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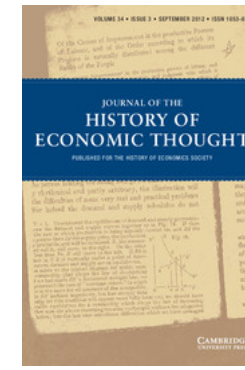

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Smith was influenced by Newton's method. Nonetheless, he introduced elements that led him far from the Newtonian perspective. The present essay analyzes how historical dimensions, contingencies, institutions, and conflicting human inclinations modify a Newtonian horizon. Finally, the paper focuses on how, in Smith's view, institutions determine "unintended outcomes," which are sometimes opposed to those of the market. In this sense, the "invisible hand" is not only the result of the behavior of myopic individuals trying to improve their conditions; it is also the outcome of the work of institutions that operate as structures autonomous with respect to individuals.

I. INTRODUCTION

Adam Smith considered Isaac Newton's work to be a turning point in modern science, similarly to a number of Scottish scientists and philosophers of his age, for whom Newton's method constituted a paradigm, especially as regards its application to human sciences. But what did it mean to adopt Newton's method? The literature has provided different answers, and this paper tries to make a further contribution in this direction.

The application of the great physicist's methodological concepts in the social and economic sciences gave shape to an original perspective compatible with certain concepts (such as, for example, those of self-organization, emergent properties, path dependency, unpredictability) usually considered distant from classical dynamics. Therefore, the first aim of this paper is to show how Newton's method (and specifically the notion of "principle"), when incorporated in social and historical domains, assumed new functions, and consequently changed important features.

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In general terms, Newton represented nature as invariant, and as regulated by constant laws. By contrast, Smith put forward a different view, although he adopted Newton's concept of "principle" to explain the variety of human (and social) phenomena by means of a unitary cause. Nature, when observed in the human realm, is multifaceted, ambivalent, and characterized by conflicting inclinations, which, nonetheless, in the long run are channeled within the general tendency to improve the human condition, conceived as the capacity to increase private and public wealth. Moreover, Smith says, the "natural course" of history has not followed this tendency linearly, and, consequently, it cannot be represented as a well-ordered process governed by laws comparable in their defined effects to Newton's gravitation. In particular, the history of European society, from the decline of the Roman Empire to the late eighteenth century, was not marked by a "natural course of things" but by an "unnatural and retrograde" one. The former, however "natural," did not prevail because contingencies and institutions impeded or slowed social and economic development, although, after centuries, re-equilibrating forces allowed the emergence of the market society. Moreover, institutions, even when harmful, exhibit both a distinctive autonomy with respect to individuals and an inertial dimension. They persist over time, and even when the reasons that may account for their origins cease to exist, they still strongly influence human and social relations. This kind of path dependency—which, for example, characterized certain feudal institutions—constitutes a version of the "heterogenesis of ends," because individuals cannot foresee the future outcomes of their current actions, although a social and economic order will emerge in an indefinite future. More precisely, some institutions (which hampered the fulfilment of "perfect liberty"), as impersonal forces, have acted against other impersonal forces (those of the market in the long run), although the latter are considered predominant. This implies that the "invisible hand" is characterized by different (sometimes contrasting) forces, whose interrelations yield an unintentional order, although in Smith's view—I repeat—man's endeavor to improve his condition is predominant, and promotes the emergence of the market order.

Given this premise, human nature and social domains are more complex than physical nature, where a simple principle (gravitation) in all times and places yields an unaltered order of the universe whose movements are precise and essentially predictable.[1] In particular, Smith points out that Newton's system, by means of his "principle" of gravitation, "ascertains the time, the place, the quantity, the duration of each individual phenomenon, to be exactly such as, by observation, they have determined to be" (*The History of Astronomy,* Smith 1980, IV.6; henceforth *HA*). By contrast, his theory shows that the economic and social realms exhibit unpredictable and less defined configurations, which change over time, and in which only a very general tendency can be detected. As a consequence, it seems important to deal with the question of how a non-Newtonian perspective arises from Smith's Newtonianism or, more precisely, how some of Newton's concepts, incorporated into Smith's

[1]The concept of predictability under certain conditions is related to that of determinism. The debate on Newton's determinism is still open. Many physicists maintain that Newton's theory is deterministic (see, for example, Prigogine and Stengers 1979; Ruelle 1991, ch. 5). Nevertheless, this view has been challenged in the past two decades, and some authors state that Newton's mechanics is not a deterministic theory. Norton (2008) summarizes both arguments in favor of his non-deterministic interpretation well as the relative objections. For criticisms of Norton's theory, see Malament (2008).

theoretical apparatus, determine non-Newtonian outcomes. In short, the human universe (so irregular, history-dependent, and unpredictable) seems radically to diverge from Newton's physical universe (regular, a-temporal, and predictable).

The arguments just outlined will be dealt with as follows. After a brief discussion of Smith's Newtonianism (sect. II), his *Considerations Concerning the First Formation of Languages* (Smith 1983b; henceforth *Languages*) is examined as a distinctive view of the analytic-synthetic approach. For Smith, the analytic and synthetic phases reflect both a human cognitive procedure, as a general strategy that confers a new configuration on the world, and a scientific method. General induction, Smith supposes, leads to general terms by means of which concrete objects can be comprehended in their individuality. A concrete term, considered at the beginning of the cognitive process, is not the same as the one found at the end, when it finally acquires an appropriate definition. In this sense, reality is re-described (sect. III). The same perspective is adopted in the *HA*, where the search for new "principles" able to connect "discordant phenomena" is a continuous effort whereby the world assumes a new structure for the observer. This view shows how—in Smith's political economy—history, contingencies, and empirical circumstances contribute to shaping the structures and changes of economic systems, even though their movements should be directed in general by some basic principles. A fundamental fact is that Smith considers the principles within a temporal framework. On the one hand, this implies that analysis leads to "general conclusions" from which to deduce phenomena; on the other hand, it is part of an endless process whereby *new* "connecting principles" emerge and reorganize observational material in order to give it a *new* coherence. All this renders the succession of analysis and synthesis rather problematic because synthesis is provisional, and analysis is re-examined and rearranged according to new paradigms; that is, new principles (sect. IV).

Moreover, the reference to principles raises questions in the economic domain. Part of the literature correctly considers the first two books of *Wealth of Nations* (Smith 1776; henceforth *WN*) as being where principles explain and unify the variety of economic phenomena. In particular, the *WN* starts with the concept of the division of labor, in light of which a number of events, from the increase in wealth to the coordinated social division of activities, are explained. Yet, this principle is neither "original" (it derives from other basic inclinations) nor universal (it does not always appear in human history), and its explanatory capacity exhibits some problems. In fact, the extent of competition and of markets depends on the—social—division of labor, but the extent of the division of labor depends on an empirical fact: the extent of the market. In addition, the division of labor (as a concrete event) engenders unpredictable configurations of the market (sect. V). The distinction between natural and market prices replicates a situation in which the principles require consideration of their empirical counterparts (sect. VI). Finally, sections VII and VIII show how history, contingencies, and institutions contribute strongly to establishing a certain order of the market society in a way that cannot be directly deduced from principles (of human nature). These latter matter, but interpretation must also consider conflicting human inclinations, institutions, and historical accidents in order to understand the structure of the world. As a consequence, science is described as an "imaginary machine," rather than—as Newton points out—as a body of sound

knowledge able to describe how the world is,[2] within the limits allowed to human beings by God.

II. SMITH'S AND NEWTON'S METHODS: ESSENTIAL POINTS

Newtonianism largely influenced intellectual debates in the Scottish Enlightenment. On the one hand, it entailed criticism of both Aristotelianism (and occult qualities of scholastic tradition) and Descartes' rationalism; on the other, its Humean version was very influential, and Condillac's and D'Alembert's interpretations, although elaborated by French philosophers, were part of a general context characterized by the effort to legitimate the use of Newton's results (cf. Megill 1975). Moreover, the diffusion of Newtonianism in Scotland was linked with, among others, Scottish scholars such as James Gregory, a correspondent of Newton, his nephew David Gregory, and George Turnbull. Finally, Colin Maclaurin (a Scottish mathematician) was very influential with his *An Account of Sir Isaac Newton's Philosophical Discoveries* (1748), and John Keill, Henry Pemberton, and Jacob 'sGravesande contributed to introducing Newton in Britain and in Europe.

Smith's Newtonianism took shape in this rich context, although it cannot be separated from other fundamental debates: for example, the critique of contractual theories, especially the Hobbesian one; and the wide acceptance in the Scottish cultural environment of Montesquieu's teachings.

Smith maintained that "Philosophy is the science of the connecting principles of nature" (*HA*, II.12). Philosophy in Smith's age was synonymous with scientific inquiry, and the reference to a search for basic and simple principles able to explain a number of (apparently different) phenomena was for Smith, as for his friend David Hume, an application of the Newtonian method to human sciences. As is well known, the *Rules of Reasoning in Philosophy* included in Newton's *Principia* (1687) and the "Query 31," which concludes the *Opticks* (1704), are very important sources for understanding Newton's method.

In particular as regards the analytic-synthetic method, as specified in the "Query 31," Newton maintains:

> As in Mathematicks, so in Natural Philosophy, the Investigation of difficult Things by the Method of Analysis, ought ever to precede the Method of Composition. This Analysis consists in making *Experiments and Observations*, and in drawing *general Conclusions* from them by Induction, and admitting of no Objections against the Conclusions, but such as are taken from Experiments, or other *certain Truths*. For Hypotheses are not to be regarded in experimental Philosophy. And although the arguing from Experiments and Observations by Induction be no Demonstration of general Conclusions; yet it is the best way of arguing which the Nature of Things admits of, and may be looked upon as so much the stronger, by how much the Induction is more general. And if no Exception occur from Phænomena, the Conclusion may be pronounced generally. But if at any time afterwards any Exception shall occur from

[2]Newton (1687, p. 547) maintains: "And to us it is enough that gravity does really exist, an act according to the laws which we have explained."

> Experiments, it may then begin to be pronounced with such Exceptions as occur. By this way of Analysis we may proceed from Compounds to Ingredients, and from Motions to the Forces producing them; and in general, from Effects to their Causes, and from particular Causes to more general ones, till the Argument end in the most general. This is the Method of Analysis: And the Synthesis consists in assuming the *causes discover'd, and establish'd as Principles*, and by them explaining the Phænomena proceeding from them, and proving the Explanations (Newton 1704, pp. 404–405; emphasis added).

The role of "principles" was widely accepted in the Scottish Enlightenment, and the analytic-synthetic method seems to be echoed in Hume's words when he reminds us that human scientists proceed "from particular instances to general principles, they still push on their enquires to principles more general, and rest no satisfied till they arrive at those original principles, by which, in every science, all human curiosity must be bounded" (Hume,1748, p. 88).

Although in the "science of human nature," in Hume's sense, it is rather difficult to find "experiments," by contrast "observations" in the social realm were largely considered by the Scottish thinkers of the eighteenth century, and especially by Adam Smith, who discussed a number of empirical cases in each chapter of the *WN*. Yet, observations are not experiments, and, contrary to Newton, there was no room for mathematics in Smith's approach.[3] This raises the question as to how—given the different subjects—the empirical approach had been translated from Newton's physics to human and economic science, during which process it had undergone some unavoidable changes, although Newton himself affirmed that, on pursuing his method, "the Bounds of Moral Philosophy [would have been] enlarged" (Newton 1704, p. 405).

Smith assumed the notion of principle, and he also had a distinctive vision of the analytic-synthetic approach—as many scholars maintain in different ways—although it is neither mentioned as such nor theoretically defined. H.J. Bittermann (1940), probably influenced by his contemporary notion of empiricism, declares that Smith adopted an empirical methodology inspired by Newton and Hume, yet he did not carefully distinguish between inductive and deductive reasoning. S. Moscovici (1956, p. 8) pointed out the originality of Smith's perspective with respect to those of his Newtonian contemporaries—Pemberton, David Gregory, and Maclaurin—since Smith did not believe (in contrast with the latter) that many philosophers of the past had prepared, as precursors, the Newtonian revolution. H.F. Thomson (1965, p. 226), states that in both *The Theory of Moral Sentiments* (Smith 1759, henceforth *TMS*) and the *WN*, Smith "appears to have taken his main hypothesis, or his *analogy*, from the Newtonian principle of attraction." T.D. Campbell (1971, p. 54), considering the *TMS* from an essentially Popperian perspective,[4] points out the importance of the Newtonian method of induction and of deduction. A.S. Skinner

[3]On the role of mathematics in Newton's *Principia* related to the complex characteristics of his "style," whereas Newton proceeds from simple to complex cases in an idealized form, see Cohen (1980). See also G.E. Smith (2002) and Guicciardini (2002).

[4]The literature has found some similarities between Smith's method and the approaches of T.S. Kuhn, K.R. Popper, I. Lakatos, and W.V.O. Quine. Evidently, there is a risk of providing an anachronistic reading. Yet, on evaluating the textual evidence and the Scottish cultural context, it is possible to consider the relation between Smith's and Kuhn's perspectives (see sect. IV).

(1972, p. 315) stresses Smith's debt to Newton, and also emphasizes that "the route to scientific knowledge in the eighteenth century" required the method of "experimental philosophy" based on analysis (to establish basic principles by means of induction) and synthesis (to clarify phenomena by means of deduction). Similar statements are put forward in D.D. Raphael and A.S. Skinner (1980, p. 12), and L. Montes (2003, p. 725). N.S. Hetherington (1983, p. 504) finds "important similarities of structure" between Newton's *Principia* and the *WN*, and S. Cremaschi (1984) gives an account of how Newton's work is a model for the *WN*. A partial exception is G. Freudenthal (1981), who maintains that Newton referred to the analytic-synthetic method, while Smith treated only the synthetic one, omitting "analysis" and interpreting Newton's method as "evident-synthetic." However, this perspective does not pay much attention to the role of observations in Smith's work. Finally, for other scholars, it is more appropriate to consider Newton's influence as consisting merely in inspiration and orientation (Redman 1993, p. 225; cf. Berry 2006, p. 126), or even as a "rhetorical device" (Redman 1993, p. 225). In my view, the influence of Newton's method on Smith's approach assumed the form of a few general rules (and concepts) useful for conceiving how to construct science correctly (specifically the economic theory, although other disciplines shared a similar perspective), whereas the previous model was basically characterized by Cartesianism. In particular, my focus is on how this theoretical structure partially changes when it is applied to economic, social, and other realms, engendering in some cases a perspective far from Newton's. This view can be connected to I.B. Cohen's assertion that "Smith was well educated in Newtonian science," and his "example ... is particularly interesting because it brings us to a significant feature of many interactions between the natural sciences and the social sciences. ... I have called this aspect of innovation 'creative transformation', an intellectual leap forward that often occurs when a concept, a method, a principle, or even a theory is transferred from one domain to another" (Cohen 1994, p. 66).

Another element in understanding how, despite Newtonian premises, some issues of Smith's work were not Newtonian is that Newton's teaching in the Scottish environment (and specifically in Smith's theory) interacted with other (and was included within) previous strands of thought, and this interconnection determined its reception, its reuse, and its partial modification. From this perspective, the connection between the Newtonian legacy and the "Natural jurisprudence" seems relevant, since this latter was part of Smith's moral philosophy. Cremaschi has provided an overview of this intricate relation. In very general terms, Smith's work is characterized by its opposition to *a priori* perspectives and to rationalistic approaches, like that of Descartes, which were not suited for conceiving a social science able to deal with dynamic processes. In particular,

> The views [that Smith] wants to criticize are primarily those of Hobbes and Locke, and secondly those of the 'rationalist' natural Law philosophers Grotius and Pufendorf and of the 'moral sense' Natural Law philosopher Hutcheson. He wants to take over Hume's attempt at finding an alternative 'foundation' to Natural law, other than reason or moral sense, but he adds to Hume's solution a powerful dose of Montesquieu's genetic account of law and of the Scottish evolutionary theory of society (Cremaschi 1989, p. 89).

Moreover, "Scottish moral Newtonianism" comprised many (very different) authors who referred to the new natural philosophy (from Galileo to Newton) and—especially as regards Hume —shared the project to reform moral philosophy on experimental bases (i.e., in opposition to *a priori* and theological principles) (Cremaschi 2009, p. 81). This perspective also allowed Hume to consider not *a priori* concepts, such as the state of nature or the original contract, but to focus on the observation of habits and customs. Smith adhered in many respects to Hume's experimental interpretation of Newtonianism, and this involved both his moral theory and his project to develop a "renewed natural law free of the main shortcomings of its rationalistic versions, primarily the lack of empirical content" (Cremaschi 1989, p. 100). This perspective enables us to see how a distinctive interpretation of Newtonianism was connected to great philosophical debates, in some cases prior to Newton's work, which contributed to modifying Newtonian categories. Therefore, the non-Newtonian aspects of Smith's thought can be interpreted as outcomes of these processes.

Also, Montesquieu's approach influenced the Scottish Enlightenment. Although Montesquieu was "ignorant of Newton's physics" (Cohen 1994, p. 65), he used the gravitation metaphor (1748, bk. 3, ch. 7, p. 25), and gave a definition of "principes" sufficiently compatible with Newtonian culture in that a variety of multiple particular cases are explained in reference to general laws. Moreover, Montesquieu's empirical perspective considered contingencies to be elements able to explain the divergence between, on the one hand, historical configurations of societies and institutions, and, on the other, the model incorporated into natural laws (as later in Smith's work), because the social and human world "is far from being so well governed as the physical. For though the former has also its laws, which of their own nature are invariable, it does not conform to them so exactly as the physical world" (Montesquieu 1748, bk. 1, ch. 1, p. 2).[5]

Finally, the model inspired by living systems tacitly coexisted with (and contributed to) a rethinking of the Newtonian model. Smith represents the evolution of society by means of biological metaphors, since these appear better able to capture dynamic processes than models inspired by physics. In this sense, he specifies that the constant "effort of every man to better his condition,"—that is, the principle that guides "the natural progress of things toward improvement"—can be compared to "the unknown principle of animal life [that] frequently restores health and vigour to the constitution, in spite, not only of the disease, but of the absurd prescriptions of the doctor" (*WN*, II.iii.31). The metaphor of organism is used to describe the self-regulating and self-organizing properties of societies over time. Yet, not every biological model is a valid theoretical tool. In fact, Smith rejects François Quesnay's medical approach, according to which "the health of the human body could be preserved only by a certain precise regimen of diet and exercise," since this implies that the "political body . . . would thrive and prosper only under a certain precise regimen, the exact regimen of perfect liberty and perfect justice" (*WN*, IV.ix.28). By contrast, the "unknown principle of preservation," by means of which the individual improves his condition, makes it possible to remedy dangerous effects of

[5]A similar interpretation is made by Aron (1965), while Ingrao and Israel (1990, ch. 2) connect Montesquieu to theorists of natural law.

"the folly and injustice of man" (*WN*, IV.ix.28). This line of thought defined a paradigm that tacitly interacted with the Newtonian one, and was probably influenced by French scholars who studied the problem of organization in living beings. In particular, Buffon, Diderot, Daubenton, and Réaumur are cited in the *Letter to the Edinburgh Review*, and their works, together with those of Maupertuis, were in Smith's library.

Given these premises, in the next section I seek to show that Smith referred to the inductive approach more clearly in *Languages* than in other works (for which reason I start with this essay), while synthesis or deduction, in turn, is considered a fundamental step in re-describing the reality and conferring a new identity on singular events or objects.

III. *LANGUAGES*, A POSSIBLE VIEW OF THE ANALYTIC-SYNTHETIC APPROACH

The analytic-synthetic approach is a method that should be applied by scientists. In *Languages*, this procedure is considered, at least partially, as if it were unintentionally followed over time by mankind in the real world, and not as a (part of) scientific method. In fact, Smith states, the formation of languages was characterized by an inductive process that led to the definition of a few principles that simplified the functioning of language, and this simplification resembled the one realized by gravitation in the physical universe (as a force that governs a number of phenomena).[6]

From Smith's perspective, in the beginning, "particular names" were "probably" assigned to "particular objects," and because some of them exhibited a close resemblance, "those words, which were originally the proper names of individuals, would each of them insensibly become the common name of a multitude" (*Languages*, 1, p. 204). In general, the process characterizing the generation of languages is conceived in terms of a continuous passage from the particular to the general; that is, as an increasing ability to produce abstractions in order to represent reality. Adjectives and prepositions appeared later (and in succession) with respect to nouns, in that they respectively represented qualities and relations among things, without reference to concrete objects, and this involved a certain capacity to produce "abstraction and generalization" (*Languages*, 12, pp. 209–210). The same reasoning is applied to other parts of speech such as number, impersonal and personal verbs, and personal pronouns. Finally, in modern languages—with respect to Latin and Greek—a "simplification" came about when "instead of a great variety of declensions, one universal declension, which is the same in every word, of whatever gender, number or termination" appeared (*Languages*, 33, p. 221).

This process is also interpreted in terms of an increasing capacity of languages to simplify their grammar structures, thus improving their performances, and becoming progressively better able to deal with external complexity. This perspective is represented by a famous passage in which changes in languages are compared to changes in machines, and where the reference to Newton's concept of "principle"—considered in a new, dynamic, context—is clear.

[6]In his first *rule of reasoning,* Newton maintains that "Nature is pleased with simplicity, and [as gravitation shows] affects not the pomp of superfluous causes" (Newton 1687, p. 398).

> All machines are generally, when first invented, extremely complex in their principles, and there is often a particular principle of motion for every particular movement which it is intended they should perform. Succeeding improvers observe, that one principle may be so applied as to produce several of those movements; and thus the machine becomes gradually more and more simple, and produces its effects with fewer wheels, and fewer principles of motion (*Languages*, 41, p. 223).

In short, cognitive (inductive) processes permit delineation of "fewer principles of motion" by means of which languages work in a simpler way. These principles explain the simplification of language and the change of its structure. They can, therefore, be considered in their theoretical dimension, which is the same as adopted in *HA* to explain the "formation" of (physical and astronomical) theories. As a consequence, a close relation emerges between real cognitive processes and the scientific method in assuming an analytic-synthetic procedure, where the definition of principles allows explanation of a given phenomenon: the change of languages over time.

From Analysis (Induction) to Synthesis as a Process of Individualization

According to Smith, an inductive process characterizes the formation of languages. The literature generally recognizes that, in Smith's essay, language takes shape by moving from concrete to abstract, from simple to complex (cf. Becker 1961, p. 15), where the more it is abstract, the more it is able to deal with complexity. Yet, a close examination shows that this is only the first part of the process. The passage from a proper to a common noun is an inductive generalization whereby particular objects like "cave, tree, fountain" became common nouns indicating a whole class of objects because of their close similarity. The second part of the process, generally neglected, is the one when common nouns were created to denominate classes of similar objects: "it was impossible that the greater part of that almost infinite number of individuals, comprehended under each particular assortment or species, could have any peculiar or proper names of their own, distinct from the general name of the species" (*Languages*, 2, p. 205). It was necessary to distinguish each particular entity subsumed under the same collective noun by referring to its qualities and its spatial relations with other objects.

In short, objects can be identified only when a process of abstraction and of (inductive) generalization has been performed. For this purpose, it is necessary to move from abstract to concrete, since this process makes it possible to connote an element in its individuality. So to speak, the object viewed by an observer at the end of this process is not the same as the one seen at the beginning. The concrete, original, object, whose name was used to define (by analogy) a general class, is not the same object that we recognize when a common noun is available. The specific object can be defined and identified as singular only if we have a general (abstract) class that subsequently permits us to identify it as an individual element with its own properties, qualities, and relations with other ones. The difference is between a concrete, unrelated, term and a concrete object definable in its individuality, precisely because we start from an abstract term. Therefore, the complete process is from (unrelated) concrete to abstract entities, and subsequently from abstract to concrete objects (related to others reconstructed, redefined, and recognizable in their identity). In turn, this entails re-describing reality and assigning identities to its objects.

Similarly, "The word *I* . . . is a general word, capable of being predicated . . . of an infinite variety of objects." This pronoun is only apparently the more concrete one; by contrast, it is "abstract and metaphysical," and this fact constitutes the condition for identifying a particular person, attributing to him many qualifications (*Languages*, 32, p. 219).

The idea that abstract notions are fundamental steps in explaining and unifying a variety of phenomena, however derived from concrete objects or events, first appeared in *HA*, which adopts a perspective similar to that outlined in *Languages* as regards the relation between abstract and concrete terms. Our attention must therefore focus on *HA*.

IV. PRINCIPLES AND DYNAMIC MACHINES

The aim of science is to overcome "wonder." One kind of wonder arises when our imagination is unable to include an object within the usual classificatory systems. Another kind arises when the imagination is unable to explain "an unusual succession of things" (*HA*, II.9). As a consequence, the role of science is to discover the "connecting chain of intermediate events," and "Philosophy is the science of connecting principles of nature" (*HA*, II.12). Yet, Smith considers these latter in a dynamic context. His aim is not just, as for Newton, to provide increasingly rigorous observations (and experiments, for the great physicist) in order to corroborate "general conclusions"[7]; it is also to explain how observed anomalies can lead to a change of paradigm. In particular, in a well-known passage similar to that in *Languages*, Smith maintains:

> Systems in many respects resemble machines. A machine is a little system, created to perform, as well as to connect together, in reality, those different movements and effects which the artist has occasion for. A system is an imaginary machine invented to connect together in the fancy those different movements and effects which are already in reality performed. The machines that are first invented to perform any particular movement are always the most complex, and succeeding artists generally discover that, with fewer wheels, with fewer principles of motion, than had originally been employed, the same effects may be more easily produced. The first systems, in the same manner, are always the most complex, and a particular connecting chain, or principle, is generally thought necessary to unite every two seemingly disjointed appearances: but it often happens, that one great connecting principle is afterwards found to be sufficient to bind together all the discordant phaenomena that occur in a whole species of things (*HA*, IV.19).

It has been remarked that this scheme is similar to T.S. Kuhn's (Skinner 1972, p. 312; Lindgren 1973, p. 18; Raphael and Skinner 1980, p. 15; Cremaschi 1984, p. 59; Schliesser 2005, p. 704) because Smith describes how a paradigm changes. Yet, for our purposes here, it is sufficient to point out that, from this perspective, the relation between analysis and synthesis is more complex than the version (generally attributed to Newton) in which they are two successive phases of the same process. More precisely, induction leads to "general conclusions," which are provisional in that more accurate observations

[7]In this regard, see Newton's fourth *rule of reasoning*, and "Query 31." For a general view, see Koyré (1965, ch. 7).

subsequently evidence a number of anomalies. Initially, the reaction to incoherent events induces a proliferation of "wheels," creating a cumbersome theoretical mechanism. Only later does there emerge a new principle that permits a simpler and more efficient operation of the machine. The consequence is that a new mental chain, which connects "discordant phenomena," does not derive from the original analysis-synthesis process that has produced an inefficient machine-theory. By contrast, the new synthesis (realized by a new connecting principle) reorganizes the material of the previous analytic and observational activity. Consequently, it is not the logical extension of the previous process, but a new one, which makes it possible to deduce new properties of the observed world. Science is thus characterized by a sequence of analytic and synthetic processes that can exhibit strong divergences in their results.

All this leads to interpretation of Newton's method in light of the fourth *rule of reasoning* as a process of "successive approximations" by means of which laws (including the law of gravity) are continuously refined (cf. G.E. Smith 2002). According to L. Montes (2008), with reference to E. Schliesser (2005), Smith's Newtonianism adopts this "open-ended" method. Yet, this process seems conceived more to provide successive improvements of the theory (as in Newton's case) than to adopt radically divergent paradigms. By contrast, the emergence of different principles is what characterizes *HA*.[8]

Finally, it is precisely the Newtonian logic, translated to a temporal dimension, that introduces a certain innovative perspective. This latter, when applied to theories, shows a capacity to unify and explain an increasing variety of phenomena by means of progressively simpler connecting principles.[9] The complexity of the explanatory "machine" corresponds to the complexity of the world, whereas the "machine" reflecting epistemological complexity is opposed to the "machine" reflecting intricateness (and a poor explanatory capacity).

In this way, by means of the metaphor of a machine that changes and improves over time,[10] two domains—theories and languages—are linked together. A third one is political economy, although the search for principles traversed Smith's entire work, from the *TMS* (VII.ii.2) to *Lectures on Jurisprudence* (Smith 1978a and 1978b; henceforth, *LJ*[A] and *LJ*[B]).[11]

Some additional remarks, however, are required in order to clarify Smith's vision in connection with Newton's influence. In particular:

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[8]Schliesser's analysis (2005, p. 706), assuming Kuhn's perspective (in general, and with respect to Smith's "Ancient Logics"), stresses this point by referring to the notion of "incommensurability," which hampers finding "a common measure between two competing theories."

[9]Newtonian method "gives us a pleasure to see the phaenomena which we reckoned the most unaccountable all *deduced* from some principle (commonly a wellknown one) and all united in one chain" (Smith 1983a, ii.134, p. 146; emphasis added).

[10]This makes the difference with respect to images of a machine conceived in the static sense. The most famous was probably that of a clock used to represent the universe as an idealization of a perfect, divine, mechanism. For a detailed historical analysis, see Mayr (1986).

[11]According to Campbell (1971, p. 31), in the *TMS*, Smith applies the Newtonian method based on the "principle" of sympathy. Also to be noted is that the first statement of *LJ*(B) is: "Jurisprudence is that science which inquires into the general principles which ought to be the foundation of the laws of all nations" (I, p. 397). Finally, the term 'principle' is so pervasive that it even appears in the title of Smith's work *The Principles which Lead and Direct Philosophical Enquires*, in which *HA* and *History of Ancient Physics* are included.

1) Theories are "imaginary machines."[12] The relation between them and external reality is not based on the discovery of final truth but on a distinctive dynamic between our perception of reality and the world *out there*. Newton's certainty concerning the capacity of his theory to describe outer reality in linear manner (as far as is possible to man)[13] is not to be found in this perspective.
2) In the *HA*, Smith reconstructs his "history" on the basis of Newton's notion of "principle," and he shows that, from antiquity to his age, what great philosophers had in common was the search for principles, which was conducted with different degrees of success. Conversely, Newton cannot be seen as the inventor of the approach based on principles in that—with many imperfections—it had been used by a number of his predecessors. Rather, his theory is the best example of the application of this method.
3) Smith wrote both a history of languages and a history of astronomy (to which the histories of "ancient physics" and of "ancient logics and metaphysics" should be added), and history played a special role in his political economy as well. But history is precisely what is lacking in Newton's physics, and this fact directs attention to the use of Newton's view within an historical dimension, observing the consequences of this theoretical operation.

Moreover, it should be pointed out that Smith followed Newton in considering principles to be instruments that introduce simplicity into explanation. But he also delineated the process that progressively produces simpler principles over time. As a consequence, principles are history-dependent, and their simplicity emerges at two levels: one concerns their simplification in the course of time; the other concerns the capacity of principles as such to simplify explanation.

Therefore, in the next section, I shall try to clarify how political economy is a science in which both Newtonian and non-Newtonian arguments are used, and how this gives rise to a distinctive vision of the social world.

V. PRINCIPLES AND HUMAN NATURE IN THE REALM OF POLITICAL ECONOMY: THE DIVISION OF LABOR

Smith described principles as tools able to explain a variety of empirical phenomena in his political economy as well, and especially (but not uniquely) in the two first

[12]Smith declares that theories are "imaginary machines": that is, *mental constructs* able to connect phenomena and that, according to Lindgren (1973), are influenced by habit and custom. This perspective has been labeled the "anti-realistic" approach in the literature (cf. Berry 2006, p. 122), and it reminds us that, according to Smith, philosophy (i.e., science) "may be regarded as one of those arts which address themselves to the imagination." He therefore examines the history of "systems of nature" "without regarding their absurdity or probability, their agreement or inconsistency with truth and reality," and considering only how they were "fitted to sooth the imagination" in order to render the "theatre of nature" coherent (*HA*, II.12).

[13]Only God knows everything, so that in "General Scholium" Newton points out: "Hitherto we have explained the phenomena of the heavens and of our sea by the power of gravity, but have not yet assigned the cause of this power . . . I have not been able to discover the cause of those properties of gravity from phenomena, and I frame no hypotheses" (Newton 1687, pp. 546–547). See also "Query 31."

books of the *WN*. His reference to these theoretical devices is often joined to both observations, by means of which he shows how principles work, and their historical dimension. This perspective introduces some novelties in regard to Newton's method, because observations are not experiments, mathematics is not used, and the historical dimension does not characterize Newton's physics, given that nature and its laws do not depend on history, and the future is generally predictable.

Analysis of the division of labor enables examination of this perspective.

1) The division of labor, to which the first chapter of the *WN* is devoted, is the cause of increased labor productivity. Indeed, the division of labor is not an original human inclination, in that it derives from a deeper "principle" (*LJ*[B], p. 492): "a certain propensity in human nature ... to truck, barter, and exchange," which, in turn, is probably "the necessary consequence of the faculties of reason and speech" (WN, I.ii.1; cf. *LJ*[A], p. 352). In short, we must refer to the division of labor as a derived principle, rather than as the original one, in order to understand certain fundamental characteristics of an economic system. This modifies the Newtonian assumption that one must, as far as possible, start from no further reducible principia when explaining phenomena. More precisely, the propensity to "truck, barter, and exchange" (or, more profoundly, the faculties of reason and speech) is comparable to the law of gravity. Both in Newton and in Smith, these latter are not the ultimate principles of reality (see here note 13, and Cremaschi 1989, p. 84); nonetheless, the law of gravity is the main "cause" (or "general conclusion") from which we deduce a number of phenomena within the limits of our knowledge, and a similar role should be ascribed to the propensity to truck and barter. By contrast, not this latter propensity but the division of labor is assumed as the basic category for economic discourse.[14]

This procedure can be generally viewed as a normal adaptation of Newtonian concepts into forms useful for economics (see Cohen 1994, p. 66; Redman 1993, p. 221), which, if observed more in detail, can reveal important details of Smith's method.

2) Although the division of labor arises from basic elements of human nature, it does not connote the entire history of mankind, and its appearance takes different historical forms. In fact, the initial phases of the "rude state of society" involved no division of labor (*WN*, II, Intr. 1), and when it was introduced, it contributed to determining diverse configurations of societies. It was limitedly present in a "tribe of hunters or shepherds" (*WN*, I.ii.3), and increased progressively in agriculture and commerce (*WN*, V.i.1–15), although, Smith says, agriculture does not admit a large division of labor. In addition, as book III of the *WN* shows, in modern Western history from the fall of the Roman Empire to Smith's age, specific institutions had modified the "natural" division of labor between town and country (*WN*, III.i), while the history of the North American colonies was

[14]Schliesser (2011) remarks that, in Smith's view, human nature is a collection of human propensities and that these latter "can either be bedrock parts of human nature (e.g., reason, speech) or the (necessary) consequence of such bedrock human nature." He calls the former "original propensities" and the latter (as the inclination to barter and truck) "derived propensities" (p. 16).

completely different because they constituted the best approximation to that natural (ideal) order (*WN*, III.iv.19; IV.vii.b).

Moreover, the accumulation of capital precedes the division of labor (*WN*, II. Intr.). Since accumulation is an historical event, neither the division of labor nor the original principle from which it derives (i.e., the propensity to exchange) occur as a simple manifestation of human nature in "all times and places," but in consequence of specific (empirical-historical) conditions that permit (or do not permit) their emergence.

In short, the manifestation of the division of labor is history-dependent; it assumes a number of forms depending on contingencies; and in certain circumstances it cannot be realized.

3) The division of labor is not "the effect of any human wisdom, which foresees and intends that general opulence to which it gives occasion" (*WN*, I.ii.1). This is—in the *WN*—the first important statement relative to the view that behaviors, even when performed by wise and far-seeing human beings, produce unintended outcomes; i.e., they engender "invisible hand" effects. If this is so, the unintended consequences of the division of labor cannot be deduced from the original "inclination" to truck; instead, they depend on a number of circumstances that involve contingencies, history, and complex relations between human institutions and human natural inclinations (see below). Given these premises, economic science is not *stricto sensu* a predictive science (like Newton's physics).[15] It assumes that some natural inclinations influence the course of human affairs, but the former do not determine the latter, step by step, because they are often contrasted by other forces. Human myopia and contingencies (the general propensity to better human conditions notwithstanding) introduce "invisible hand" effects and complexity in the market society, and both reduce confidence in a predictive science. Science can enunciate only a general rule to explain the market self-organization.
4) The division of labor (and not the natural principle from which it derives) assumes the role of a "connecting principle" explaining the increased productivity (and wealth) in both the factory (technical division of labor) and the market (social division of labor among professions). Yet, the technical division of labor depends on the plans of capital owners, while the coordinated extension of the social division of labor in the market is unplanned and unforeseeable. Thus, competition appears as a fundamental part of the self-organizing properties of the market.
5) Smith maintains that the extent of the division of labor depends on "the power of exchanging that gives occasion to the division of labour." He therefore seems to identify "the power of exchanging" with the original propensity to truck, and to view it as the source of an hypothetical limit on exchanges, since the "extent of this division must always be limited by the extent of that power" (*WN*, I.iii.1). Nonetheless, he immediately adds that this limitation refers to "the extent of the market" (*WN*, I.iii.1). The problem is a rather subtle one,

[15]See here note 1.

> since the latter sentence seems to reverse the causal relation implied by the former: is it the power of truck and exchanging that determines the diffusion of the division of labor, progressively enlarging the market; or is it the extent of the market that determines the diffusion of the division of labor? Yet, Smith's thought is clear: the original principles do not explain the phenomenon analyzed; by contrast, it is the empirical event (the extent of the market) that explains how the division of labor is more or less extensive. This is evident when he states: "When the market is very small, no person can have any encouragement to dedicate himself entirely to one employment" (*WN*, I.iii.1). As a consequence, the extent of the market is the cause that determines the limited extent of the division of labor, and not vice versa. Once again (see point 2, *supra*), empirical circumstances seem fundamental, with respect to an original principle, in explaining certain market phenomena.

In conclusion, on the one hand, Smith adopts the Newtonian method based on principles; on the other, he attributes a new function to principles. In the case in point, the "original principle" of truck, which could be compared to the law of gravity, is not used to directly deduce and unify a number of (economic) phenomena. This task is instead left to the notion of the division of labor, which is not an original principle and requires further concepts to explain self-organization in the market. In some cases, Smith even considers certain empirical and historical events (the extent of the market, for example) to be the causes of the diffusion of the division of labor, and he marginalizes the role of natural inclinations. Whereas, in physics, gravity makes it possible to *deduce* the motion of planets, comets, and bodies on the earth, in economics, when explaining the motion of societies, we do not necessarily refer to gravity's counterpart (the propensity to truck and barter); rather, we consider notions such as the division of labor and competition.

VI. PRICES AND PRINCIPLES

Principles are heuristic devices in many other important fields of Smith's economic inquiry. Indeed, before dealing with prices, Smith delineated his project "to investigate the principles which regulate the exchangeable value of commodities" in order to explain i) the "real measure" of value, ii) the different composition of price, and iii) the differences between market and natural prices (*WN*, I.iv, 14–17). Principles are also fundamental for determining the real origin of revenue and for identifying the corresponding "orders" of society: "Wages, profit, and rent are the three *original sources* of all revenue as well as of all exchangeable value. All other revenue is ultimately derived from some one or other of these" (*WN*, I.vi.17; emphasis added).

From this perspective, history matters, because in the "early and rude state of society," goods were exchanged according to the rule of the labor time necessary to produce each of them; therefore, only labor is the source of income (*WN*, I.vi.1–5). When capital accumulation and the private ownership of land appeared, the components of price became three. Although the historical account is very general and "conjectural," the basic idea is that the fundamental (and not reducible) principles that determine every income change from the "rude" to the "advanced" state of society.

Another example is the notion of the "interest of money," which is never an autonomous income because it is "always a derivative revenue, which, if it is not paid from the profit which is made by the use of the money, must be paid from some other sources of revenue" (*WN*, I.vi.18). Empirical considerations somehow re-emerge, in that political economy cannot duplicate the perfect mechanism of Newton's physics to find a unique, universal, principle. Hence, in modern societies, we find not just one but three sources of income, which are not reducible to each other. In fact, profits and wages "are regulated by quite different principles" (*WN*, I.vi.), and rent is "the price paid for the use of the land," which "enters into the composition of the price of commodities in a different way from wages and profit. High or low wages and profit, are the causes of high or low price; high or low rent is the effect of it" (*WN*, I.xi.1–8).

Also, the difference between natural and market prices shows a distinctive use of Newton's concept of "principle." It is well known that, according to Smith, the natural price "is, as it were, the central price, to which the prices of all commodities are continually gravitating"; it is the "center of repose and continuance" to which market prices "constantly" tend (*WN*, I.vii.15). I. Bernard Cohen (1994, pp. 65–68) remarked that economics is not a clone of physics, and that Smith reasonably adapted Newtonian concepts to the economic realm, although this was an "imperfect replication."[16] In fact, a close application of the law of gravity would have implied that, just as every physical body must gravitate towards all the bodies of a system, so the natural price should gravitate towards all the other prices. Given these considerations, two points ensue.

a) It is at the level of market prices that competition comes about (*WN*, I.vii.1–15). This involves a peculiar dynamic of the market society, which renders its future configurations unforeseeable. Some scholars maintain that Smith's approach describes a disequilibrium prices system (for example, Foley 2003, p. 4), since market prices proceed towards natural prices, but never coincide with them. In turn, natural prices change over time (see point [b] below); consequently, there is more a move towards equilibrium than a stable one. Also, competition is an endless process: it gives shape to market society, whose order can be observed *ex post* but never defined in advance; hence, only general tendencies can be described.
b) Although natural prices are conceived as "center[s] of repose," they change in the course of time according to "their advancing, stationary, or declining condition" (*WN*, I.vii.1). History necessarily enters the scene; and this is probably the most important condition for understanding why Smith's political economy involves a certain view of complexity that cannot be ascribed to Newton's influence.

VII. HISTORY MATTERS

Smith points out two "principles" of human nature opposed each other: one is "the passion for present enjoyment"; the other is "the desire of bettering our condition,"

[16]"I believe that Smith's imperfect replication of the concept of the Newtonian force of gravity has been adequately justified by the worth of his system of economics" (Cohen 1994, p. 67).

and they respectively prompt us to consume and to save (*WN*, II.iii.28). This produces the contrast between prodigality (which dissipates wealth) and parsimony (or frugality) that is essential for understanding economic growth, since "Parsimony, and not industry, is the immediate cause of the increase of capital" (*WN*, II.iii.16), and it seems largely to predominate in the greater part of men (*WN*, II.iii.28). The prevalence of this inclination enables public and private wealth to increase, and it "is frequently powerful enough to maintain the natural progress of things toward improvement, in spite both the extravagance of government, and of the greatest errors of administration" (*WN*, II.iii.31). Given this situation, we can infer that:

1) human nature is not the precise counterpart of physical nature: both of them exhibit coherent, uniform, and constant principles, but in the former, with respect to the latter, these principles are sometimes conflictual[17]; and
2) man's propensity to "better his condition" prevails over prodigality, and explains the general tendency to move towards "the natural progress of things" (since it yields capital for productive investments); yet, as the history of Western societies shows, this happens in complex ways. Therefore, we can delineate only a general framework of the future world.

Book III of the *WN* is a good example of how real history matters in determining unpredictable configurations of the market society, sometimes reversing the "natural order of things" despite the natural (prevalent) inclination to improve mankind's condition.

The relation between town and country, from the decline of the Roman Empire to Smith's age, confirms this view. The "natural course" implies that, firstly, "the greater part of the capital of every growing society is, first, directed to agriculture, afterwards to manufactures, and last of all to foreign commerce" (*WN*, III.i.8), and, secondly, that the development of the countryside constitutes an incentive for the growth of towns. By contrast, in Western history, the development of the countryside was discouraged because the need for protection in "those disorderly times" following the fall of the Roman Empire induced the use of land as the means to acquire "power and protection" (instead of a means to acquire "subsistence"), where a "great landlord was a sort of petty prince" who provided protection to people, and his "tenants were his subjects" (*WN*, III.ii.3). The "law of primogeniture" and "entails," as institutions allowing land to be maintained undivided, reinforced the use of land as a means of power instead of a productive resource, and influenced European societies for centuries. By contrast, the inhabitants of the towns soon achieved economic development, and "arrived at liberty and independency much earlier than the occupiers of land in the country" (*WN*, III.iii.3). Wealth was accumulated in the towns, and it increased the demand for "conveniencies and elegancies of life." In short, foreign trade developed in an anomalous way, inverting the "natural order of things," according to which this kind of commerce would have been the last sector to increase after agriculture and manufacture, and in consequence of their exchange relations (for example, when the domestic market was unable to absorb surplus goods). In Smith's words:

[17]Although fundamental, it is not possible here to examine how these topics are treated in the *TMS*.

> this natural order of things . . . has, in all the modern states of Europe, been, in many respects, entirely inverted. The foreign commerce of some of their cities has introduced all their finer manufactures, or such as were fit for distant sale; and manufactures and foreign commerce together, have given birth to the principal improvements of agriculture (WN, III.i.9).

Given these premises, two points follow:

1) History matters. The "natural course of things" may be completely reversed, and this may condition civilization for many centuries. Certainly, the tendency to re-equilibrate (and to improve the individual condition) is at work, so that, in this case, the country finally develops. Yet, it is difficult to think that the outcomes of the two possible courses of history (the "natural" and the "unnatural" ones) have been the same. Many distortions remain, and harmful institutions continue to produce their effects in real life. In short, the natural order, once abandoned, is never perfectly re-established because the course of history leaves its traces. As a consequence, Smith never describes where and when the natural order reappears. [18]
2) These processes were unpredictable, as the "great revolution" showed. History, contingencies, institutions, customs, habits, and preferences of economic actors determine unforeseeable issues, although a general tendency as regards historical processes can be observed. In the human realm, "natural" tendencies and "unnatural" processes often work at the same time, and all this modifies the Newtonian perspective in human sciences.

VIII. INSTITUTIONS AND "INVISIBLE HAND"

Smith often cites institutions as responsible for the slow or inverted "natural course of things." They are the result of the myopic human reason, and of moral propensities, and in certain conditions they acquire some sort of independent structure (with respect to individuals) that persists over time. As a consequence, this is another perspective from which to examine how natural inclinations cannot impede the accomplishment of an "unnatural" "course of things." Smith points out that the lack of "perfect liberty" in Europe has caused inequalities of different kinds (*WN*, I.x.a), and, in the third book of the *WN,* he describes their political and institutional origins.

Institutions are human devices that can exhibit a kind of autonomous life owing to the limited human capacity for both rationality and prevision. At the beginning, in some circumstances, they can be consistent with reason; in others, they cannot. The

[18]According to Evensky (2007, p. 17), Smith "offers an analysis of the course of recorded history explaining why the unnatural twists, turns, stagnations, and declines of societies do not represent violations of his general principles but, rather reflect peculiar distortions of those principles caused by human frailty." In this sense, Smith's "conjectural" and "narrative" histories are consistent. In my view, there is coherence between them (at least in Smith's intention), yet the two histories cannot be completely overlapped: history follows a "design" and certain principles, but a number of empirical events and conflicting tendencies influence its direction (see sect. VIII).

law of primogeniture and entails were not "unreasonable," because great proprietors, by keeping land undivided, were able to assure protection to their "tenants," since individuals were not able to survive isolated and undefended (*WN*, III.ii.6). By contrast, laws and institutions derived, for example, from the arguments of mercantilist doctrine were unreasonable, and their permanence—generally considered "absurd" and harmful—can be explained by showing how the interests of some social groups influenced their duration (like those of corporations or of the East India Company). Yet, in many cases, institutions are described as inertial structures, which survive even though their original function has ceased: "Laws frequently continue in force long after the circumstances, which first gave occasion to them, and which could alone render them reasonable, are no more" (*WN*, III.ii.4). And their inertial character depends on habits and customs arising from those original institutions, which survived after these latter were "greatly altered," leading the course of history towards an "unnatural and retrograde order" (*WN*, III.i.9). Smith points out that the "order of things" is usually promoted by the "natural inclinations of man." Nonetheless, institutions often do not mirror such propensities: "If human institutions had never thwarted those natural inclinations, the towns could no-where have increased beyond what the improvement and cultivation of the territory in which they were situate could support" (*WN*, III.i.3).[19]

In short, human institutions "disturbed the natural course of things" (*WN*, III.i.4), often worked *against* it, and their autonomy defined a specific configuration of society at each point of time. The case of "law of primogeniture" and of "entails" is interesting in that the autonomy of institutions is not determined by the permanence of self-interest of social groups able to influence laws (like those of merchants, who tried to condition policies in the mercantilist sense). By contrast, those medieval institutions survived, even though they soon became "unreasonable," and were largely but not definitively removed by means of a "slow and uncertain" historical process that allowed landlords to spend their revenue on consumer goods. Smith does not provide a precise theory as regards these events; rather, he shows how history and contingencies slowly changed institutional structures by gradually introducing market relations between country and town.[20]

Institutions as autonomous structures conditioning human life and imposing their own rationality on individuals, instead of being manageable tools of man's intentionality, produce an "invisible hand" effect: reasonable institutions are engendered by men, yet their gradual change (or their inertial duration) produces unintended outcomes, and—to use Adam Ferguson's words—they appear to be "the result of human action but not the execution of any human design" (Ferguson [1767] 1969, p. 250). From this perspective, legal institutions (not only the market) are connoted as

[19]Rosenberg (1960) maintains that Smith's inquiry is characterized by the attempt to define the "appropriate institutional framework" able to harmonize selfish individual and social interests, since he was aware that some legal structures impeded economic progress in Europe. Samuels (1977) accepts this view and points out that, according to Smith, the market does not work optimally. It depends on institutions and other forces of social control; yet, the unintended outcomes of the market sometimes conflict with legal and moral rules, causing tensions between these domains.

[20]For example, Smith simply points out the gradual transformation, so that he maintains: "To the slave cultivators of antient times gradually succeeded [the] Metayers" (*WN*, III.ii.11), and subsequently to them "succeeded, though by very slow degrees, farmers properly so called" (*WN*, III.ii.14).

self-sustaining systems, unintentionally adapted (or survived) to new situations that exhibit a self-organizing capacity that extends beyond agents' rationality. On the other hand, Smith sometimes considers the autonomy of certain institutions to be among the causes of that unnatural "order of things" that culminates in the absence of "perfect liberty" in Europe (*WN*, I.x.a.2). If we consider the course of civilization from the natural/conjectural perspective, some institutional structures, owing to their autonomous mechanisms, are certainly "the result of human action," but, at the same time, they work against civilization, in that they reduce both the liberty and the social capacity to produce increasing wealth, although nature provides some re-equilibrating mechanisms in the long run. Individuals operate and contribute to the change in institutions, but these latter in their turn are, in many respects, independent from agents. Moreover, they condition their behaviors, and are regulated by autonomous rules.

From this perspective, the "invisible hand" involves both the market and legal institutions, and its action within these two domains is often connoted by conflicts.[21] In other words, the tensions between these realms evidence that the same mechanism that produces "unintended outcomes" can exhibit opposite tendencies: on the one hand, the "invisible hand" (described in the *WN*) works to establish an unintentional order consistent with individual and public welfare; on the other hand, certain institutions determine an unintended result culminating in the state of "im-perfect liberty"; that is, an order far from the "natural course of things."[22] Therefore, some (inertial and harmful) institutions act against the unintentional effort of individuals to improve general wealth, and the action of these contrasting forces contributes to determining unforeseen (and unintentional) results.

In the ideal world of the natural order, market and institutional forces are aligned. Consequently, the "natural order" seems to constitute a benchmark with which to evaluate the approximation (or the distance) of the real and "unnatural" from this reference point. From this perspective, the North American colonies represented the best approximation to the natural order, while the European countries, to varying extents, were more distant from that benchmark.[23] In particular, the British institutional system, although it "retarded the natural progress . . . has maintained the progress of England towards opulence," because law protected the "effort to better [individual's] condition" and "allowed by liberty to exert" it (*WN*, II.iii.36). A greater distance from the ideal model is exhibited by Spain and Portugal, where the "bad policy is not . . . counter-balanced by the general liberty and security" (*WN*, IV.v.b.45). What characterizes the contrasting tendencies (which push towards either the natural or the unnatural

[21]Otteson (2002) maintains that the idea of unintended outcomes is an organizing principle that connects *Languages*, *TMS*, and *WN*. The pervasiveness of a set of ideas (like coordination, unintended outcomes, etc.) related to the notion of the invisible hand is dealt with in Fiori (2001, 2002). For a different interpretation, which considers Smith's invisible hand as an ironic expression, see Rothschild (2001, ch. 5)

[22]According to Smith, in his age, the market system and the related, coherent, institutional framework was not definitely established. In fact, nowhere in Europe did policies leave "things at perfect liberty" (*WN*, I.x.a.2), and "Entails . . . are still respected through the greater part of Europe" (*WN*, III.ii.6).

[23]The North American colonies followed the ideal prescription of the natural order to invest first in agriculture (*WN*, III.i.5). Moreover, the "Good land" of the English colonies was "inferior to those of the Spaniards and Portugueze," therefore their success depended on their "political institutions [which] have been more favourable to the improvement and cultivation" than other colonies (*WN*, IV.vii.b.17).

order) is that 1) they exhibit different strengths in space and time; and 2) they determine the configuration of socio-economic systems.

Finally, the opposition between these tendencies impedes prediction of precisely which kind of social and economic configuration will emerge.

Contrary to the idea of an economic and social science based on predictive powers, Smith delineates a discipline in which the future is open, and scientists can predict only very general tendencies grounded on the human inclination to better man's condition among contrasting forces. The great "revolution" that definitively ratified the passage to the market society occurred without "the least intention" of the social classes involved (*WN*, III.iv.17).[24] This incapacity to foresee is shared by both social actors and scientists, where the former are characterized by structural myopia, and the latter by a constant search for "connecting principles" in order to overcome scant human far-sightedness.

The *TMS* explicitly treats the weakness of reason (*TMS*, II.i.5.10): "The natural course of things cannot be entirely controlled by the impotent endeavours of man" (*TMS*, III.5.10), where this course does not often follow the most "natural" way. History and contingencies deviate this latter from its ideal path, the one described by a "conjectural" approach. Nature does not direct human behaviors by means of prescriptions; rather, it exploits a more subtle and indirect device based on a kind of esthetic consideration, since wealth is not perceived for its concrete benefits but "as something grand and beautiful and noble," so that "nature imposes upon us in this manner [and] It is this deception which rouses and keeps in continual motion the industry of mankind" (*TMS*, IV.I.10).

By contrast, according to Smith, a prescriptive interpretation of nature was put forward by Quesnay, who maintained that the market systems can survive only within a unique equilibrium, while "the wisdom of nature has fortunately made ample provision for remedying many of the bad effects of the folly and injustice of man" (*WN*, IV.ix.28). Nature, represented by means of a biological comparison between humans and the "political body" (and not by means of a model inspired by physics), does not intervene deterministically to re-establish "the natural progress of a nation towards wealth and prosperity" according to precise laws.

Moreover, not always can nature spontaneously re-establish the lost order, and man must intervene. For example, restoring the free importation of foreign goods, when this commerce has been prohibited for long time, could provoke high unemployment in those branches of industry artificially expanded by mercantilist policy. In this case, a correct response should be human intervention characterized "by slow gradations, and with a good deal of reserve and circumspection" (*WN*, IV.ii.40). Similarly, "To open the colony trade all at once to all nations" might produce "permanent losses" of capital investments in the sectors of industry involved; therefore these "ought gradually to be opened," but "in what manner the natural system of perfect liberty and justice ought to be restored, we must leave to the wisdom of future statesmen and legislators to determine" (*WN*, IV.vii.c.44). In addition, some basic human inclinations must be moderated. For example, pride induces the "love to domineer," which prompts the

[24]A similar gap between original intention and actual outcomes connoted the conquest of colonies (*WN*, IV.vii.b.21).

imposition of slavery where it is possible (*WN*, III.ii.10), although productive activities realized by means of slaves are less efficient than those accomplished by free, self-interested, men. In this sense, a basic propensity, like the love of domination, works against other inclinations coherent with a "natural" course, the one able to induce increasing wealth.

In short, the "natural" and institutional orders (including laws, and political systems) continuously interact and interfere with each other. The former corrects human "follies," mainly in the long run. Nonetheless, human reason can intervene when the self-adjusting mechanism of nature cannot be activated.

IX. CONCLUSIONS

The aim of this paper has been to show that Smith, in many fields of his work, produced a theory in some sense non-Newtonian, although he sought to apply Newton's method in many circumstances. At first glance, this conclusion appears to be the consequence of many events: 1) the shift of the notion of "principle" (and of the related analytic-synthetic approach) from physics to the human sciences; 2) the inclusion of (Scottish and Smith's) Newtonianism within complex traditions of thought, which gave it a distinctive configuration; and 3) the influence of Montesquieu and of authors who dealt with the organization of organisms. The latter allowed Smith to use biological models to describe social changes, and the relation between natural and unnatural orders of society. More specifically, Smith, in *Languages*, *HA*, and *WN,* always treated subjects in which history and contingencies matter, and where the human realm appears much more ambivalent and conflicting than the physical world.

The first part of the article has described how the analytic-synthetic method was essentially utilized to point out processes of re-description of the world, rather than to describe its intrinsic truth, establishing a reciprocal—complex—influence between concreteness and abstractness.

The second part of the article has examined some concepts in Smith's economic analysis in light of the Newtonian approach. In particular, the division of labor, although it is not an "original" (but a derived) principle, is used to explain (or deduce) a number of economic phenomena. Yet, it cannot be understood without reference to history and contingencies, which, in turn, must be considered in order to explain when and how the division of labor works. More specifically, the (technical and social) division of labor permits the market to expand, generating increasing returns; yet, the extent of the market (as an empirical fact) determines the extent of the division of labor. Once again, a reciprocal influence is established between principles and empirical events.

From this perspective, history matters. In fact, the "inverted" history of Europe shows the extent to which contingencies and empirical circumstances have imposed their influence on the "natural" course of events, whereas the latter is a process coherent with original propensities that should govern human behavior. In particular, institutions play an important role in determining the "unnatural" "course of things." Their structure, relatively autonomous from the agent's intentionality and plans, is—so to speak—the other side of the invisible hand, since, given their inertia, their

action over time is unpredictable and sometimes conflicts with the rationality of the market, which, in its turn, is another institutional framework in which the invisible hand mechanism works.

Finally, for Newton, nature is fundamentally predictable, since it is always the same in every time and place. For Smith, this means that Newton's physics is characterized by a high degree of precision, while the science of society is not. In the social and economic domain, the future is not predictable: laws of (human) nature can produce unexpected effects if specific circumstances intervene to reverse the "natural course of things." The confidence in certain principles (by means of which the system works) remains, but within an open universe, whose dynamics engender unpredictable outcomes (i.e., the heterogenesis of ends), and whose configurations are unknown in advance, as in the market, whose rationality emerges as a property of the system distinguished by the limited rationality of a number of agents operating within that framework.

REFERENCES

Aron, Raymond. 1965. *Main Currents in Sociological Thought. Vol. I. Montesquieu, Comte, Marx, Tocqueville, the Sociologists of the Revolution of 1848*. New York: Basic Books.

Becker, James F. 1961. "Adam Smith's Theory of Social Science." *Southern Economic Journal* 28 1 (July): 13–21.

Berry, Christopher J. 2006. *Smith and Science*. In Knud Haakonssen, ed., *The Cambridge Companion to Adam Smith*. New York: Cambridge University Press, pp. 112–134.

Bittermann, Henry J. 1940. "Adam Smith's Empiricism and the Law of Nature: I." *The Journal of Political Economy* 48, 4 (August): 487–520.

Campbell, T. D. 1971. *Adam Smith's Science of Morals*. London: Allen & Unwin.

Cohen, I. Bernard. 1980. *The Newtonian Revolution. With Illustration of the Transformation of Scientific Ideas*. Cambridge: Cambridge University Press.

Cohen, I. Bernard. 1994. "Newton and the Social Sciences, with Special Reference to Economics, or, the Case of the Missing Paradigm." In Philip Mirowski, ed., *Natural Images in Economic Thought*. Cambridge: Cambridge University Press, pp. 55–90.

Cremaschi, Sergio. 1984. *Il sistema della ricchezza. Economia politica e problema del metodo in Adam Smith*. Milano: Franco Angeli.

Cremaschi, Sergio. 1989. "Adam Smith: Skeptical Newtonianism, Disenchanted Republicanism, and the Birth of Social Science." In Marcelo Dascal and Ora Gruengard, eds., *Knowledge and Politics: Case Studies on the Relationship between Epistemology and Political Philosophy.* Boulder, CO: Westview Press, pp. 83–110.

Cremaschi, Sergio. 2009. "Newtonian Physics, Experimental Moral Philosophy and the Shaping of Political Economy." In Richard Arena, Sheila Dow, and Matthias Klaes, eds., *Open Economics: Economics in Relation to Other Disciplines*. London and New York: Routledge, pp. 73–94.

Evensky, Jerry. 2007. *Adam Smith's Moral Philosophy. A Historical and Contemporary Perspective on Markets, Law, Ethics, and Culture*. New York: Cambridge University Press.

Ferguson, Adam. 1767. *An Essay on the History of Civil Society.* Fourth edition, England, repr. by Gregg International Publishers Limited, 1969.

Fiori, Stefano. 2001. *Ordine, mano invisibile, mercato. Una rilettura di Adam Smith*. Torino: UTET.

Fiori, Stefano. 2002. "Visible and Invisible Order. The Theoretical Duality of Smith's Political Economy." *The European Journal of the History of Economic Thought* 8, 4 (Winter): 429–448.

Foley, Duncan K. 2003. *Unholy Trinity: Labor, Capital, and Land in the New Economy.* London and New York: Routledge.

Freudenthal, Gideon. 1981. "Adam Smith's Analytic-Synthetic Method and the 'System of Natural Liberty.'" *History of European Ideas* 2 (2): 135–154.

Guicciardini, Niccolò. 2002. "Analysis and Synthesis in Newton's Mathematical Work." In I. Bernard Cohen and George E. Smith, eds., *The Cambridge Companion to Newton*. Cambridge: Cambridge University Press, pp. 308–328.

Hetherington, Norriss S. 1983. "Isaac Newton's Influence on Adam Smith's Natural Laws in Economics." *Journal of the History of Ideas* 44, 3 (July): 497–505.

Hume, David. 1748. *An Enquiry concerning Human Understanding*. Edited by T. L. Beauchamp. Oxford: Oxford University Press, 1999.

Ingrao, Bruna, and Giorgio Israel. 1990. *The Invisible Hand. Economic Equilibrium in the History of Science*. Cambridge, MA: MIT Press.

Koyré, Alexandre. 1968. *Newtonian Studies*. Chicago: The University of Chicago Press.

Lindgren, Ralph J. 1973. *The Social Philosophy of Adam Smith*. The Hague: Martinus Nijhoff.

Malament, David B. 2008. "Norton's Slippery Slope." *Philosophy of Science* 75 (December): 799–816.

Mayr, Otto. 1986. *Authority, Liberty and Automatic Machinery in Early Modern Europe*. Baltimore: The Johns Hopkins University Press.

Megill, A. D. 1975. "Theory and Experience in Smith." *Journal of the History of Ideas* 36, 1 (Jan.–Mar.): 79–94.

Montes, Leonidas. 2003. "Smith and Newton: Some Methodological Issues Concerning General Economic Equilibrium Theory." *Cambridge Journal of Economics* 27: 723–747.

Montes, Leonidas. 2008. "Newton's Real Influence on Adam Smith and its Context." *Cambridge Journal of Economics* 32: 555–576.

Montesquieu, Charles-Louis de Secondat, Baron de. 1748. *The Spirit of Laws*. New York: Cosimo Classics, 2011.

Moscovici, Serge. 1956. "À propos de quelques travaux d'Adam Smith sur l'histoire et la philosophie des sciences." *Revue d'histoire des sciences et de leur applications* 9 (1): 1–22.

Newton, Isaac. 1687. *Mathematical Principles of Natural Philosophy and His System of the World*. Trans. into English in 1729. Cambridge: Cambridge University Press, 1934.

Newton, Isaac. 1704. *Opticks*. Fourth English edition (1730). Foreword by A. Einstein, Introduction by Sir Edmund Whittaker, Preface by I. Bernard Cohen. New York: Dover Publications, 1952.

Norton, John D. 2008. "The Dome: An Unexpectedly Simple Failure of Determinism." *Philosophy of Science* 75 (December): 786–798.

Otteson, James. 2002. "Adam Smith's First Market: The Development of Language." *History of Philosophy Quarterly* 19, 1 (January): 65–86.

Prigogine, Ilya, and Isabelle Stengers. 1979. *La Nouvelle Alliance. Les Métamorphoses de la Science*. Paris: Gallimard. English version: *Order Out of Chaos*, New York: Bantam, 1984.

Raphael, D. D., and A. S. Skinner. 1980. "General Introduction." In Adam Smith, *Essays on Philosophical Subjects*, edited by W. P. D. Wightman. Oxford: Clarendon Press, pp. 1–21.

Redman, Deborah A. 1993. "Adam Smith and Isaac Newton." *Scottish Journal of Political Economy* 40, 2 (May): 210–230.

Rosenberg, Nathan. 1960. "Some Institutional Aspects of the *Wealth of Nations*." *Journal of Political Economy* 68, 6 (December): 557–570.

Rothschild, Emma. 2001. *Economic Sentiments: Adam Smith, Condorcet and the Enlightenment*. Cambridge, MA: Harvard University Press.

Ruelle, David. 1991. *Hasard et chaos*. Paris: Odile Jacob.

Samuels, Warren J. 1977. "The Political Economy of Adam Smith." *Ethics* 87, 3 (April): 189–207.

Schliesser, Eric. 2005. "Wonder in the Face of Scientific Revolutions: Adam Smith on Newton's 'Proof' of Copernicanism." *British Journal for the History of Philosophy* 13 (4): 697–732.

Schliesser, Eric. 2011. "Reading Adam Smith after Darwin: On the Evolution of Propensities, Institutions, and Sentiments." *Journal of Economic Behavior & Organization* 77: 14–22.

Skinner, Andrew S. 1972. "Adam Smith: Philosophy and Science." *Scottish Journal of Political Economy* 19 (November): 307–319.

Smith, Adam. 1759. *The Theory of Moral Sentiments*. Edited by A. L. Macfie and D. D. Raphael. Oxford: Clarendon Press, 1976.

Smith, Adam. 1776. *An Inquiry into the Nature and Causes of the Wealth of Nations*. Edited by R. H. Campbell, A. S. Skinner, and W. B. Todd. Oxford: Clarendon Press, 1976.

Smith, Adam. 1978a. *Lectures on Jurisprudence*: Report of 1762–1763. Edited by R. L. Meek, D. D. Raphael, and P. G. Stein. Oxford: Clarendon Press, pp. 1–394.

Smith, Adam. 1978b. *Lectures on Jurisprudence*: Report dated 1766. Edited by R. L. Meek, D. D. Raphael, and P. G. Stein. Oxford: Clarendon Press, pp. 395–558.

Smith, Adam. 1980. *The History of Astronomy.* In W. P. D. Wightman and J. C. Bryce, eds., *Essays on Philosophical Subjects*. Oxford: Clarendon Press, pp. 33–105.

Smith, Adam. 1983a. *Lectures on Rhetoric and Belles Lettres*. Edited by J. C. Bryce. Oxford: Clarendon Press.

Smith, Adam. 1983b. *Considerations Concerning the First Formation of Languages*. In J. C. Bryce, ed., *Lectures on Rhetoric and Belles Lettres*. Oxford: Clarendon Press, pp. 201–226.

Smith, George E. 2002. "The Methodology of the *Principia*." In I. Bernard Cohen and George E. Smith, eds., *The Cambridge Companion to Newton*. Cambridge: Cambridge University Press, pp. 138–173.

Thomson, Herbert F. 1965. "Adam Smith's Philosophy of Science." *Quarterly Journal of Economics* 79, 2 (May): 212–233.