607>

Preprint submitted on 18 Mar 2014

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**The laws of imitation and invention:
Gabriel Tarde and the evolutionary economics of innovation**

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Abstract

Gabriel Tarde was a French sociologist and criminologist whose work is rediscovered from time to time. Economists of innovation have paid insufficient attention to an author who devoted a large part of his work to the laws of imitation and invention. The purpose of this paper is threefold. The first is to give a succinct account of these laws of imitation and invention. The second is to re-examine and extend the debates on the similarities between Schumpeter and Tarde. The third and main purpose is to examine the similarities, hitherto unexplored to the best of our knowledge, between Tarde's work and contemporary neo-Schumpeterian and evolutionary theories.

Keywords : Tarde, Schumpeter, evolutionary theory, innovation, imitation.

Introduction

Gabriel Tarde (1843-1904) was a French sociologist and criminologist whose name crops up repeatedly in lively controversies in contemporary sociology. Whether he is regarded as a minor thinker (Muchielli, 2001, 2004) or as a giant unfairly eclipsed by another (Emile Durkheim), nobody seems indifferent to him. It might even be said, paradoxically, that the energy expended on attempting to demonstrate the relative insignificance of his work actually has the opposite effect.

Economists, for their part, have paid insufficient attention to Tarde's work. And yet 'The Laws of Imitation' ('Les lois de l'imitation' 1890 [1993]) and 'The Social Logic' ('La logique sociale' 1895 [1999]), two of his main works, contain – implicitly or explicitly – many of the ideas that lie at the heart of evolutionary theories of technical change and innovation. The aim of this paper, therefore, is to try to establish or to strengthen the relationship between 'The

Laws of Imitation and Invention' and neo-Schumpeterian and evolutionary theories of innovation.

More specifically, the paper has three objectives.

The first is to give a succinct account of 'The Laws of Imitation', Tarde's major work. According to Tarde, these laws of imitation are universal laws that apply not only to the social sciences but also to the natural sciences (the living world and physical phenomena). Thus imitation is the main element in social cohesiveness (there are two others: opposition and adaptation). Society is not defined by the economic criterion (or law) of utility (mutual exchange of services) and division of labour but by the criterion (or law) of imitation. It is made up of individuals who resemble each other because they imitate (or counter-imitate) each other.

The second objective is to re-examine the similarities between Schumpeter's vision and that of Tarde. Some of these similarities have already been examined in a number of papers (a small number, admittedly). Due attention will be paid to these studies here, but further studies are required. It would seem that Schumpeter drew inspiration from Tarde, although he does not cite him in any of his works on innovation theory and refers to him only in a footnote in his 'History of economic analysis' (Schumpeter, 1954 [1983], p. 65). Thus it is said to be Tarde who provided the inspiration for Schumpeter's analysis of the relationship between entrepreneurs and innovation (Nahavandy, 1958; Piètre, 1966) and who, more generally, laid the foundations for a theory of economic development, before Schumpeter and the philosopher Bergson (Taymans, 1950).

Our last and principal objective is to try to show that evolutionary economists have made inadequate use or even no use at all of Tarde's work, particularly the 'Laws of imitation', and that certain arguments in favour of an implicit link can be defended. It would seem, after all, that certain hypotheses and a not insignificant number of concepts in evolutionary theory are more or less explicitly formulated in 'The Laws of Imitation' and, more generally, in Tarde's work. To the best of our knowledge, however, there is no allusion to this work in the studies that laid the foundation of modern evolutionary economics (particularly those of Nelson and Winter, Freeman, Dosi, etc.).

1. Imitation as a universal law

‘The Laws of Imitation’ is one of Tarde’s most important books. The author’s purpose in writing it was to lay the foundations of a ‘pure’ or ‘general’ sociology whose laws would be free of the contingencies of space and time (Tarde, 1890 [1993], p. XXII). The general argument Tarde advances can be summarised as follows. In sharp contrast to Durkheim’s approach, Tarde argues that social development is determined not by general laws of a vague, impersonal or transcendent nature, external to individuals, but rather by ‘individual renovative initiatives’, which could be described as inventions, discoveries or innovations. These innovations are spread by imitation. Thus the basic principles of social development are contained within the invention-imitation pairing. ‘Socially, everything is just inventions and imitations’ (Tarde, 1890 [1993], p. 3).

The starting point for Tarde’s analysis is his identification of a universal phenomenon of repetition. His aim in ‘The Laws of Imitation’ is twofold: firstly, to reveal the manifestations of that phenomenon in the social world and, secondly, to identify its logical laws and extra-logical influences.

1.1. Universal repetition and social imitation

According to Tarde, repetition and resemblance are universal phenomena that determine the existence of all sciences (whether exact or social). After all, it is knowledge of resemblances and repetitions that makes it possible to count and measure phenomena. Thus, for example, in order to establish a cause-and-effect relationship between events, that relationship has to be repeated or repeatable. Repetition may take particular forms, one of which is growth or increase (increase in the number of followers of a religion, in the number of cells in a growing body, etc.). However that may be, without counting or measurement, virtually no science is possible. In the social sciences, the synonym of repetition is imitation.

It is universal repetition that explains similarity, whether social, biological or physical. Thus similarities in the social world are the direct or indirect consequences of various expressions of imitation, whether determined by fashion, custom, sympathy, obedience or education, whether deliberate or instinctive, etc. ‘Each instance of social similarity has its origins in imitation’ (Tarde, 1890 [1993], p. 40). Physical and biological similarities can be explained,

respectively, by vibratory movements (repetition being synonymous with vibration) and by heredity (repetition being synonymous with generation). Thus vibration, generation and imitation are the three main (interdependent) forms of universal repetition. When social similarities do not appear to be explicable as the results of a system of repetitions (for example, in the absence of any links between the actors), it is very often because the repetition is manifested in the other registers (biological or physical) or because time has erased all traces of the original invention that is the source of the similarity.

The repetition mechanism that is at work in the social world, namely imitation, has certain interesting characteristics. Firstly, it is subject to a law of geometric progression. In this sense, Tarde would seem to be a precursor of innovation diffusion theory, and in particular of the S curve, in both economics and other disciplines (Rogers, 1995; Kinnunen, 1996; Marsden, 2000). Secondly, this repetition is never mechanical, which means that an innovation is modified and reconstructed in the course of the imitation process. In other words, imitation (and, more generally, repetition) does not lead to a world characterised by convergence and monotony. On the contrary, it of necessity produces differentiation and variation. 'Thus repetitions are favourable to variations' (Tarde, 1890 [1993], p. 7). Whether the objects of imitation are the words of a particular language or the myths of a religion, for example, they are modified in the process of imitation, as a result of changes of context, being passed from one race or nation to another, from one firm to another, etc. Thirdly, imitation can be vague or precise, conscious or unconscious, voluntary or involuntary. Finally, separate imitation processes may come into contact with each other and either strengthen or compete with each other.

This deliberation on the universal nature of repetition leads Tarde to put forward a new definition of society. He begins by rejecting the economist's definition of society as a separate groups of individuals who perform services for each other. Instead of this definition based on the exchange of services or utility and on the division of labour, he advances one based on the principle of resemblance and imitation. Thus a society is made up of individuals who resemble each other (because they imitate each other or, as he adds in the preface to the second edition of the 'Laws of imitation', counter-imitate each other). 'Social beings, by virtue of their very socialness, are by nature imitators' (Tarde, 1890 [1993], p. 12). Education, for example, is an instrument of imitation. Thus society was born when one person imitated another. But if society is imitation, what is imitation? According to Tarde (1890 [1993], p.

80), ‘sociologists must hand over to psychologists’ if this question is to be answered. After all, imitation pure and simple is akin to sleep-walking (‘To have only received ideas while believing them to be spontaneous: this is the illusion to which both sleepwalkers and social man are prey’ (Tarde, 1890 [1993], p. 83). However, social development (multiplication of the mutual imitation flows) makes ‘this sleepwalking, this enslavement to imitation, increasingly personal and rational’ (Tarde, 1890 [1993], p. 90). Thus faced with a multiplicity of complex imitation flows, the sleepwalker acquires a degree of freedom to choose, depending on his character and certain logical laws.

1.2 The logical laws of imitation and extra-logical influences

According to Tarde, the general laws that govern acts of imitation (which explain, for example, why only ten of every 100 innovations become widely diffused) can be divided into two groups: physical and social. Having adopted a theoretical perspective based on ‘pure, abstract sociology’, he quickly dispenses with physical laws (for example, the influence of climate, geography, etc.) in order to emphasise social causes, which he divides into two categories: logical causes (or laws) and non-logical causes (or laws).

The logical causes of imitation are those that lead an individual to choose (to imitate) an innovation, on the grounds that he considers it to be ‘the most useful or most well-founded’, that is the one that accords most closely with his own goals or principles (which, it should be noted, are themselves established and internalised through imitation). The extra-logical causes are analogous to a subjective assessment of the innovation on the basis of its individual, temporal or spatial origins (reputation, etc.). There are two mechanisms that can be used to describe them. The first is that imitation operates from inside individuals towards the outside. Paradoxically, therefore, internal models (i.e. personal goals or ideas) are imitated before external models (i.e. means or expressions). The second is that imitation operates on the top-down principle (from the superior to the inferior). In other words, the innovations associated with entities (individuals, groups, places, even dates, etc.) assumed to be superior are more likely to be imitated than those associated with inferior entities.

Of course, this distinction between logical and extra-logical factors is ideal-typical, since the logical causes of imitation seldom manifest themselves in a pure form. In other words, extra-logical factors, such as the prestige or poor reputation of the purveyor of the innovation, his

geographical or historical origin, also play a role. Thus it is quite often the case that the worst options for imitation from a logical point of view are, for extra-logical reasons, given preference over better choices.

Another important question concerns the content or substance of the basic social acts of invention and imitation. Tarde's answer is that they can ultimately be reduced, on the one hand, to beliefs and, on the other, to desires (i.e. needs). Thus belief and desire are the two basic social and psychological factors that form the substance of invention and imitation. Societies are organised around converging or competing beliefs. Similarly, they function on the basis of converging or competing desires (i.e. needs). In other words, social progress, whatever it may be (like individual progress, incidentally), is driven by two mechanisms: 1) the substitution of one discovery or invention (that is of a need or a belief) by another, a process that Tarde denotes by the term logical combat or duel ; 2) accumulation, that is the addition of one invention or discovery (that is of a need or belief) to another. This process of mutual reinforcement is described by Tarde as a logical union or pairing (or even combination).

The desire for combat or union and the outcome of that combat or union depend on the forces of imitation. The logical duel (yes/no, choice between two religions, two theories or two commodities) is initially an individual matter. It is when it has ceased to be individual, that is when an individual has made a choice (that is, when he imitates), that it becomes social. As long as an individual hesitates, he is not imitating. However, 'it is only in so far as he imitates that he is part of society'. The logical duel can have three different outcomes: 1) the natural and irresistible propagation of one of the alternatives; 2) violent substitution; 3) the emergence of a third alternative (innovation) to displace the others. As far as the logical pairing is concerned, Tarde proposes a distinction between those inventions or discoveries that can accumulate indefinitely (e.g., the words of a language, the myths of a primitive religion or the listing of scientific facts) and those which, beyond a certain threshold, have to be replaced (grammar, the dogmas of a religion, scientific theories, etc.). The multiplication of 'logical pairings' contributes to the development of coherent corpora or systems.

2. From the laws of imitation to the laws of invention: Tarde and Schumpeterian theories

As we have just noted, imitation and invention are closely linked, but different phenomena. In ‘The Laws of Imitation’, Tarde does of course tackle the question of invention, but it is the mechanisms or laws of imitation that occupy a central position. It is in ‘La logique sociale/The social logic’ (1895 [1999]) in particular, as well as in a short article published after this book (‘L’invention, moteur de l’évolution sociale/Invention, the engine of social development’ Tarde, 1902b)¹, that he focuses his analysis on ‘the laws of invention’. Schumpeter’s theories and those of Tarde have a certain number of similarities which, with a few exceptions (Taymans, 1950; Nahavandy, 1958; Piettre, 1966; Marco, 1985), have been ignored in the economic literature.

Our purpose here is to describe the similarities between Schumpeter and Tarde. These similarities can be divided into two groups: those relating to the nature of invention and innovation and those relating to their dynamics and mechanisms (laws).

2.1 The nature of invention and innovation

As far as the nature of invention (innovation) is concerned, the similarity between Tarde and Schumpeter can be considered at different levels, the first being the distinction between invention and innovation, the second their broad and open concept of innovation and the third the importance they both attached not only to the novelty criterion (even relative novelty) but also to the combinatory nature of innovation.

Invention versus innovation

In Tarde’s theory, *invention* is an ‘engine of development’. For his part, Schumpeter (1939 [1982], pp. 84-86) makes a very clear distinction between invention, which for him is an extra-social, continuous and cumulative phenomenon, and innovation, which is a discontinuous social phenomenon. For Schumpeter, it is *innovation* that lies at the heart of the economic dynamic. Nevertheless, the hypothesis of a similarity between the two authors is not weakened by this apparent semantic divergence (Taymans 1950). After all, Tarde also

¹ This article is the text of an address given on June 11 1902 to the Paris Sociological Society.

makes a very clear distinction, within the general category of inventions (or ‘individual initiatives’, ‘successful initiatives’ or even ‘innovations’), between *theoretical inventions* (which meet ‘the need to believe, affirm or deny’, Tarde, 1902b, p. 565) and *practical inventions* (which meet ‘the need to desire, want and act’). Logically and chronologically, the former precede the latter ‘and continue even after they have run their course’ (Tarde, 1890 [1993], p. 189). Tarde also makes a distinction between *accumulable inventions* and *substitutable inventions*. Thus ‘only scientific discoveries can accumulate ceaselessly, while industrial innovations (as means of action) frequently replace each other’ (Tarde, 1902b, p. 565). Translated into the language of Schumpeter, the first terms (theoretical inventions and accumulable inventions) of the two preceding alternatives are clearly synonymous with invention, while the second terms (practical inventions and substitutable inventions) are synonymous with innovation.

A similarly broad and open concept of innovation

Schumpeter’s approach to innovation is acknowledged to have been considerably broader and more open than the traditional approaches in economics. Thus his well-known typology encompasses product, process and organisational innovations, as well as those involving new raw materials and new outlets (Schumpeter, 1912 [1999]). Tarde’s concept of innovation is even broader and more open than Schumpeter’s, to the extent that it goes beyond purely economic phenomena to encompass all social phenomena (innovation in the military, legal and artistic spheres, for example, as well as in industry). It should also be noted that Tarde clearly preceded Schumpeter in offering a precise formulation of the notion of ‘innovation based on new outlets’. ‘An invention being, after all, only the product of a singular conjunction of heterogeneous imitations in an individual’s brain, (...) anything that opens *new outlets* to the different rays of imitation tends to increase the chances of similar singularities’ (Tarde, 1890 [1993], p.100).

Novelty but not necessarily radicality

For both Tarde and Schumpeter, invention (innovation) is defined by the novelty criterion. This does not mean, however, that such novelty is necessarily spectacular. A minor or incremental invention (innovation) is just as important (and often even more so) than a radical invention (innovation). It can manifest itself at the most modest of levels. Schumpeter (1947, p. 150) took the view that it was absolutely essential to consider this phenomenon ‘even at the humblest levels of the business world’, while Tarde (1898 [1921], pp. 145-146) believed

we had too great a tendency to speak ‘of great men when in fact we should be speaking of great ideas, which often come from very small men, or even of small ideas, of the tiny innovations each of us contributes to the common enterprise’.

The combinatory nature of innovation

Another idea (which extends this deliberation on novelty, while at the same time addressing other aspects of the nature of innovation) seems to be common to both Tarde and Schumpeter. This is the notion that invention (innovation) is combinatory in nature. For Schumpeter, indeed, to innovate meant to introduce ‘a new (productive) combination’. If innovation is synonymous with novelty, then it is essentially the product of a new combination of previously existing elements. Innovation is association, as Tarde never ceases to point out: ‘Invention is always, by its very nature, an intersection of imitation rays, an original combination of imitations’ (Tarde, 1902b, p. 565). ‘Our innovations are, for the most part, combinations of previous examples’ (Tarde, 1898 [1921], p. 36). ‘All new machines are made up of old tools and old procedures, differently arranged’ (Tarde, 1902b, p. 565).

2.2 The mechanisms of innovation

A certain degree of similarity between Schumpeter’s and Tarde’s approaches can also be detected in the ‘mechanisms’ of innovation, that is in the causes, logics or laws of innovation, as well as in the nature of the actors involved and their roles. Schumpeter, of course, advanced the hypothesis that economies function not in a state of static equilibrium but as closed circuits, which remain closed until an individual with particular talents – the entrepreneur – intervenes. An entrepreneur introduces ‘new productive combinations’, possibly by socialising old inventions. These innovations break the circuit, thereby unleashing immensely powerful forces that sweep away the old and replace it with the new: ‘destructive competition’ and ‘waves of creative destruction’. This dynamic of innovation and the notion of the entrepreneur as the key actor seem to be already present in Tarde’s work.

a) The innovation dynamic

Tarde described, before Schumpeter but in strikingly similar terms, several aspects of the innovation dynamic, whether they fall within the scope of circular flow theory, development theory or (economic) cycle theory.

Circuit theory

Tarde described, very evocatively, what Schumpeter was subsequently to call the ‘stationary circuit’ or ‘circular flow’. For Tarde, after all, invention is the (new and original) result of an (original) combined imitation of previously existing inventions. If the new combination produces no novelty or originality, then there is no invention (innovation). ‘Without it (originality), we would always be going from one thing to the same thing, from equations to equations, and there would never be anything really new’ (Tarde, 1902b, p. 568). This is a configuration which, as Taymans (1950) points out, is very reminiscent of Schumpeter’s ‘circular flow’ theory, that is a (hypothetical) economy, without entrepreneurs or innovation, that is not static (since it functions as a closed circuit, reproducing itself in identical fashion from period to period) but stationary. This is an economy whose production functions remain unchanged, since no new productive combinations are introduced. Thus ‘we would be going ... from equations to equations’ could, according to Taymans (1950), be interpreted literally.

Development theory

Economic development, that is exit from the ‘stationary circuit’ or the ‘hypnotic state’, occurs when the entrepreneur intervenes, bringing ‘individual initiative’ with him. Both Schumpeter and Tarde recognise the existence of other forces driving development, but they both regard innovation and the innovator (entrepreneur) as the fundamental cause (‘the guiding, decisive and explanatory force’, in Tarde’s words (1902b, p. 562). For Schumpeter (1912 [1999]), economic development is essentially the result of the introduction into the ‘circular flow’ of a ‘new combination’ (in one of the five forms listed above).

Furthermore, as Taymans (1950) points out, both authors argue that individual initiatives (i.e. innovations), which in themselves are ‘small (driving) forces that are both accidental and novel’, set in motion colossal, constant, irreversible and lasting forces, just as ‘the beating of a bird’s wing triggers an avalanche’ (Tarde, 1902b, p. 592). Thus innovations are ‘small shocks’ that come about accidentally but serve as a trigger and guide for ‘large constant forces’.

Theory of economic cycles

A certain degree of similarity between the approaches of Tarde and Schumpeter can also be seen in their analyses of economic cycles (Taymans, 1950).

If its starting point is defined as the moment of invention (that is, the point at which a variation is grafted on to imitation flows), Tarde's cycle (which is not strictly economic) comprises the following three stages: 1) imitation (or repetition), 2) opposition and 3) adaptation. After all, the initial invention begins by being the subject of multiple *imitations*. These imitation flows then enter into competition with each other: they come up against and oppose each other. This is the *opposition* phase, which denotes 'a balance of forces and symmetry of forms, (...) a struggle between living organisms, (...) a battle among all beings' (Tarde, 1898 [1921], pp. 9-10). Finally, this opposition is resolved, either through the destruction of the imitation flows or through *adaptation*, which signifies 'creative joint production' (Tarde, 1898 [1921], pp. 9-10), that is the emergence of a new invention. 'Repetition, opposition, adaptation of phenomena (...) these three terms constitute a circular series that is capable of going on and on for ever. It is through imitative repetition that invention – the basic means of social adaptation – spreads and becomes stronger and tends, through the conjunction of one of its own imitation rays with an imitation ray emanating from some other invention, whether old or new, either to arouse new struggles or, perhaps directly or perhaps as a result of such struggles, to yield new, more complex inventions, which in turn will soon be radiating out imitatively, and so on indefinitely' (Tarde, 1898 [1921], pp. 106).

In 'Business Cycles' (1939 [1982]), Schumpeter describes economic cycles as having four phases, which extend from the point preceding a period of prosperity to the end point of a recovery (Perroux, 1965). These four phases are: 1) prosperity; 2) recession; 3) depression; 4) recovery. In phase 1, the innovation is introduced by the innovator. In phase 2, 'it is absorbed by the system'. For both Schumpeter and Tarde, this means that it is the object of imitation by competitors (opposition). It spreads and loses its status as an innovation. In phase 3, 'the system is brought into a level lower than equilibrium'. Diffusion leads to the loss of the entrepreneur's monopoly and the gradual disappearance of his profits. In phase 4, equilibrium is gradually restored, before a new period of prosperity begins.

There are obvious similarities between these two descriptions of the economic cycle. In both, the economic cycle begins with an innovation. They both include an imitation phase. The 'opposition' that Tarde often compares to war and likens, in the economic sphere, to 'competition' (as 'social opposition of an economic order' (Tarde, 1898 [1921], p. 91) is very close to what Schumpeter calls 'destructive competition' and which he regards as 'a knife

war' (Schumpeter, 1942 [1963], p. 117). 'The sole value (...) of opposition is that it generates tension within the antagonistic forces capable of arousing the spirit of invention in order to produce, for example, the military invention which, by giving victory to one camp, brings the war to a temporary end, or the industrial invention which, when adopted or monopolised by one of the competing industrialists, will ensure he triumphs, thereby putting an end temporarily to competition' (Tarde, 1898 [1921], p. 167). Industrial competition is defined by Tarde (1890 [1993], p. 171) as a series of 'multiple duels, which may be successive or simultaneous' between the existing invention and new inventions.

However, Marco (1985) points to several differences between the two authors' analyses of economic cycles and crises. For Schumpeter (1939 [1982]), after all, it is innovation that is the sole factor capable of explaining economic cycles (regardless of whether they are long or short, incidentally). In Schumpeter's view, Juglar cycles are triggered by minor innovations, while Kondratieff cycles are set in motion by clusters of innovations or by major innovations. Economic crises are the result of obstacles to innovation, that is disruptions caused by the implementation of the new combinations and the way in which entrepreneurs emerge (Perroux, 1966, p. 76). Tarde, for his part, offers two different explanations depending on the type of crisis. 'War crises' are caused by aggressive innovations, while 'decline crises' arise because of the excessively routine nature of certain innovations.

b) The nature of the entrepreneur

As far as the nature and role of the entrepreneur are concerned, Piettre (1966) takes the view that Schumpeter's contribution lies more in its form than its content. 'Thus Schumpeter's originality lies less in the *substance* of his arguments than in the *manner* in which they are expressed' (Piettre, 1966, p. 287). After all, in developing his concept of the entrepreneur, Schumpeter is said to have borrowed the notion of the entrepreneur as coordinator from P. Leroy-Beaulieu and J.-B. Clark, the dynamic role of the entrepreneur from J.-B. Say and the basic link between the entrepreneur and innovation from G. Tarde.

In 'The Laws of Imitation', Tarde never uses the term 'entrepreneur' as such, but rather the term 'inventor'. However, just as there are two different types of invention (theoretical inventions and practical inventions), so it can be said that there are two types of inventors. It

is the inventor associated with the second type of invention who can be likened to Schumpeter's entrepreneur, the other type being an inventor in the sense of scientist.

In 'The social logic', a lengthy work, the term 'entrepreneur' is used only in Chapter VIII, which is entitled 'Political economy'. Here, the entrepreneur (at least in a large factory) is considered in terms of 'his foresight and ability to combine factors of production' (Tarde, 1895 [1999], p. 497). The 'invention' aspect of entrepreneurship is acknowledged, but it does not appear to be the only aspect. The term 'entrepreneur' does not seem to be considered here solely from the perspective of innovation. The entrepreneurship's relationship to risk is also dealt with. 'When we state that the entrepreneur's profits are, in part, compensation for the risks he has taken, we are acknowledging the legitimacy of such compensation. The keener desire awakened in the entrepreneur's heart by the lure of a profit considerably greater than his workers' wages compensates him for being much less certain of success than they are of receiving their pay' (Tarde, 1895 [1999], p. 473).

In his 'Economic psychology' (1902a), Tarde also makes explicit use of the term 'entrepreneur'. This time, he clearly links it to innovative activity. 'Thus the entrepreneur is he who takes lasting advantage of an imitation that has become an innovation' (Tarde 1902a, p. 168). It is this innovative activity that justifies the entrepreneur's high level of remuneration and not the capital he commits. 'If they are seen as compensation for the capital committed to a particular enterprise, then the profits made by an entrepreneur considered solely in his capacity as a capitalist can certainly often be regarded as excessive and obtained at the expense of the workers' wages. Things seem different, however, if the entrepreneur is seen for what he sometimes, but not always, is, namely a minor inventor, whose invention consists of having applied known inventions in a certain way (...) In his capacity as an inventor, the entrepreneur may, after all, be entitled to the enormous profits which, as a capitalist, he could not justly claim' (Tarde, 1902a, pp. 168-169).

Thus Tarde's entrepreneur and that of Schumpeter seem to have many points in common as well as some differences.

They are exceptional personalities, endowed with particular intellectual capacities and psychological characteristics that enable them to 'break the circuit' (in Schumpeter's words) or 'disrupt the state of hypnosis' (in Tarde's words). The entrepreneur is an imitator who, by

virtue of his capabilities, is able to identify and take advantage of the innovation that emerges from the conjunction of different imitative flows. For Tarde, clearly, the key element in the laws of invention is the individual brain able to free itself from the state of hypnosis afflicting the rest of society. After all, the innovation that is produced when existing inventions are recombined can be explained in two different ways, by internal and external causes, which describe, respectively, the logical and extra-logical laws of invention (Tarde, 1895 [1999]; 1902b). The internal causes equate to the mental effort of the individual inventive mind (its beliefs, desires, etc.), the external causes to the environment (particularly the social environment) in which it develops. An innovation emerges when, in the wake of a conjunction of imitation systems ('imitation rays'), an individual brain awakens briefly from the collective sleepwalk to see an external reality from a new perspective. 'An invention being, after all, only the product of a singular conjunction of heterogeneous imitations in an individual's brain' (Tarde, 1890 [1993], p. 100).

Tarde's entrepreneur is 'audacious', a 'dreamer', spurred on by his convictions, his passions and his dreams. What motivates him is not a quest for utility and personal gain. 'There have always been bold inventors or initiators who have had grandiose dreams and extraordinary ambitions and passions.' (Tarde, 1895 [1999], p. 72). The activities of an entrepreneur cannot be interpreted by reference to traditional rationality, since they have more to do with a form of monomania and madness. 'Because of his strangeness, his monomania, *his imperturbable and solitary faith in himself and in his idea*, (...) the inventor, the initiator of any kind is (...) a sort of madman. Madmen leading sleepwalkers...' (Tarde, 1895 [1999], p. 160-161).

Tarde pits the entrepreneur (inventor) against the worker or, to put it another way, the innovator against the operator. The entrepreneur's 'work' is different in nature from that done by the operator, since one is associated with pleasure, the other with effort and difficulty. 'Although the inventor has assuredly almost always worked hard and the worker sometimes makes discoveries, the inventor differs fundamentally from the worker. To invent is a great joy; to work is always an affliction. Once the man of genius has cried 'Eureka', all his previous tiredness suddenly disappears; and indeed, however great it was, whether long or short, it is of no significance at all compared with the value of his discovery or the pecuniary advantage he will derive from it. It is joy for which he is going to be paid, not his pain. (...) And the price of his creation is proportionate to the intensity of his pleasure rather than that of his pain' (Tarde, 1895 [1999], p. 478).

Similarly, the motivations of the Schumpeterian entrepreneur are not governed (solely) by hedonism. His motives are also irrational: the pleasure of creation and an overwhelming desire for domination and power. 'The typical entrepreneur does not ask himself whether each of his exertions will ensure him an adequate surplus of enjoyment. He is little concerned with the hedonistic fruits of his acts. He creates continuously, since he is incapable of doing anything else' (Schumpeter, 1912 [1999], p. 358).

Like Tarde, Schumpeter notes that this liberation, this lucidity are also temporary. Thus once his innovation is introduced, the entrepreneur once again becomes a mere sleepwalking imitator (Tarde) or a mere operator within the circuit (Schumpeter). Similarly, for both authors, during this period of lucidity the entrepreneur is never anything other than an entrepreneur. At any given moment, indeed, this entrepreneurial function is compatible with imitative or operative functions.

For Tarde (1902b), the 'guiding forces', that is innovations, are accidental. However, this does not mean that they are unintentional or fortuitous. This could bring the two authors' analyses into conflict since, as Marco (1985, p. 98) notes, Schumpeter 'emphasises the rationality of the innovation decision'. For Tarde, innovations are actually the result of an individual will, without being calculable. They are not automatic and predictable responses (routines) to particular stimuli. Tarde emphasises the idiosyncratic, unpredictable and unprogrammed nature of the responses. Inventors (innovators) are not homogeneous, interchangeable agents, but individuals who create 'original' solutions in unique (space-time) environments. They are not engaged in routine work. Schumpeter does not say anything different.

Contrary to what Marco (1985) states in his analysis, the similarities identified are not simply terminological but also substantive in nature. Thus the hypothesis of a link or relationship between the two authors cannot be definitively invalidated even though, as Marco (1985) notes, there are also some differences between their concepts of the entrepreneur.

Thus, just as Tarde's approach to innovation is broader than Schumpeter's (because it is not limited to the economic sphere), his concept of the entrepreneur is also much broader, and for the same reason. According to Tarde, any individual can, at a given moment, be an innovator

and hence an entrepreneur. Marco (1985) notes other differences. Thus it is not the entrepreneur and innovation that lie at the heart of Tarde's theoretical framework but imitation. Secondly, whereas Schumpeter attaches greater importance to analysis of the impact of innovation on the economy, Tarde emphasises the genesis of inventions. However, the most significant difference lies in the entrepreneur's relationship to risk. Schumpeter, after all, takes the view that the entrepreneur does not bear the risks associated with the failure of an innovation, whereas for Tarde (1902a I, p. 168), as already noted above, it is this risk-taking that justifies the entrepreneur's remuneration (in his innovative activity).

3. Tarde's laws and the evolutionary economics of innovation

The main purpose of this section is to compare, from various perspectives, 'The Laws of Imitation', principally, but also other works by Tarde, with contemporary evolutionary theories of innovation. Paradoxically, contemporary neo-Schumpeterian analyses seem to have given up asserting and investigating the similarity between the approaches adopted by Tarde and Schumpeter (cf. previous section). To the best of our knowledge, none of the founding texts of contemporary evolutionary economics makes reference to Tarde's laws. Our aim here is to show, nevertheless, that while Tarde seems to share with Schumpeter the same vision of the socio-economic dynamic of innovation, he also seems (despite the fact that there is no 'neo-Tardian' school) to share that vision (also seen from different and new perspectives) with Schumpeter's theoretical successors, namely the neo-Schumpeterian or evolutionary economists.

However, none of the terms used in evolutionary theory is used by Tarde. For this reason, the hypothesis of an implicit link or relationship cannot simply be dismissed as a 'terminological illusion', as Marco (1985), for example, argues in the case of the link between Joseph Schumpeter, on the one hand, and Jean-Baptiste Say, Paul Leroy-Beaulieu and Gabriel Tarde, on the other. In other words, if its existence is confirmed, the relationship that we suspect exists will be based not on terminological similarities but on conceptual and theoretical convergences.

3.1 Similarities of hypotheses

Located at the confluence of different research traditions, notably the Schumpeterian tradition, biological theories, the thermodynamics of irreversible systems, systems theory and organisation theory, the evolutionary approach to technological change marks a break with the traditional image of technology as an infinite set of techniques, which can themselves be reduced to given combinations of production factors. Innovation is not perceived as a permanently constituted outcome, where the main issue at stake is evaluating its impact on a black box, but as an (*institutionalised*) *process* of problem resolution in which *learning* and the multiplicity of *interactions* between the agents in the organisation play a central role. The *cumulative* nature of the learning process and the *specificity* or *local nature* of the problems to be resolved reflect the existence of *path constraints* (historicity) and give this process a considerable degree of *irreversibility* (the phenomenon known as ‘lock-in’). As it unfolds, this process does not follow the dictates of substantial rationality and the maximisation principle. Rather, it is driven by *procedural rationality* and the *satisfaction* principle. Behaviours, including R&D and innovation activity, are determined by *routines*. They are *selected* from sets of routines on the basis of various principles or *selection environments*.

Thus the approach to innovation set out in ‘The Laws of Imitation’ is relatively similar to that adopted by evolutionary theorists: innovation is considered as a problem-solving process that is specific, non-maximising, cumulative, interactive and institutionalised.

Innovation as an activity intended to solve specific problems

Tarde, like Dosi (1982, 1988), defined innovation as an activity intended to *solve problems specific* to a particular environment (for example, a firm or an industry) and period of time. ‘It is true that, among those (i.e. the inventions) that will be produced, only the most useful will, as it were, survive, by which I mean those that provide the best answer to the problems of the time, since all inventions, like all discoveries, are answers to a problem. However, apart from the fact that these problems, which are always unspecified, like the needs of which they are a vague reflection, allow of the most multifarious solutions, the real question is to discover how, why and by whom they were posed, on such and such a date and not at any other, and then why such and such a solution was adopted in one place, while another was preferred elsewhere’ (Tarde, 1890 [1993], p. 49). This concept of innovation as a problem-solving process (‘innovation as problem solving’) lies right at the heart of Dosi’s definition (1988).

Non-maximising process and selection environments

This innovation process is not necessarily governed by a substantive, maximising rationality. Rather, it follows the dictates of logical and extra-logical laws. The solution adopted is not necessarily the optimum one. It is not unusual for a bad solution (judged in terms of logical rationality) to be adopted to the detriment of a better one. ‘In general, extra-logical influences (...) play a part in determining the choice of examples to be followed, and frequently the worst choices from a logical point of view are preferred by virtue of their origin or even their date of creation’ (Tarde, 1890 [1993], p. 154). The ‘*sleepwalking*’ which, according to Tarde, defines the social being, has something in common with what we will call *limited rationality*. The processes described by Tarde tend to emphasise routines (the term is used explicitly) and heuristics rather than ‘calculated’ choices. Tarde seems intuitively to have foreshadowed what evolutionary economists were to borrow from Simon (1982) (whose thinking, let us not forget, was heavily influenced by psychology, as was Tarde’s of course), namely the *procedural rationality* hypothesis, in which choice is considered as a process (determined by past experience) rather than as the outcome of that process (substantial rationality). ‘Previous discoveries and initiatives that have been successfully propagated vaguely determine the direction that will be taken by the successful discoveries and initiatives of the future.’ (Tarde, 1890 [1993], p. 21)

Tarde’s analysis of the logical causes of imitation (i.e. the diffusion of an innovation) seem to foreshadow what Nelson and Winter (1977) were to call the innovation’s *selection environment* which, they were to suggest, could be defined on the basis of the following three variables, one of which is the nature of the mechanisms of imitation: 1) the exact meaning attributed to ‘profitability’ (in the broad sense) by firms in the industry in question; 2) the nature of the influence consumer preferences and regulatory rules exert on profitability and 3) the nature and impact of the investment and imitation mechanisms brought into play.

Thus Nelson and Winter identify two types of selection environments: 1) the market selection environment, in which it is the traditional mechanism of anticipated profits that guides technological choices and 2) the non-market selection environment, in which less priority is given to the essentially financial motivation in favour of political, regulatory or professional control procedures. For example, decisions on the introduction of a new drug are assumed to be determined more by the expected therapeutic benefit than by doctors’ profits.

Tarde's 'logical causes' have certain similarities with the market selection environment. They do, after all, take account of the economic arguments, based on the notion of utility, that determine choices. Tarde's extra-logical causes, such as prestige, custom and practice etc., can be likened to the non-market selection environment. 'The logical causes come into play when a man selects an innovation because he considers it to be more useful or more authentic than the others, that is more in keeping with the objectives or principles he has already laid down (always by imitation). The only choice here is between old or more recent inventions or discoveries, with any prestige or discredit attached to their purveyors or to the time and place at which they were created being wholly disregarded. However, it is very rare that the logical causes come into play in this way in all their purity. In general, the extra-logical influences, to which I have just alluded, come into play in the choice of examples to be followed, and in many cases the worst choices from a logical perspective are preferred by virtue of their origin or even their date...' (Tarde, 1890 [1993], p. 153-154).

Cumulative process and learning

In 'The Laws of Imitation', Tarde several times stresses the cumulative nature of innovation. This cumulativeness is the result of repetition and, more specifically, of the imitation in which repetition finds its social expression. Thus Tarde is here emphasising the phenomena of learning and memory. His analysis of the mechanisms of imitation contains the elements of a debate that was to be initiated by evolutionary economists more than a century later: the distinction between individual learning and collective or organisational learning and between individual and organisational memory. According to Tarde, a distinction has to be made between learning, memory and habit as reflexive imitation (of oneself by oneself) and as mechanisms involving a relationship with others. In the first case, we are dealing with a psychological phenomenon and in the second with a psycho-social phenomenon. 'Thus all acts of perception, in so far as they involve acts of memory, which they always do, require a sort of habit, an unconscious imitation of oneself by oneself. Such imitation, obviously, is in no sense social. (...). However, if the idea or image that is recalled was originally lodged in the mind by conversation or reading, if the habitual act originated in the sight or knowledge of a similar act performed by another, then this memory and this habit are social as well as psychological phenomena. This is the sort of imitation of which I spoke so much previously. This imitation is a memory and a habit which are not individual but collective. (...) Society could not exist, take a single step forward or change without a repository of routines, mimicry

and sheep-like behaviours that have been constantly added to by successive generations.’ (Tarde, 1890 [1993], pp. 82-83)

For Tarde, the very definition of work is very closely linked to the notion of imitation and learning. ‘Work is a set of similar actions, of acts repeated by following the example of others, whether consciously or unconsciously (...). Thus work is merely one of the branches of imitation.’ (Tarde, 1895 [1999], p. 474) Over and above this apparent uniformity, however, the forms of learning vary depending on whether work is regarded as an interaction with objects, individuals, tasks, etc. After all, Tarde’s concept of learning, as expressed in the extended notion of imitation, encompasses all the dimensions of learning that contemporary adherents of the evolutionary approach have sought to highlight (Malerba, 1992) 1) learning by doing (Arrow 1962), by using (von Hippel 1976; Rosenberg 1982) and by trying (Fleck, 1994), all of which ultimately express the notion of repetition and of imitation of one’s own actions in the course of a given economic activity or interaction with a given technical object; 2) learning by interacting (Lundvall, 1988; von Hippel, 1988) and by consulting, which reflect the imitation and repetition of others’ actions in the course of a relationship with them; 3) learning by searching (Cohen and Levinthal, 1989).

Just as in contemporary evolutionary economics, this attempt to peer into the ‘black box’ and this recognition of the fundamental relationship between learning and innovation lead Tarde to conclude that learning and incremental (minor or progressive) innovations have a greater impact on (social or economic) performance than spectacular radical innovations, even though the individual impact of such innovations is insignificant. ‘Although their combined effect is extremely important in the growth of productivity, no single one has dramatic effects’ (Freeman, 1988, p. 51). The following extracts from ‘The Laws of Imitation’ also express this very same idea. ‘How much more new life is injected into our societies by work, with its accumulation of actions each modelled upon the other, than by revolutions!’ (Tarde, 1890 [1993], p. 7). ‘Despite everything, I believe that even here I was right to violate the common language somewhat by describing the simplest innovations as inventions or discoveries, all the more so since those most easily achieved are not always the least fruitful, nor the most difficult the least useless’ (Tarde, 1890 [1993], p. IX).

An interactive process

Evolutionary theory defines innovation as an interactive process, that is a process that brings into play a multiplicity of different actors (who may or may not be specialists in innovation) who are capable of establishing different types of (temporary or permanent) mutual relationships in space and in time. This approach contrasts with the traditional linear model of innovation, in which a distinction is made between specialists in innovation and the other actors (producers, consumers, etc.) and no consideration is given to any possible retroactive links between them. The best-known interactive model of innovation is probably the ‘chain-link’ model developed by Rosenberg (1982). For its part, the socio-economics of innovation (Callon, 1994) uses the image of the ‘turbulent process’ in order to describe the interactive nature of innovation. Of course, Tarde does not provide such a formalised and precise model. In his description, the interactive nature of innovation lies in the aspects already mentioned above, and in particular in the fact that invention (innovation) is not simply an activity confined to specialists but is, rather, a ‘democratised’ activity in which anyone may be involved. This interactivity is also to be found in the genetic, combinatorial and systemic approach to innovation advocated by Tarde. Thus invention and cooperation are synonymous, since inventions are jointly produced. ‘The essence of an invention is that it makes it possible to combine resources that previously seemed alien or in opposition to each other; it brings together forces that were previously opposed or in sterile juxtaposition to each other.’ (Tarde, 1987, p. 255)

3.2 Similarity of concepts

The seeds of several key concepts in the evolutionary theory of innovation are also to be found in Tarde’s works, as we will attempt to demonstrate. These include the notion of (technological, techno-economic or socio-technological) paradigm regarded as a set of artefacts and heuristics, the concept of technological trajectory and the idea of the irreversibility of technological phenomena and the concept of technological system, as well as of national or local innovation system, which is based on the interactive nature of innovation processes (Lundvall 1988).

a) Paradigm

The evolutionary notion of technological paradigm (Dosi, 1982, 1988) has its roots in the philosophy of science, and in particular Kuhn’s work (1983) on scientific paradigms. A

paradigm is a “model” and a “pattern” of solution of *selected* technological problems based on *selected* principles derived from natural sciences and on *selected* material technologies’ (Dosi, 1982, p. 152). It denotes a set of artefacts (dominant design, technological regime, technological guidepost) and problem-solving heuristics that are stable over a certain period of time. ‘A technological paradigm is both an *exemplar*— an artifact that is to be developed and improved (such as a car, an integrated circuit, a lathe, each with its particular technoeconomic characteristics)— and a *set of heuristics* (e.g., Where do we go from here? Where should we search? What sort of knowledge should we draw on?’ (Dosi, 1988, p. 1127)

Without using this terminology of course, Tarde’s work takes account of socio-economic phenomena that are extremely similar in substance to the concept of the scientific or technological paradigm. The similarities, it should be noted, go beyond the ‘static’ definition of these general concepts. They also concern a certain number of intermediate concepts associated with them that have been highlighted by evolutionary theory, as well as the (‘dynamic’) conditions under which these concepts are implemented and their links with other concepts (in particular the intermediate concepts alluded to above, as well as the notion of trajectory), together with a number of theoretical consequences.

1) In Tarde’s work, it is terms such as ‘parent inventions’, ‘social type’ and, in certain places even, ‘society’ or ‘civilisation’ that seem to denote an idea that we consider to be relatively close to the notions of scientific and technological (or socio-technological) paradigm developed by Kuhn and evolutionary theorists. After all, Tarde defines ‘social type’ and ‘civilisation’ not only as a set of inventions and discoveries (‘artefacts’) but also as a coherent set of heuristics, questions and aspirations, as the following extracts from ‘The Laws of Imitation’ seem to show.

‘Of what does this [social] type consist? It consists of a number of needs and ideas created by thousands of inventions and discoveries accumulated over the ages. These needs form a more or less coherent whole, that is they contribute to a greater or lesser degree to the emergence of a dominant desire that is the soul of an age and of a nation. Similarly, these ideas or beliefs are more or less consistent with each other, that is they are linked logically to each other, or at least do not generally contradict each other.’ (Tarde, 1890 [1993], p. 74)

‘A civilisation [is] the totality of moral or aesthetic goals [a hierarchy of needs established by unanimous judgement] and industrial means that characterise a particular period.’ (Tarde, 1890 [1933], p. 135)

'Industry strictly defined [is a] store of devices and procedures that can be used to give tangible expression to some aesthetic or set of moral standards or principles ['that is a hierarchy of needs established by unanimous judgement']. Industry in this sense is the *substance* whose *form* is determined by the prevailing ideas on justice and beauty, on the *quid deceat quid non* for what is judged to be the best way of guiding behaviour.' (Tarde, 1890 [1993], p. 196)

2) As far as the dynamic of these paradigms is concerned, Tarde, like evolutionary theorists and Kuhn, seems to identify what might be called a 'pre-paradigmatic' phase, during which several schools of thought are in competition ('opposition') with each other and no single intellectual solution prevails over the others, and a 'paradigmatic' phase, during which one school of thought succeeds in imposing its intellectual model. This dominant model proves to be the most relevant and the one best able not only to answer the questions of the moment but also to formulate new questions, to which answers might be found. 'Among these governing ideas, among these scientific hypotheses or *inventions*, there are some that mutually reinforce each other and are in turn increasingly reinforced by the continual accumulation of newly discovered phenomena which, as a result, no longer confine themselves to simply not contradicting each other but repeat themselves and reinforce each other as if bearing testimony to the same law or the same collective proposition. Before Newton, successive discoveries in astronomy did not contradict each other; since Newton, they reinforce each other.' (Tarde, 1890 [1993], p. 192-193)

Tarde also formulates what might be called the paradigm exhaustion hypothesis: when a paradigm is no longer able to provide answers to the problems of the moment, then it has to give way to another one. Moreover, he puts forward the idea that it is the exhaustion of the *heuristics* (that is of the relevant questions and guidance mechanisms: 'the moral or aesthetic goals') rather than the exhaustion of the *artefacts* (that is the technological realisations) that precipitates the exhaustion of the socio-technological paradigm. After all, although the applications (artefacts) in a particular socio-technological paradigm can be multiplied ad infinitum (the term 'pervasiveness' is used in evolutionary theory), this does not apply to the heuristics (the methods, laws, general principles, 'the theoretical uniform'), since they eventually begin to compete with, contradict and replace each other. On several occasions, Tarde uses the distinction between dictionary (infinitely extendable) and grammar

(necessarily limited). In a paradigm, the artefacts constitute the (socio-technological) dictionary, while the heuristics are the (socio-technological) grammar.

‘As it expands, grows and improves and complicates its institutions, language, religion, law, government, trades and professions and arts, a society loses its civilising and progressive spirit, which has been used for these very purposes. In other words, it grows richer in beliefs than in desires, if it is true that the substance of social institutions consists of the sum of faith and assurance, truth and security, in a word, of the unanimous beliefs that they embody, and if the driving force of social progress consists of the sum of curiosities, ambitions and solidary desires of which it is the expression.’ (Tarde, 1890 [1993], p. 160)

‘A nation’s *industrial plant* is continuously expanding, but after a certain time the purposes to which this equipment is put cannot succeed each other until the previous ones have been eliminated.’ (Tarde, 1890 [1993], p. 194) ‘However, to tell the truth, what has disappeared irretrievably in this way is civilisations rather than the industries of the past, if by civilisation we mean the totality of a period’s moral and aesthetic goals and its industrial resources.’ (Tarde, 1890 [1993], p. 195)

3) Evolutionary theory has also concerned itself with less extensive concepts than the paradigm. Thus ‘dominant design’ (Abernathy and Utterback 1978), ‘technological guidepost’ (Sahal, 1981, 1985) and ‘technological regime’ (Nelson and Winter, 1977) are different terms devised in order to denote the same technological phenomenon, namely a basic artefact that remains essentially unchanged for a relatively long period (the duration of several paradigms). Although he did not actually attach a name to it, Tarde can be said to have formulated such a notion before evolutionary theory. ‘Now, these purposes cease to exist but these technical resources live on in their essence. A less perfect machine survives, when it comes down to it, by a sort of metempsychosis in the more perfect and complex machine that apparently killed it off, at least in certain respects’ (Tarde, 1890 [1993], p. 195). ‘At first, the problem thus posed gives rise to all sorts of contradictory inventions and imaginings that appear here and there, only to disappear again after a short time, until a clear solution emerges, a convenient machine of some kind that consigns all the rest to oblivion and serves henceforth as a fixed basis for the superimposition of subsequent improvements and developments’ (Tarde, 1890 [1993], p. 161).

Tarde describes the process of producing innovation in terms that are fairly close to the industrial cycle model developed by Abernathy and Utterback. However these innovations are

produced and in whatever order they appear, they all follow the dictates of a harmonising law that ‘concentrates (them) in harmonious, logical and stable systems’ (Tarde, 1895 [1999], p. 294). This harmonising law (that is, in Abernathy and Utterback’s terminology, the establishment of a ‘dominant design’) can come into effect more or less slowly. According to Tarde, the process is divided into three periods, ‘which follow each other in the same irreversible order’ (Tarde, 1895 [1999], p. 297) and have strong similarities with Abernathy and Utterback’s notion of the life cycle (Abernathy and Utterback, 1978).

The first period is characterised by a great diversity of innovations. There is no dominant design. ‘The first one is that preceding the effort to harmonise. It is marked by (...) the unimpeded introduction, as it were, of a sparse scattering of new ideas into the social consciousness. Since they have not yet come into contact with each other, either they do not impede or reinforce each other in any way or it is not yet evident that they mutually contradict or reinforce each other’ (Tarde, 1895 [1999], p. 295).

The second period (in Tarde’s view, the most important) sees some degree of order being put into apparently competing and contradictory innovations. There is an effort to harmonise them. A dominant design sees the light of day. ‘The second period begins when people begin to notice these contradictions and to be troubled by them or to become aware of the fact that the ideas now circulating mutually reinforce each other and to acquire a taste for them. This desire to reconcile desires with each other and beliefs with each other, the perceived value of harmonising interests and judgements, begins to spread and, up to a point, grows all the stronger since it has already been satisfied’ (Tarde, 1895 [1999], p. 295). This desire for harmonisation leads to ‘a sort of framework, which is more or less fixed but also able to incorporate an indefinitely extendable regimen’ (Tarde, 1895 [1999], p. 296).

In the third phase, this radical innovation, which has established itself as the dominant design, may be the object of an infinite number of incremental improvements. ‘The third phase is that in which this regimen expands little by little, in which the dictionary grows richer, a religion’s catalogue of martyrs and saints increases and its theology or casuistry develops, the legislative applications of a law are extended, a government attains complete control over its administrative functions and the dramas, paintings, operas and novels of the dominant art proliferate.’ (Tarde, 1895 [1999], p. 297)

b) Trajectory

The second important concept in evolutionary theory is that of technological trajectory (Dosi, 1982, 1988). For evolutionary theorists, this concept arises out of the view of innovation as a cumulative and specific problem-solving process.

Once again, we find in Tarde's work a description of a social phenomenon that tallies with this notion of innovation trajectory. Here too, this overlap between Tarde's analysis and evolutionary theory encompasses not only the definition and general description of a reality, but also the more or less complex mechanisms through which it manifests itself (in particular its relationship to the paradigm), the diversity of forms its manifestations take (typologies) and even the social uses to which it can be put (strategies).

1) In evolutionary theory, a technological trajectory is one possible development path that can be pursued within the framework of a particular paradigm. Tarde does not use the term 'paradigm' but a number of very clear and obvious images that express a similar idea: 'route', 'direction', 'stream of aspirations', 'of a thousand possibilities, the one achieved in actuality', 'more or less logical series of inventions', 'logical sequence of inventions', 'family tree of inventions', 'itinerary', as is shown by the following extracts from 'The Laws of Imitation', 'The Social Logic' and 'Economic Psychology'.

'The discoveries and initiatives that have already been successfully made and propagated vaguely determine the route that will be taken by the successful discoveries and initiatives of the future. (...) (Tarde, 1890 [1993], p. 21).

'These are so many more or less logical series of inventions that are more or less logically grouped or clustered together, and it would be equally mistaken to believe that they follow each other in a totally random order or that they do so in an invariable sequence, or even in a single standard order.' (Tarde, 1895 [1999], p. 260)

'However, we can say of any invention whatsoever that it could not have come into being before such and such another one that preceded and gave rise to it; and we are largely convinced, beyond all reasonable doubt, that there is a logical sequence of discoveries and inventions, that is to say that they appear in an irreversible order.' (Tarde, 1902a, p. 39)

Dosi (1982, p. 154), in describing a trajectory, uses the image of a cylinder that constitutes a 'cluster of possible technological directions whose external boundaries) are defined by the

nature of the paradigm itself'. Provided they do not leave the space encompassed by the cylinder, therefore, there is a multiplicity of different possible paths or trajectories. To take a particular path or trajectory is to refrain from going down others. Thus technological potential is characterised by a significant exclusionary power (Dosi, 1982). This notion of exclusionary power and the relationship between paradigm and trajectory are also formulated in very evocative terms by Tarde: 'Any invention that hatches forth is one possibility realised in actuality, one among the thousand possibilities, I mean among the conditional necessities that the mother invention that gave birth to it was carrying in its womb; through its very appearance, it renders impossible most of these possibilities but makes possible a whole host of other inventions that were previously not possible. These may or may not be realised, depending on the direction and extent of the influence exerted on populations already enlightened by other sources of knowledge' (Tarde, 1890 [1993], p. 49).

2) Evolutionary trajectories can be described in different ways. They may be 'natural' in the sense Nelson and Winter (1977) attribute to the term, that is they amount to nothing less than a genuine 'technological imperative' that asserts itself in all sectors of economic activity (this applies, for example, to mechanisation and the search for economics of scale). They may be powerful or weak; they may be mutually complementary or in competition with each other and therefore substitutable. Thus for Tarde, 'trajectories' may have different 'depths'. They may also be 'natural'. This designation is explicitly used by Tarde, as the following extract from 'The Laws of Imitation' shows: 'Thus it is not without good reason that, in any category of social phenomena, the epithet *natural* is generally attached to the spontaneous, not suggested resemblances that arise between different societies. In considering these spontaneous similarities, therefore, it is entirely justified to describe as natural this aspect of the laws, religions, government, customs and crimes of those societies and to speak of natural law, natural religion, natural politics, natural industries, natural (not naturalist) art and natural crimes...' (Tarde, 1890 [1993], p. 54).

3) Just like contemporary evolutionary theorists, Tarde also highlights on several occasions the idea that trajectories are irreversible. In evolutionary theory, this irreversibility, which is expressed by a number of different concepts ('path dependency', 'lock-in, etc.), is the consequence of two important characteristics of innovation phenomena, namely their cumulative nature and their specificity (David, 1985; Arthur, 1989). In the conclusion of 'The Laws of Imitation', Tarde regards the question of irreversibility (in the sense, he says, of

thermodynamics) as a major issue. He also deliberates at length on this question in ‘Economic Psychology’ (Tarde, 1902a, pp. 39 ff.). He too very clearly associates this irreversibility with the cumulative nature of innovation. ‘No less than this accumulation principle, the irreversibility principle that derives from it seems to me to apply to all forms of adaptation.’ (Tarde, 1902a, p. 39)

4) Tarde raises a question that still today lies at the heart of contemporary evolutionary theory: is innovation a factor leading to convergence (‘universal uniformisation’) or divergence? Although imitation leads to gradual similarity among individuals, in Tarde’s view it does not, for all that, stifle their originality; on the contrary, it encourages it, because there is not a single model to be imitated but rather an infinite number thereof. This infinite combination is a source of both originality and divergence. The determinism of development trajectories does not mean homogeneity. Tarde’s sociology is a sociology of diversity, just as evolutionary economics defines itself as a form of economics in which diversity plays a fundamental role. ‘One can be as deterministic and transformative as the next person and yet affirm the multiplicity of possibilities and contingent pasts that exist in any category of social and even natural phenomena. (...) It is sufficient to believe in the heterogeneity and initial autonomy of the various elements of the world which, before they are realised in actuality, conceal virtualities that are unknown and profoundly unknowable, even to an infinite intelligence; once realised in accordance with their own logic and at the time required by that logic, these virtualities cause real novelties, previously unforeseeable, to spring forth from the very depths of their being to the surface of the phenomenal world.’ (Tarde, 1895 [1999], p. 255)

Furthermore, the notion that imitation systems can interfere with each other (‘imitation-interferences’) as they develop over time (Tarde, 1890 [1993], p. 26) is Tarde’s way of expressing the idea of interaction between trajectories. In Tarde’s view, two dynamic imitation systems (i.e. two trajectories) may simply pass each other by (‘neither aid, damage, reinforce nor contradict each other’). However, they may also come into contact and interfere with each other in two different ways, either through the combination or hybridisation of complementary trajectories (‘combination-interferences’), which leads to ‘increased driving force and vitality’ (Tarde, 1890 [1993], p. 27), or through struggles between rival systems (‘struggles-interferences’) that reflect substitutability and competition between different trajectories.

5) Evolutionary theory teaches us that the notion of technological trajectory, like that of the life-cycle curve before it, can be used as an operational tool, particularly for the purposes of forecasting (Larue de Tournemine, 1991). Similarly, Tarde takes the view that these notions can be used in order to make certain predictions. ‘Thus our ignorance of the unexpected discoveries that will take place in ten, twenty or fifty years, (...) would not prevent us from making almost certain predictions, based on the hypothesis advanced above, as to the direction and depth of the flow of aspirations and ideas.’ (Tarde, 1890 [1993], pp. 21-22)

c) Systems

The systemic aspect of innovation phenomena is also frequently highlighted in Tarde’s analysis, whether the system in question is essentially technological in nature or, more generally and fundamentally, an organisational and institutional system based on these technologies.

The first and simplest level, that of the *technological system*, is undeniably present in Tarde’s work. Thus there are many analyses in ‘The Laws of Imitation’ that take account of the morphology of technologies, that is the way in which unitary technologies are linked or combined with each other in space and time to form coherent systems (in Bertrand Gille’s (1978) sense of the term).

However, the second level is also hinted at in Tarde’s work. After all, in examining the morphology of technologies, Tarde reveals some of the institutional modes of technology production (whether those modes be systemic in nature or structured as networks). Thus there are some intuitions that foreshadow the notion of *technological systems* as developed by Freeman et al. (1982), that is a set of innovation clusters that are closely interconnected both economically and technologically. Tarde’s technological systems arise out of the multiplication of logical pairings or unions of innovations or imitations (i.e. imitated innovations). ‘With each complication of an existing invention, the solidary links between the various branches of production are strengthened, extended and multiplied, to the point where, today, to pursue our example, all the different trades – bricklayers, smiths, carpenters, casters, labourers, etc. – work together, even though there are no formal ties between them, on the common task of creating or maintaining a railway.’ (Tarde, 1895 [1999], p. 507)

There are also intimations of what, in contemporary evolutionary theory, is known as (*local, regional, national or sectoral*) *innovation systems* and what the socio-economics of innovation calls *technico-economic networks*. These latter consist of a number of different actors (firms, governments, research centres, etc.) that interact with each other through financial, legal, political, technological and informational flows (cf. Lundvall, 1988; Callon, 1991; Niosi et al., 1992). ‘At the same time as the various invention systems are being organised, this indefatigable logic is at work systematising these systems, reconciling and harmonising the totality of a country’s institutions and all the groups of men in which they are embodied, all of that country’s organised resources, its workshops, militias, convents, churches, academies, trades and schools of art and absorbing all their discords into a superior and truly national state of harmony, under the influence of one dominant idea and ideal. Then, after these systems have begun to be systematised and these associations to be nationalised, the logic attempts its supreme effort as it seeks to establish systems of nations, systems of the third degree, as it were, gigantic federations or empires’. (Tarde, 1895 [1999], p. 297)

Conclusion

Some sociologists take the view – and do not mince their words in expressing it – that if Tarde, unlike Durkheim, did not really leave any theoretical legacy, it is because his analyses lack scientific rigour. ‘(...) Durkheim succeeded in embodying a certain form of rationality (*scientific rationality*), which consists of methods, examples, principles of reasoning and standardised validation and argumentation procedures, none of which are to be found in Tarde’s work. His thinking, in contrast, has its roots in traditional philosophy, or even sometimes in a form of writing and demonstration that is closer to journalism. However, the term ‘social sciences’ includes the word “science”’ (Muchielli, 2000, p. 181). Tarde’s posthumous response to ‘this positivist ideology of science and society’ (Alliez 2001) might be as follows: ‘So why has social science still to be born, or is at best scarcely alive, amidst all its vigorous adult sisters? The main reason, in my opinion, is that we have been chasing shadows, given up what we had for some fanciful alternative. We thought that the only way we could give sociology a scientific slant was by dressing it up as biology or, even better, engineering’ (Tarde, 1890 [1993], p. 1). It should be noted that some economists have criticised Schumpeter in similar terms for being too much of a sociologist and historian and not enough of a formalist and mathematician.

However that may be, economists who adopt a more neutral stance with regard to these debates, which touch on the very nature of sociology, cannot but observe certain similarities, not just at a formal level but also, in some cases, at a conceptual level, between Tarde's work and certain economic theories of innovation. It is often the similarity between Schumpeter's work and that of Tarde that has attracted the attention of economists. We have attempted in this paper to give an account of and, to some extent, to complete this comparative analysis. And yet, there is another set of similarities that seem to have escaped the attention of economists: this is the similarity between Tarde and Schumpeter's intellectual descendants. Whether dealing with Schumpeter or neo-Schumpeterians, we have emphasised only the similarities without analysing in sufficient depth the nuances and differences. This is probably a limitation of the analysis. Finally, by way of conclusion, we will point out, as far as the similarities are concerned, that, over and above the economics of innovation on which we have focused our analysis, Tarde's influence can be seen in a number of other spheres of economics, including, among others, labour economics, the economics of information and theories of value. Thus Tarde's work seems to provide an excellent 'toolbox for investigating the changes taking place in contemporary capitalism' (Lazzarato, 2003).

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